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CONTENTS

PLENARY EVENTS **8**

Plenary Lecture 9

Koyré Prize Award 10

Young Scholars 11

SYMPOSIA **13**

Symposium 13: Prosopography and the History of Science in a Networked Computational Environment: Theoretical, Methodological, and Technical Considerations 14

Symposium 17: Enduring Ideas, New Alliances: Social and Epistemic Factors in the Renaissance of General Relativity 22

Symposium 19: On the move: the circulation of radioactive materials in the cross road of health physics and biomedicine 27

Symposium 24: Science funding and gendered scientific personae in interwar Europe 30

Symposium 29: Skulls and roses: natural history collections and their meaning in 18–19th centuries 34

Symposium 37: The Principle of Energy Conservation: history, philosophy, education, digital humanities 41

Symposium 38: The Power of the Knowledge of Geometry in the West and the East 45

Symposium 40: Revisiting the Marie Curie effect: "Invisibly powerful" women in science – Challenges of Empowerment for Women in Science: A Transnational Perspective 50

Symposium 41: Textbooks and Handbooks as an Instrument of Power 58

Symposium 46: Disciplining Knowledge: The Emergence of Learned Journals and The Consolidation of Scholarly and Scientific Disciplines in the German lands 66

Symposium 67: Algebra, Humanism and Cultural Policies 69

Symposium 69: Forgotten Pages in the History of Genetics 74

Symposium 70: Pugwash and the communism question: Perceptions and Realities 77

Symposium 72: The Big Brother Role Model? Soviet and American impulses for Central and Eastern European academic systems, 1945–1989 81

Symposium 78: Anti-authoritarianism in natural philosophy: radicalism and folk intuitions 89

Symposium 82: Pariah sciences. Episteme, Power and Legitimization of Knowledge, from Animal Electricity to Low-Energy Nuclear Reactions 93

Symposium 88: European Physicists and Chinese Physics in the 20th Century 100

Symposium 94: The power of tropical biology: Creating epistemic spaces in the long twentieth century 103

Symposium 105: Odd scientific objects in post-Great Depression Europe 106

Symposium 110: Scientists and the powerful from the Middle Age to the Classical period 109

Symposium 115: The power of norms: standardisation and normalisation through International Scientific Organisations 112

Symposium 116: From Lysenkoism to Evolutionary Biology 117

Symposium 121: Scientific Persona as a way to scientific Power: how scientists deal with categories of social difference (SPaSP) 121

Symposium 123: Astral Sciences and Power in Europe and China 124

Symposium 142: Science, Medicine and the State: The Revolution of Chinese Medicine in Modern China 129

Symposium 149: Power and Authority in 20th Century Childbirth 133

Symposium 157: Mendel and the Uses & Abuses of the Scientific Past 136

Symposium 170: Counteracting erroneous interpretations of bibliometrics: Tensions between science and politics 140

Symposium 197: Hungarian schools and students in various fields of power 143

Symposium 200: Comparative study on the interplay between knowledge practices and powers in Chinese history 148

Symposium 202: Domesticating the air: The politics, technics, and material culture of breathing safely 154

Symposium 205: Natural knowledge, power and politics in the long eighteenth century 158

Symposium 206: Challenges for the history of engineering: Education, professions, circulation, sustainability, power 161

Symposium 226: Science and Education in the Context of Modernization 171

Symposium 240: Statistics and Power – Power of Statistics? 174

Symposium 247: To Learn and "Correctly" Understand: Popularization of Science in Central Europe 1944–1989 180

Symposium 263: Science, self and power: Self-Orientalism and others performances of identity in relation to Science (19th–21st century) 184

Symposium 264: The Power of Experiments: The Interdisciplinary Reconfiguration of Dense and Rare in Early Modern Europe 186

Symposium 268: The Science of the Human: Naturalization and Control 190

Symposium 282: Environmental Science and the Politics of Power, 1890–1970 193

Symposium 290: The power of the historiography of science 196

Symposium 299: Changing mathematical spaces: geometry and physics in the 20th century . 203

Symposium 316: Representing global power in Iberia: Diogo Ribeiro's world maps and Early Modern Science 208

Symposium 321: The Acknowledged Ambassadors: Scientists' role in international relations during the Cold War 215

Symposium 336: Power and display: Museums, science and politics in Southern Europe (1918–1939) 222

Symposium 348: History of Science – Inspired Theatre: The Social Power of Recent Plays..... 227

Symposium 355: Re-contextualising Urban History of Medicine. Cities, Power relations and Networks of Urban centers of Medicine, 1848–1955'..... 231

Symposium 364: Inequality in Early Modern Philosophy and Science: The Impact of Social Order on Learned Identity and Knowledge Production 237

Symposium 367: Sciences and Universities in the context of political regime changes..... 239

Symposium 374: Historical-Epistemological Prospects on Science as Power 246

Symposium 380: Circulation of mathematics, sciences and techniques between continents, 19th–20th centuries 251

SESSIONS 255

Session 1: Perspectives on Politics, Power and Knowledge from Russian and Soviet History 256

Session 2: The Power of Newton's Ideas and their Reception 259

Session 3: The Cold War 262

Session 4: The History of Mathematics: Concepts, Practices and Political Issues 267

Session 5: WW2 274

Session 6: Universities and their Political Environments 278

Session 7: Women and Science in Different Political Environments 280

Session 8: Power Issues in Science and the Theory of Science 283

Session 9: Science, Politics, and Issues of Race and Ethnicity 287

Session 10: History of Medicine 289

Session 11: Power Issues in the History of Psychiatry and Psychology 292

Session 12: Perspectives on Politics, Power and Knowledge from Chinese History 294

Session 13: Science, Religion and Power in the Middle Ages 300

Session 14: Science, Technology, and Gaining Power on New Spaces 304

Session 15: The Attitude of Scientists towards Totalitarian Systems in the 20th Century 309

Session 16: The Power of Ideas, Practices and Instruments in Physics and Chemistry 313

Session 17: Analyzing and Assessing Scientific Activity 317

Session 18: Politics of Science 319

Session 19: Biopolitics 323

Session 20: Scientific Issues in the Astral Sciences 328

Session 21: The Power of Scientific Networks and Institutions 332

Session 22: The Attitude of Scientists towards Authoritarian Regimes in the 20th Century (Portugal and Spain) 339

Session 23: Global Approaches to Science and Power 343

Session 24: The Power of the Media 348

Session 25: Politics, Technology and Science in the 19th Century 351

Session 26: Science, Religion, and Power Issues 354

Session 27: Environmental Studies, Climatology and their Political Environments 356

Session 28: Plants and Pharmaceutical Products in the Eastern Block 359

Session 29: Contribution of "Unwanted" Russian Scientists to the World Science 362

NAME INDEX 365

PLENARY EVENTS

Plenary Lecture

Science and Power: Francoist Spain (1939–1975) as a Case Study

Toni Malet *(Universitat Pompeu Fabra, Barcelona, Catalonia)*

The title words "case study" do not point to some specific scientific field or institution within Francoist Spain. Rather it is Franco's Spain in itself that I would like to turn into a case study for the ways in which power shapes science and technology and conversely. Spain, an important European country with outstanding literary and artistic traditions, lacked powerful and consolidated scientific institutions. From 1939 to around 1960 it was economically and politically the most isolated country in Western Europe. This lecture will focus on what forms science got under a regime with totalitarian ambitions. It will sketch —in a perforce impressionistic way— the sallient features of the growth of science and technology in Francoist Spain.

Koyré Prize Award

The Dream That Never Dies: Universal Knowledge as Utopia and Myth

Robert Fox *(University of Oxford, UK)*

The Baconian aphorism that knowledge is power has been amply vindicated since the seventeenth century, as the holders of political, economic, and cultural power have sought to control access to information, typically in opposition to advocates of openness. By the mid-nineteenth century, those who believed that knowledge should be open to all faced unprecedented challenges. One challenge lay in the replacement of the universal scholarly language of Latin by vernacular languages that placed a constraint on scholarly communication. More telling was the sheer quantity of what there was to know. The accelerating pace of publication stimulated new departures in information retrieval, exemplified in Paul Otlet's International Institute of Bibliography in Brussels in 1895. Driving this and other initiatives was a conviction that free access to knowledge was a pre-requisite of peace, a principle exemplified in Hendrik Christian Andersen's plan for a World Centre of Communication in 1913.

The First World War was to reveal the fragility of Otlet's and Andersen's dreams. Thereafter, the inter-war years were marked in museums and international exhibitions by increasingly patriotic displays at odds with a now unfashionable universalism. Contrary voices, in the International Committee on International Co-operation and H. G. Wells's idea of a universally accessible "World Brain", were frail. And even they were silenced in the Second World War, to be resurrected once again, in the new foundation of UNESCO in 1946.

The history of universalist sentiment in science and scholarship reflects both the travails and the resilience of a dream that has endured against the odds. Attempts to wrest knowledge from the seats of power have certainly bred more failures than success. But in our own age of the Internet and the World Wide Web, might they may now have yet another hope of realization?

Young Scholars

Note-taking, especially in early 17th century Europe

Elaine Leong (Max Planck Institute for the History of Science, Berlin, Germany)

Note-taking, notebooks and 'paper technologies' have, in recent years, come under intense scrutiny by historians of science and medicine. It is now widely acknowledged that practices of pen and paper are central to the production of knowledge across the pre-modern world. Within this literature, scholars have examined the function and epistemic impact of note-taking in two main areas: notes from reading and notes from experimenting, observing and doing. In the former, scholars such as Ann Blair have argued for the centrality of note-taking in early modern reading practices. As our historical actors engaged with and appropriated knowledge from books, they abstracted, extracted, summarized, arranged and re-arranged their reading notes, thereby creating personalized and customized information management systems. Scientific note-taking also took place beyond the study and the library. Naturalists such as René-Antoine Ferchault de Réaumur noted their finds of new plants and their observations of insects and animals. Figures such as Robert Boyle and George Starkey took meticulous notes of their experiments in work diaries or 'laboratory' books. This urge to 'write down experience' extended well beyond the elite circle of early modern men of science. As Pamela Smith and Sven Dupré have shown, craftsmen and artisans also readily recorded their investigations and manipulation of materials in books of recipes and notes. Likewise, householders, men and women, made careful notes of their 'trials' in hundreds of surviving medical, culinary and veterinary recipe books. Scribbled over, crossed through and annotated over time, these books are the collective 'notes' of a household's exploration of the natural world across generations. Note-taking, in many cases, was much more than a mere recording of an instance of reading or an encounter with a rare botanical specimen; rather, it was part and parcel of the making of new knowledge.

This paper offers a brief overview of recent studies on note-taking and paperwork in histories of early modern science. Showcasing the wide variety of note-taking practices performed by a range of historical actors across diverse sites and knowledge practices, it argues that a focus on note-taking and 'paper technologies' enables us to put in conversation a number of linked epistemic practices from reading and writing to making and doing to observing and surveying to classifying and categorizing. By viewing these practices as a continuum rather than as distinct parts, we are able to further understand early modern knowledge production.

What Have the Historians of Quantum Physics Ever Done for Us?

Massimiliano Badino *(Universitat Autònoma de Barcelona – Massachusetts Institute of Technology, Cambridge, MA, USA)*

Once a driving force in the establishment of history of science as an academic discipline, the history of quantum physics has recently gone through a deep revision of questions, objectives, and methods. For nearly fifty years, historians have mainly concerned themselves with the cognitive aspects of the theory, the evolution of its internal structure, its arguments, and its conceptual connections. This tradition of intellectual history, which has collected an impressive scholarly production and has shaped our understanding of how quantum physics evolved, still occupies a central position. However, in the last decades we have also witnessed the emergence of two novel historiographical trends. On the one side, historians have increasingly looked upon quantum physics as a specific culture with its own rules, rituals, dynamics, and values. This has resulted in a larger deployment of concepts imported from cultural studies such as community, value-system, network, identity, cultural authority, ideology, myth construction, tacit knowledge to mention only a few. Admittedly, the "cultural turn" in history of physics has a longer genealogy, but a sustained effort to apply these methodological insights to quantum physics has gained a remarkable momentum at the outset of this century. On the other side, the

history of quantum physics has been more and more often engaged by philosophy of science. While the relation between philosophy and quantum physics is an old one, but it is especially in recent years that attempts at creating an effective amalgamation of history and philosophy of science have originated particularly stimulating works, projects, conferences, and workshops. In this lecture, I survey the landscape of the scholarly production in this field with special attention to these three trends. I show that, by making the methodological boundaries between intellectual history, cultural studies, and philosophy of science more porous, the history of quantum physics is profoundly redefining our image of the theory and is setting the agenda for history of physics at large. More importantly, I argue that the recent attempts at integrating their expertise on the development of the mathematical and experimental practices with cultural and philosophical approaches, have led historians of quantum physics to elaborate models of construction of scientific meaning that can be illuminating also in other ambits of the history of science.

SYMPOSIA

Symposium 13: Prosopography and the History of Science in a Networked Computational Environment: Theoretical, Methodological, and Technical Considerations

Organizers: ***Gavan McCarthy*** *(University of Melbourne, Melbourne, Australia),* ***Stephen Weldon*** *(University of Oklahoma, Norman, USA),* ***Birute Railiene*** *(Lithuanian Academy of Sciences, Vilnius, Lithuania)*
Chairs: ***Birute Railiene*** *(Lithuania),* ***Stephen Weldon*** *(University of Oklahoma, Norman, USA)*

Prosopography (a form of data-driven collective biography) came to prominence in the mid-twentieth century with several landmark books that demonstrated how large and complex data sources could be used to tell new stories about the past. Among those path-breaking works was a book by the sociologist of science Robert Merton, Science, Technology, and Puritanism in Seventeenth Century England (1938), which used data gleaned from the Dictionary of National Biography to show that there were clear statistical links between scientific activities of prominent and active men at the time with what Merton identified as a Puritanism. Despite this early engagement with collective biography and prosopography, historians of science have not been as active as other historians in doing this kind of work.

This symposium is meant to explore ways in which the new networked and computational environment for scholarship has lent itself to new types of data-driven research, especially in the area of collective biography and prosopography. Now that it is relatively easy to find databases that contain vast amounts of biographical information about individuals, the authors of these papers are exploring how the new sources are enabling—and sometimes hindering—research that can reveal answers to questions we couldn't have asked before.

The symposium is sponsored by the Commission on Bibliography and Documentation of the IU-HPST/DHST. The Commission actively encourages institutions that hold digital resources to collaborate with each other by making their resources as open, accessible, and inter-compatible as possible, and it encourages individual scholars to understand how to use and build their own resources that they can share. In order to ensure that the tools that are built serve the needs of the scholars, the Commission wants to have both researchers and producers of digital resources exploring the advantages and pitfalls of different kinds of data-driven history.

As early as 1974, prominent scholars like Arnold Thackray, Steven Shapin, and Lewis Pyenson were talking about how the history of science as a profession could benefit from the theoretical advances made by prosopographical historians and the then still-embryonic computational tools that existed. In the second decade of the twenty-first century, we have an extraordinary infrastructure about us. The possibilities are immense, but, as these papers will show, we need to move sure-footedly to ensure that historians actually benefit from the new paradigm.

This symposium was sponsored by the Commission on Bibliography and Documentation of the IU-HPST/DHST.

Keywords: Prosopography, Bibliography of science, Social and cultural informatics, Network science

Bibliographical data of PhD records – a source for prosopography of scientific communities in Lithuania (ID 27)

Giedre Mikniene *(Wroblewski Library of the Lithuanian Academy of Sciences, Vilnius, Lithuania),* ***Birute Railiene*** *(Wroblewski Library of the Lithuanian Academy of Sciences, Vilnius, Lithuania)*

A dissertation as a document provides data on new knowledge, but also encodes important scientometrical information. Research-advising is one of main scholarly communication formal links (besides co-authorship and citation) in a social structure of science. PhD records may expose a scientific relation of research-advising both in personal and institutional levels within a certain scientific area.

This survey was inspired by the rich experience of PhD bibliographical tradition in Lithuania (Wroblewski Library of the Lithuanian Academy of Sciences, Vilnius University Library). In Lithuania dissertations defended after 1996 are registered in a database at a national level. Bibliographical information about these dissertations is catalogued by research institutions and is available from Lithuanian electronic e-library *eLABa* (1). If a dissertation was maintained before 1996, information about it is available only in print version (2) or searching card catalogues.

Nevertheless the survey of scientific communities of 1945–1990 in Lithuania encouraged us to analyze possibilities to register retrospective data on PhD abstracts in a digitally accessed form. A PhD, as a book format, is catalogued in library catalogues, though provided with additional scientometrical data: name of research advisor and name of institution where the PhD research was performed/maintained.

In the paper statistics of PhD records from library catalogues will be introduced, and will be also compared to the statistics of international PhD databases. Also the tradition of cataloguing scientometrical data will be unveiled, so depicting the role of a library catalogue in a history of science and prosopography on a national and international level.

Keywords: Bibliography, PhD records, Library catalogue, Scientometrics, Prosopography

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Intersecting Prosopography: Connecting the IsisCB Online and the Encyclopedia of Australian Science (ID 26)

Gavan McCarthy *(The University of Melbourne, Parkville, Australia)*

The *IsisCB Online* is the most important advance in recent times for the support, at a global level, of the study of the history of science. It is by far the largest bibliography of the discipline and has been running almost continuously since 1914. Its new online platform with an underlying prosopographically supportive informatic, geared for the needs of the 21st Century, will enable researchers to tackle questions previously deemed too challenging, allow the community to contribute new information directly and open the door to new services to enhance the productivity of the scholarly endeavour. However, there are limits to the coverage of the content which means that the history of science, technology and medicine in some countries, languages and cultures is poorly represented. Australia is a good case in point. In 1987 the Australian Science Archives Project established a national biographically-focused register of the archives of science in Australia and this was extended in the late 1990s to include a bibliography of the history of Australian science (HASB). In conjunction with the Australian Academy of Science, an annual bibliography, utilising the efforts of volunteers and enthusiasts, was published in the journal *Historical Records of Australian Science*, and a cumulative bibliography was published online as part of the *Bright Sparcs* web resource, later the *Encyclopedia of Australian Science*. Although some of the references assembled for the Australian bio-bibliography might also be found in

the IsisCB, it is only by chance as the collection channels were entirely independent. The extent of the intersection of the two data sources, both geared to support prosopographical methodologies, is unknown but it was clear that a large number of significant local references are not found in the IsisCB. The new IsisCB platform and standardised information structures should enable these two sets of formalised knowledge to be interconnected in a systematic and sustainable way. It is planned to test this in 2016 and this paper will report on the outcomes of that work. It is not a trivial exercise. If poorly done it may create problems at both ends but if done carefully and successfully it is likely to completely change the way these endeavours are undertaken both locally and at the global level. In an era of rapidly rising information entropy (due to the exponential deluge of random and chaotic data) the curation of data within a standards-driven information infrastructure designed to meet specific human knowledge needs, that is a multi-facetted bibliography, is as important now as it was in 1914, perhaps even more so. This experiment in interconnection will provide a model for others to share their localised knowledge with the global community without losing their particular contextual relevance.

Keywords: IsisCB Online, Encyclopedia of Australian Science, Bibliography, Social and Cultural Informatics, Network Science

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Turning the Isis Current Bibliography into a Prosopographical Tool: Managing Authorities in a Linked Open Data Environment (ID 179)

Stephen Weldon *(University of Oklahoma, Norman, Oklahoma, USA)*

The availability of new resources for scholarly research is always welcomed by scholars, and for scholars doing culture studies, encomiums to bio-bibliographies stand out as especially noteworthy because they provide such rich material for scholarly analysis. Bio-bibliographies stand at the intersection of the intellectual world (the publications) and the social world (the lives of the authors). Bio-bibliographies combine a bibliography of works by a community of authors with biographical information about the authors themselves. Because of the widespread and interlinked nature of information these days—especially freely accessible and easily harvested information (open linked data)—it is possible to produce a bio-bibliographical resource far more easily today than ever before.

This paper explores how the data in the *Isis Current Bibliography of the History of Science* can be combined with other sources of biographical data about the authors to give insights into how the discipline of history of science developed over the twentieth century. The author of the paper is the editor of the *Isis Bibliography* and is creating an online open access resource from this data. By linking to and adding biographical information about authors and institutional information about publishers and universities, I will create a bio-bibliographical resource. This will facilitate a limited prosopographical study. Along the way, I will be able to explore the technical and structural problems faced in building a robust bio-bibliographical dataset.

The online version of the IsisCB has an extraordinary authority list built from (1) a simple thesaurus of terms and proper names used for indexing the subjects of the citations and (2) an index of all authors, editors, publishers, journals, universities, and academic societies that have published these citations. I am now in the process of adding more biographical and institutional data to the authority records so that the biographical material will be more complete.

In the prosopographical study, I will compile data that will help me study how history of science scholarship moves geographically over time, how important specific institutions are, how gender diversity changes, and other similar questions. Although I expect that the results will be inherently interesting to historians of science, the project will be valuable as a case study to learn about how to create similar bio-bibliography resources for other historical areas. I will explain kinds of questions can be most readily answered with data that can be easily collected, and what kinds of data are more complicated to obtain and to integrate. In other words, by doing a limited prosopographical analysis of the history of science community, I can both test the limits of the resources of the current online environment as well as provide a few interesting insights into our discipline's history.

Keywords: Prosopography, Isis Current Bibliography, Open Access, Bio-bibliography, Intellectual and cultural history, Disciplinary history, Cultural informatics, Digital humanities resources, Historiography

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Digital sources as a fund of words and persons: Designing new prosopographical tools (ID 56)

Markus Schnöpf *(Berlin-Brandenburg Academy of Sciences and Humanities, Berlin, Germany)*

The Prussian Royal Academy of Sciences, founded in 1700 by Leibniz, was in a moment of despair when Frederik II. came to power in Prussia in 1740. It had to struggle for its existence already for some years, although being very successful for various reasons: The concept of Leibniz for the academy answered the former necessities of sciences. With the publication of calenders it had its function in society and was financially independent. Finally, the academy was connected to other Berlin scientific institutions and met the king's interests by the election of representative scientists.

Soon after he began to reform the Academy by inviting the mathematician and philosopher Christian Wolff and Pierre-Louis Moreau de Maupertius, who became president of the academy from 1746 until his death 1759. When Maupertuis became president, the academy got a new charter and was renamed to Académie Royale de Sciences et Belles-Lettres. The four classes were kept. The regular members of the academy were obligated to participate in the weekly meetings. Publications had to be finalized in French. During the weekly meetings letters sent to the academy were read and lectures were held. Protocols had to be produced by the academy's secretary, Johann Heinrich Samuel Formey.

The complete stock of the protocols between 1746 and 1786 has been transformed to a digital edition following to the rules of the Text Encoding Initiative. In case of later publications of the lectures, a link to the image digitized publication has been set. All mentioned persons have been identified and linked

to normative data sets (GND), allowing thus easy access to bio-bibliographical data. This information has been integrated in the biographical information system of the academy, the personal data repository, offering access to the biographical information collected in the various projects of the academy, e.g. Alexander von Humboldt.

The digital edition of the academy's registres brings up several questions for a digital history of science:

– how can the different science topics treated in the minutes be clustered? Is it possible to identify historical developments in science?

– Can prosopographical information systems be combined with bibliographical systems, especially when the sources have been digitized?

– As already a huge amount of sources relevant to the history of science have been digitized, are there data models, that allow the access to distributed digital sources, beyond OAI?

Keywords: Academy, TEI, Prussia, Bio-bibliographical information systems, Digital editions, 18th century

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http://akademieregistres.bbaw.de

Understanding historical audiences for science using prosopography (ID 15)

Hattie Lloyd *(University College London, London, UK)*

This project proposes an alternative methodology to understand historical audiences for science. I use prosopography as part of a composite methodology to examine the audience at Humphry Davy's chemistry and geology lectures at the Royal Institution of Great Britain in London, 1801–1812. In this paper I present the results of my prosopographical study, and use those results to answer the research questions:

Who was Davy's audience?

Why were Davy's lectures so popular?

How did Davy's audience shape the development of chemistry in early-nineteenth century Britain?

To understand the structure of the audience I look at variables such as title, first name, surname and address. These variables can be linked to the resources at the actor's disposal. Using the data I can establish how many of the actors lived at a fashionable address, the dominant professions among the actors, and the social, family and professional networks in Davy's audience.

I address the challenges of finding primary sources to build the prosopographical database due to a scarcity of evidence, particularly from female actors. The database contains hundreds of actors, most of which are male. This contradicts the accounts of the lectures by Davy's contemporaries, which describe the audience as mostly female. In this study, prosopography is directed by the conclusions drawn from the lecture accounts of Davy's contemporaries.

Keywords: Audiences, Prosopography, Chemistry

Mapping the cultural topography of chemistry – Chemical manufacturers in France, 1755–1815: A prosopographical study (ID 359)

John Perkins *(Oxford Brookes University, Oxford, UK)*

The enormous growth of public interest in chemistry in France from the early 1770s can be attributed to the public conception of chemistry as a useful science: practical, experimental, open and progressive; a science that was no longer speculative or secret. It was the source of enlightenment, the basis of all the arts, the means of improving them and hence the source of the wealth of the individual and the country. This image was constructed and disseminated widely through chemistry courses many of which devoted a large part to what later became known as chemistry applied to the arts. We find its reflection, and that of the popularity of chemistry, in the private laboratories, 300 or so in Paris alone in the mid-1780s, set up by wealthy bourgeois and aristocrats, magistrates and financiers, farmers-general and state officials. It was these groups who were persuaded to provide finance for large speculative chemical ventures and it was in the laboratories and lecture halls, and the networks linking them, that they encountered the chemists who were seeking their money, and the conception of chemistry that encouraged them to part with it. The financiers, tax officials, and royal administrators who were the principal backers of the Javel works all took Sage' s private chemistry courses as, it seems, did some of those who financed Chaptal's works. In Rouen Descroizilles' chemistry course and laboratory were where he met the textile manufacturers who funded his various ventures. It was in Jean Darcet's Paris laboratories that Le Blanc developed the details of his soda process and Darcet had given private courses to the duc d'Orleans who became Le Blanc's principal backer.

The Situating Chemistry database, which can be viewed at http://situatingchemistry.org has been developed to record information not only on chemists and their biographies, but also on the sites at which they worked, the networks that they participated in and the people, processes and materials that circulated around these networks. This paper will use the database to analyse the social origins and the networks of kinship, connection, education and patronage through which chemical entrepreneurs sought political protection and economic advantage, as well as the capital and credit necessary for their operations. This, in turn, will throw light on the larger question of the role of chemistry in technological innovation in the first industrial revolution.

1750 has been chosen as the starting date because it marks both the rapid expansion of the textile industry, which was the primary driver of the growth of the chemical industry, and the rapid growth in the popularity of chemistry. 1810 saw the crisis that brought to an end the 10 years of boom, which had brought many new entrepreneurs into the industry.

Keywords: Prosopography, History of Chemistry, Paris, Historical Databases, Industrial Revolution, Science and Industry

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Situating Chemistry – Integrating a History of Science Database with a Growing Ecology of Open Data Sources (ID 373)

John Stewart *(University of Oklahoma, Norman, USA)*

The Situating Chemistry database is a web-based, open-note research tool and a reference guide for storing prosopographical information on scientists. In addition to biographical data, it can be used to gather and interrelate information about the sites where science was practiced, the networks of materials, processes and experiments that circulated around them, university and extra-mural courses and their audiences, events, organizations, and associated documents and images. The database was developed for the project Situating Chemistry 1760–1840, which explores the interactions between the conceptual transformations of chemistry, its institutionalization and the role of chemistry and chemists

in innovation in industry and agriculture. It is now being expanded to include information related to any discipline and period of science. It is searchable and the reports it generates include interactive maps. The database can be found at http://situatingchemistry.org.

In this presentation, I will present the system's key features and intended use for mapping the networks of the history of science. Rather than focusing on the narrow networks of renowned scientists, the database gathers information on the broadest possible swath of people involved in science. This bottom up approach to the history of science redefines the prosopographical networks to include not only the university chemist, but also the chemical manufacturers, apothecaries, glass-makers, printers, family, students, and teachers that supported him or her. Because this database is intended to help organize necessarily fragmentary information on often obscure and unstudied individuals, it occupies a point of entry for data into an increasingly complex system of linked data. Both the implementation of this database and the interlinking of it with other resources offer experiential insight into the affordances and challenges of open prosopographical data for the history of science.

Keywords: Prosopography, Historical Databases, Open-Note, Open Data

The 'Historical Dictionary of Switzerland': a powerful source for the historiography of science (ID 603)

Erwin Neuenschwander *(University of Zurich, Zurich, Switzerland)*

The *Historical Dictionary of Switzerland* (HDS), the new Swiss encyclopaedic academic reference work covers the history of mankind in the geographical area of today's Switzerland from the very beginning in Palaeolithic times to the early 21st century. The HDS comprises four different groups of headwords: biographies (35%), articles on families and genealogy (10%), geographical entries (30%) and headwords for thematic contributions, i.e. subject articles (historical entities, institutions, scientific disciplines etc.) (25%). The HDS was parallelly published in each of the three Swiss national languages German, French and Italian from 2002 to 2014. Each printed edition comprises 13 volumes, a total of approximately 40,000 headwords and about 8,000 illustrations, what adds up to over 10,000 pages. The HDS staff was composed of approximately 30 persons at the central editorial office and roughly 100 thematic scientific advisers who teach and research at Swiss or foreign universities or cantonal (state) archives. There existed contracts with more than 2,500 highly qualified historians who wrote the entries which were then translated by over 100 specialists into the other two national languages.

For the presentation of each volume the HDS staff organized vernissages in all the cantons treated in the respective volumes by inviting all the authors and the most important politicians of these cantons. In one of these vernissages the Federal Councillor and Head of the Swiss Department of Foreign Affairs, Didier Burkhalter emphasized that the HDS is of the utmost importance for the national cohesion, which clearly demonstrates the political dimension of the project. In 1997 the HDS board decided to commemorate the founding of the Swiss Confederation of 1848 with an internet publication of the HDS for the anniversary year 1998. The online-version is now – after the completion of the printed version – being updated in respect of a multimedia, linked data approach – newly under the auspices of the ‚Swiss Academy of Humanities and Social Sciences' with the financial support of the Swiss Government (cf. www.hls-dhs-dss.ch).

Our contribution will describe the editorial process of the whole subject area of mathematics and natural sciences in the HDS – covering about 1,200 biographies and approximately 40 thematic articles – supervised by the presenter in the years 1994–2016. Discussed are, among other things, the drafting of the keyword lists and the design of the head articles in the various scientific disciplines, how to find suitable authors possessing both the necessary historical and scientific expertise to do the complex research for the often short micro-biographies, the question of how to present in an extremely limited space a maximum of information, and the battle for more lines for the history of science in a dictionary dominated by the humanities. For the bicentenary of the Swiss Academy of Sciences, the texts about

the natural sciences and individual scientists in the HDS will comprehensively be updated by the Swiss National Committee of the IUHPST and reissued in a one-volume encyclopaedia. By this soon to be published volume one can reconstruct and analyse the development of Switzerland to a first-rate internationally linked science nation.

Symposium 17: Enduring Ideas, New Alliances: Social and Epistemic Factors in the Renaissance of General Relativity

Organizers & Chairs: ***Roberto Lalli*** *(Max Planck Institute for the History of Science, Berlin, Germany),* ***Alexander S. Blum*** *(Max Planck Institute for the History of Science, Berlin, Germany)*
Commentator: ***Jürgen Renn*** *(Max Planck Institute for the History of Science, Berlin, Germany)*

In the century following Einstein's ultimate formulation in 1915, the general theory of relativity has evolved from a revolutionary mathematical theory with limited contact with the empirical world to an observationally and experimentally based cornerstone of modern physics and cosmology. This momentous shift started around the mid-1950s. While in the previous decades general relativity was perceived as a highly formalistic subject involving only few theorists, by the mid-1960s Einstein's theory has become an extremely vital research stream of theoretical physics, at the same time sparking entirely novel fields such as relativistic astrophysics – a process that came to be known as "renaissance of general relativity." The revitalization of general relativity, moreover, crossed the boundaries of science, and had a large social impact as well as a significant influence on philosophical debates.

Starting from a re-assessment of the period that has been called the "low-water-mark" of general relativity by J. Eisenstaedt, the symposium aims at investigating the global dynamics of this complex process by taking into account the interactions of a variety of factors such as the role of quantum gravity research, the historical evolution of theoretical astrophysics until the emergence of relativistic astrophysics, the establishment of the program on gravitational wave detection in Italy and its role in furthering an international network of collaborations, the establishment of a community of scholars active in the field of general relativity analyzed by the tools of the social network analysis, the origins of relativistic hydrodynamics, and the controversy about the black hole information paradox. These case studies can shed light on the socio-epistemic dynamics through which a previously marginal field came to return to the mainstream of physics. Our symposium will especially focus on the interconnections between the enduring power of mathematical structures in theoretical physics and the relevance of power structures within the scientific communities in the renewal of general relativity in the post- and Cold-war period.

Keywords: general relativity, theoretical tools, internationalization, social networks, Cold War, quantum gravity, gravitational radiation, relativistic astrophysics, black holes, relativistic hydrodynamics

General Relativity, a Theory Ahead of its Time (ID 185)

Jean Eisenstaedt *(Syrie Observatoire de Paris, Paris, France)*

In the present paper, I argue that general relativity endured what I call a "low-water-mark" period, in which the theory was related to a few, slight, tests, and had no practical applications.

I will show that up to the sixties the range of applicability of general relativity was the same of the Newtonian gravitational theory; namely, the Sun and its planets, whose gravitational fields are weak. Since the theory provided only small corrections to the Newtonian theory, physicists considered general relativity unnecessary. Moreover, I will show that the large majority of physicists regarded general relativity as too mathematical, too difficult to handle, and in many respects incomprehensible. As a consequence, only a few of them worked on the theory, and they were isolated from each other.

When the theory of general relativity was formulated in 1915, the connection with the empirical world was limited to the three "classical" tests, all very small. This situation did not change for almost fifty years. For the large majority of the physics community, it was unnecessary to investigate the details of such a complicated theory just to account for the slight anomaly of the Mercury perihelion, the gravitational bending of light first observed in 1919, and the gravitational red-shift, whose confirmation remained controversial up the 1950s. The limited range of applicability of the theory affected the way in which scientists interpreted general relativity and understood its physical consequences. What I call

a neo-newtonian interpretation of the theory was good enough to explain the three "classical" tests. This way to understand the theory was widespread during the low-water-mark period and significantly affected its evolution up to its renewal in the 1960s.

This renewal came from two parallel developments. The first one was related to the field of physical cosmology that general relativity revolutionized in the late twenties, when the theory of the expanding universe aroused a real interest in, and permitted a better understanding of, the theory. The other one came in the sixties from astrophysics, when new technics led to new discoveries, which in turn implied theoretical problems involving strong gravitational fields. These developments led to a plainly relativistic interpretation of the theory linked with the possibility of a collapse of a massive star into a black hole, whose concept was not accepted before.

Keywords: general relativity, neo-newtonian interpretation, relativistic astrophysics, relativistic cosmology, low water mark of general relativity

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A farewell to speculation: How quantum gravity drove the renaissance of general relativity (ID 356)

Alexander Blum *(Max Planck Institute for the History of Science, Berlin, Germany)*

Almost from its inception, Einstein's general theory of relativity pointed beyond itself: A case in point are the attempts by Einstein himself and others to extend general relativity to a unified field theory, which would also incorporate the electromagnetic field and possibly matter as well. In the early 1950s, John Wheeler and Peter Bergmann initiated a more conservative approach of constructing a quantum theory of gravity based on the well-founded principles of quantum mechanics and general relativity. It was hoped that this might actually solve the current problems of quantum field theory and the infinities involved in combining the concepts of point particle and field. While these attempts at a quantum theory of gravity encountered diverse and grave problems and the search for such a theory continues to this day, the research on quantum gravity uncovered many unanswered problems within the classical theory of general relativity. Ultimately, this realization led many young physicists away from the ambitious programs of their mentors, instead to pursue problems within general relativity proper, thereby providing both the manpower and the driving questions for the renaissance of relativity in the 1950s and 1960s. In my talk, I will discuss this development, focusing on the formulation of Wheeler's and Bergmann's quantum gravity programs and the specific problems in general relativity implied by them, which became central research questions in the renaissance.

Keywords: Peter Bergmann, John Wheeler, quantum gravity, general relativity, renaissance of general relativity, particles and fields

The emergence of relativistic astrophysics in the early 1960s (ID 223)

Luisa Bonolis *(Max Planck Institute for the History of Science, Berlin, Germany)*

Starting from the mid-1920s, different strands of research used stars as "cosmic laboratories" for thinking about matter under extreme conditions of densities and pressures that were impossible to realize on Earth. Along this trajectory, a small number of key actors working within overlapping but different scientific cultures were able to mold from nuclear dense matter basic physical systems that in turn led to the first pioneering application of general relativity to a prototype of very compact astrophysical object. Post-war science provided new conditions for the interaction between the evolving fields of nuclear physics, astrophysics, cosmology, optical and radio astronomy, and "cosmic physics", that included cosmic rays, galactic magnetic fields, and in particular plasmas in space. In the second half of the 1950s astrophysical plasmas also came to be connected with the beginning of experimental studies on hot plasmas confined by magnetic fields after the declassifying of controlled thermonuclear fusion research by the major participating nations. At the same time, implosion and explosion problems, related to the design of thermonuclear weapons, led to reconsider with renewed interest investigations on highly dense stellar matter and the role which general relativity must play in resolving such issues as the end point of stellar evolution. These and other impressive advances in nuclear science were associated with the development of the first powerful computers, designed to perform the complex simulations for thermonuclear weapons, and now used to calculate the equation of state of condensed stellar matter and to tackle the problem of gravitational collapse within Einstein's theory. During the 1950s, following major innovations in the techniques of radio and optical astronomy, it was recognized that exceedingly high energies of unknown origin were released within strong radio sources, providing a new compelling evidence of violent events in the Universe. In 1963, some theorists suggested that such energies could be supplied through the gravitational collapse of a superstar, a belief immediately strengthened by the intriguing discovery of the so called quasi-stellar objects, a new class of powerful highly redshifted radio sources. On the other hand, in exploring the untapped potential of the general theory of relativity, the enlarged and institutionalized post-war community of relativists had already produced theoretical achievements that proved fundamental to tackle the new challenges coming from the new astrophysical discoveries. The actual merging of astrophysics and general relativity into a brand new discipline starting from the 1960s was a complex process that also needed brand new observational tools like X- and gamma-ray astronomy, that starting from the 1970s would allow systematic investigations on high-energy astrophysical processes pertaining the domain of general relativity. The study of the interaction between different material and intellectual cultural practices is thus showing that it was from the confluence of several strands of research and new technological tools that the context could flourish in which astrophysicists were able to recognize that physical processes exist in the universe in which considerations of general relativity have a dominant role or even that are understandable *only* in terms of Einstein's theory.

Keywords: General Relativity, Astrophysics, Dense Matter, New Astronomies, Stellar evolution, Nuclear Physics, Gravitational Collapse

Building a Scientific Community in the Post-War Era: A Social Network Analysis of the Renaissance of General Relativity (ID 297)

Roberto Lalli *(Max Planck Institute for the History of Science, Berlin, Germany),* ***Dirk Wintergrün*** *(Max Planck Institute for the History of Science, Berlin, Germany)*

Most historians of science and physicists agree that during the second half of the twentieth century the field of general relativity and gravitation physics experienced an impressive revival, which has been christened the "renaissance" of general relativity (Will 1986). Einstein's theory of gravitation returned to the mainstream of physics and became the theoretical basis of relativistic astrophysics and observational cosmology after a long period described by Jean Eisenstaedt as the "low water mark" of the

theory (Eisenstaedt 1986). While there is widespread agreement that this phenomenon occurred, scholars strongly disagree on its main characteristics, and there is no accepted definition of its beginning. As a consequence, many different factors have been proposed as the main cause of this process, including technological advances, new theoretical tools, and increasing funding for theoretical physics coming from military sources, especially in the United States.

The present talk aims at describing and understanding the social aspects of this dynamical process with the tools provided by the social network analysis. By mapping the network of collaborations in the research fields related to general relativity from 1920 to 1970, it is shown that the connectivity of the network of scholars who were actively involved in these kinds of research changed dramatically soon after the mid-1950s. The visual representation of the network dynamics and the related quantitative analyses allow for a more precise definition of the social dimension of the renaissance of general relativity. It is showed that the increasing connectivity and the topological changes of the network of collaborations provide for an accurate definition of the beginning of this historical process. A quantitative study of the changes of the collaboration network between scholars belonging to different disciplines, or working in different countries, also shows to what extent this connectivity was related to disciplinary and national boundaries and how these relationships changed over time. On the basis of these quantitative analyses, I will show that a community of scholars working on general relativity and gravitation was already established before new astrophysical discoveries provided further connection between the general relativity and the empirical world. I will then argue social dynamics of the community of scholars working on the fields related to general relativity is in agreement with the historiographical framework recently elaborated by Blum, Renn and myself (2015) in order to explain the global dynamics of this complex historical process.

Keywords: Social network analysis, general relativity, cold war, scientific fields, community building

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Looking for coincidences: the birth of gravitational wave detection in Italy and the beginning of the first International detector networks (ID 361)

Adele La Rana *(University of Rome 'Sapienza', Rome, Italy)*

Coincidence analysis is a fundamental issue of gravitational wave (GW) detection: in order to identify a GW signal in a stream of experimental data, a single ground-based detector is not enough and comparison between simultaneous data coming from different detectors is needed. The search for GWs is thus a community endeavor, which highlights the antinomical process of scientific competition/collaboration.

The interest in GWs had been swiftly growing in the scientific community since the end of 1960s, stimulated by the papers by Joseph Weber, claiming with increasing confidence to have detected gravitational radiation. Furthermore, the development of relativistic astrophysics and especially the discovery of pulsars in 1968 provided attractive candidates as GW sources.

The first projects for gravitational wave detection in Italy were born in 1971 at the Institute of Physics 'Gugliemo Marconi' in Rome and at the European Space Research Institute (ESRIN) in Frascati. The

key figures promoting the new research activity in Rome were Edoardo Amaldi and his young assistant Guido Pizzella; in Frascati, Donato Bramanti and Karl Maischberger.

The two research groups proceeded on parallel paths. The Rome group aimed at building a cryogenic resonant bar detector, using the recently invented technology of Superconducting Quantum Interference Devices (SQUID) to amplify the signal of the resonant transducer. Instead, the ESRIN team rapidly set up a room temperature detector, as the ones used by Weber in the late Sixties.

Both groups established collaborations for coincidence analysis. The activity of the Rome group started as a joint endeavor with the teams of William Fairbank at Stanford University and the team of William Hamilton at Louisiana State University, envisaging the construction of three cryogenic detectors, cooled to 0.003 K, to be installed in the three locations.

The ESRIN antenna worked in coincidence with the room temperature detector located at the Max Planck Institute for Physics and Astrophysics in Munich, producing its first results already in 1972 and 1973.

Part of the present historiographical work aims at analyzing how the two projects started, which were their peculiarities and how they developed and interacted, taking into account the different institutional frameworks in which they were born.

On the other hand, special attention is played to the establishment of the first GW detector networks in the International context of the increasing GW community.

Keywords: gravitational waves, Amaldi, Pizzella, resonant bar, European Space Research Institute, Fairbank, Bramanti, Maischberger, cryogenic detector

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Symposium 19: On the move: the circulation of radioactive materials in the cross road of health physics and biomedicine

Organizers: ***Maria Rentetzi*** *(University of Vienna, Vienna, Austria & National Technical University of Athens, Athens, Greece),* ***Maria Jesus Santesmases*** *(CCHS Consejo Superior de Investigaciones Científicas, Madrid, Spain)*

This session focuses on the circulation of radioisotopes in the crossroad of health physics and biomedicine during the atomic age. Focusing on the circulation of radioactive materials such as radioiodine and radiostrondium we tell the complex stories of radioactive *landscape* and *labscapes*. Questioning the role of international institutions in shaping research in health physics and biomedicine we unfold issues of authority and political involvement. The proposed papers offer more complex stories of the circulation of both materials and actors that contemporary radioactive landscape and labscapes manufactured and put in motion.

Alison Kraft traces the ways radiostrondium was transformed to a political problem, an item of scientific debates, an argument in the anti-nuclear activism. Following the circulation of radioiodine, **Maria Rentetzi** questions the role of one of the most powerful international institutions that of the IAEA, in standardizing the medical applications of radioisotopes. Politics feature ones again in a prominent position. In **María Jesús Santesmases's** paper, radioiodine becomes a tool for maintaining scientific work, securing funding and resources, sharing experimental cultures, establishing expertise in a new field. **Alexander von Schwerin** takes up the issue of scientific institutions and underlines the ways radioisotopes and chemical hazards shaped biomedical research and transformed institutional profiles.

Overall, embedded in the history of the 20th century biomedical sciences and Western societies at large, radioactive materials circulated widely, very much unseen but detected by the instruments and tools that the early atomic research technologies provided. As all travellers in the history of human civilization, radioactive elements moved around affecting living beings. Biomedicine, the clinical laboratory, and human health turned out to be political issues of major importance as radioisotopes were closely associated with the military and international regulatory institutions. Papers in this session follow the whereabouts of radioisotopes very closely and reveal untold stories of the atomic age.

Keywords: radiation, radioisotopes, circulation of materials, biomedicine, health physics, standardization, radiation hazards, late 20th century, International Atomic Energy Agency

Blood, bombs, borders: Radiostrontium – a biography (ID 23)

Alison Kraft *(University of Nottingham, Nottingham, UK)*

By the 1940s, the health hazards of ionising radiation were recognised but poorly understood. The dangers included somatic effects, including a suspicion that it could trigger leukaemia, and deleterious genetic effects, which could be passed between generations. These dangers were cast into new and sharp relief as radiation became a central problem of the atomic age and a major public health issue of pressing concern to politicians, policy-makers and the public alike. This paper focuses on one part of this story, that of radiostrontium.

Radiostrontium was one component of radioactive 'fallout' created by the hydrogen bomb and was considered to be potentially especially deadly because of its damaging effects on the blood system. Indeed, by the late-1950s, it was increasingly implicated as a cause of leukaemia. Following the US *Castle Bravo* thermonuclear test of March 1954, this isotope, already the subject of secret research within the US nuclear nexus, provided a rallying point for mounting anti-nuclear sentiment. Travelling at altitude across national borders, radiostrontium constituted a unique and universal hazard. Its circulation around the world, between animal and plant life, and within the human body, rendered it a biological, medical and political problem across the Cold War divide.

This paper examines radiostrontium from three different but intersecting perspectives. First, it explores how for the three nuclear powers it became a serious political problem. Second, it examines the highly charged debate amongst scientists who were sharply divided on its dangers, a division that often reflected pro- and anti-nuclear positions. Finally, the paper examines the significance of radiostrontium for a new kind of environmental thinking: it featured prominently, for example, in Rachel Carson's *Silent Spring* (1962). Overall, the analysis considers how radiostrontium brought radiation, leukaemia, anti-nuclear activism and the environment into new relation to each other.

Keywords: ionising radiation; radiostrontium; hydrogen bomb; weapons tests; joseph rotblat; Pugwash; anti-nuclear protest; environment.

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Ruling the World with a Suitcase: The Standardization and Calibration of Thyroid Radioiodine Uptake Measurements by the IAEA (ID 20)

Maria Rentetzi *(University of Vienna, Vienna, Austria & National Technical University of Athens, Athens, Greece)*

One of the most valuable diagnostic applications of radioactive isotopes during the 1960s was the determination of the uptake of radioactive iodine by the thyroid gland of patients suffering from thyroid disorders. Since there was not a standard method to carry this procedure worldwide the newly established International Atomic Energy Agency embarked in a major standardization project. IAEA scientists constructed a calibration equipment- a box like suitcase that included a dummy figure of the upper part of the human body filled with a small amount of radioiodine. The suitcase included a number of standard vessels of various sizes and shapes containing amounts of mock iodine. From spring 1962 to the end of 1965 one of the IAEA scientists visited 199 medical isotope laboratories in 41 countries carrying the calibration box. The aim was to standardize the measurements of the uptake of radioactive iodine worldwide. The Agency was willing to calibrate laboratory equipment in the UN Member States and at the same time to promote its standardized technique of measuring thyroid radioiodine uptake for general use. In this paper I discuss the IAEA attempts throughout the 1960s to curve a niche and legitimize its position not only within the system of UN specialized agencies but also within the broader scientific community.

Keywords: radioiodine, standardization, IAEA, calibration, UN international organizations

The journeys of radiation: The circulation of radioiodine and the Atomic era geopolitics (ID 22)

María Jesús Santesmases *(CSIC (Consejo Superior de Investigaciones Científicas), Madrid, Spain)*

In 1961, a young research couple, Gabriella Morreale and Fernando Escobar received the visit of an officer from the IAEA, who offered them the possibility of being funded by the IAEA Research Program. After their previous training as postgraduates and postdoctoral fellows, in Madrid and Leiden, at their return to Spain, their home institution (CSIC, the Spanish research council) granted them laboratory space but not the funding they needed to developed their project on experimental endocrinology. IAEA awarded the funding and this contributed to stabilise their research career, while also participated in the promises of the uses of radioactivity for the life sciences.

In this reconstruction I will show travels of both researchers and tools, and of the knowledge associated. This circulation of people and objects created, maintained and extended expert communities, a *knowing set* which carried a system of authority and was able to provide such authority.

In this presentation, I will analyse the particular trajectories of objects, subjects and ideas attached to radioiodine by emphasizing transportation, diffusion, appropriation, learning. When looking at objects, ideas and people, I will show places and travels. In this wide zone of exchanges where there was a continent – Europe – and a geographical and political culture – the West – located in the post- WWII era, both the material and the symbolic circulated attached to radiation.

Keywords: radioisotopes, circulation, travels, IAEA, Spain, life sciences

From Radioisotopes to Genomes: The Biomedical Legacy of Atomic Age's Big Science Institutions (ID 21)

Alexander Schwerin *(Max Planck for the History of Science, Berlin, Germany)*

This talk will focus on institutions that were specialized in breeding experimental animals and animal models. These institutions deserve not only special attention as they were formative for the organization of genetic research, but for the long-term development of biomedical research in the 20th century, too. Today, it seems not reasonable to associate genomics with the Atomic Age at first hand. However, if one draws the trajectory of those research institutions of the Atomic Age, which became later synonymous with the birth of "big science" in both physics and biology, one will realize an astonishing adaptability of these mammoth research centers. The talk traces the trajectory of theses centers, starting in the 1950s at the German Radiation Research Center at Munich-Neuherberg, passing the Oak Ridge National Laboratories, Knoxville, Tennessee, and ending with the foundation of the large-scale mammalian biobanks, the so called Mouse Clinics, in Munich and at the Atomic Research Establishment, Harwell, England, in the early 2000s. In doing so, the talk will discuss the mentioned institutions not in terms of stability—what in fact is the main function usually ascribed to them—but in terms of change. Also, it will figure out the moving forces in that, namely radioisotopes and chemical hazards.

Keywords: radiation, molecular biology, history of institutions, genomics, cold war science, risk policy, testing systems, big science, toxicology

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Symposium 24: Science funding and gendered scientific personae in interwar Europe

Organizers: ***Kaat Wils*** *(University of Leuven, Leuven, Belgium),* ***Kirsti Niskanen*** *(University of Stockholm, Stockholm, Sweden)*
Chair & Commentator: ***Donald L. Opitz*** *(DePaul University, Chicago, USA)*

The scientific landscape of the twentieth century has been deeply marked by the institutionalization of scientific funding. Many of the funding agencies that exist today, both national and transnational, private and public, were founded during the interwar years. These funding agencies have impacted upon the practice of science in many ways. Through the creation of specific content-related funding opportunities and through selection and evaluations procedures, both the definition of good or topical research and the definition of a good scientist have been shaped by these new structures.

In this symposium, the impact of funding agencies on the ways in which scientists and scholars came to be defined, is investigated. Particular attention is paid to the role of gender in the processes of selection and evaluation of candidates for fellowships and travel grants. Two types of funding agencies which have been active in different European countries during the inter-war years are studied. On the one hand, the science policies and gendered selection mechanisms of American philanthropic organizations are analysed, with a focus on the Rockefeller Foundation's fellowship programs and infrastructural grants in Sweden, and the Belgian American Educational Foundation in Belgium. On the other hand, the funding programme of the International Federation for University Women and the Dutch Catherine van Tussenbroek fund for female scholars is studied. In all four cases, the role of gender in the creation of scientific personae constitutes a central element of analysis.

Funding agencies have functioned as gatekeepers, defining what a good scientist looks like (both literally and figuratively), thereby impacting on scientific identity. In this process, specific epistemic communities have sometimes been created and a new scientific culture originated in which accountability and geographical mobility became important aspects of scientific life. In order to be acknowledged as a 'fundable' scientist one had to embody specific scientific personae, culturally anchored roles and repertoires that responded to the funding agency's expectations. In an overly male-dominated world of science policy, it was more difficult for women scientists (and other outsiders in science) than for men to perform these personae and to answer the organization's expectations. As a response to this, all-female organizations were created in order to enhance female scholars' opportunities to participate in this new scientific culture. Whether these organizations tried to create new scientific personae or rather adapted to existing, male oriented models of being a scientist, is one of the central questions of this symposium.

This symposium was sponsored by the Commission on Women and Gender Studies.

Keywords: funding agencies, travel grants, gender, scientific personae, interwar years, Europe, American philanthropy, International Federation for University Women, female scientists

Searching for "brains and quality". Fellowship programs and male constructions of scientific personae by the Rockefeller Foundation in Sweden during the interwar years (ID 84)

Kirsti Niskanen *(Stockholm University, Stockholm, Sweden)*

This paper will discuss the role of international research funding in creating gendered scientific personae in Swedish social and natural science research during the interwar years. It starts by stating the important role that the American philanthropy played in the internalisation of research in Europe during this period, due to the fact that there were hardly any local financiers of research that could match the financial resources, wide ranging activities and organizational capacities of these foundations. With the aid of fellowship programs and infrastructural grants, the Rockefeller Foundation contributed to building up new research areas and disciplines in Sweden (as it did in the rest of Europe) in fields that were

expanding or beginning to be institutionalized. Through these programs, ideas and practices of the American research university were conveyed to the receiving research institutions. The social form of "project" became the dominant form of research organisation. It imposed new demands on the researchers: command of team work, time limits for conducting research, expectations of presenting results, submitting reports and having past achievements evaluated. An explicit goal of the Rockefeller fellowship programs was to create excellent scientific personae – that is successful researchers who would take up leading positions in academic research and teaching in their home countries after the stays abroad. The paper analyses how the selection process of fellows and the expectations and attributions posed on them resulted in (unintended) gendered outcomes. In a gendered academic context, the criteria of nominating, selecting and supporting individuals with "brains and quality" was almost always tantamount to supporting men, thereby strengthening the existing gender structures in the academia.

Keywords: scientific personae, gender, research funding, internalisation of research, Sweden, interwar years

Funding Scholarly Women: The International Federation of University Women's fellowships program in the interwar period (ID 188)

Anna Cabanel *(University of Groningen, Groningen, the Netherlands)*

Funding agencies played an important role in reshaping both contents and practices of sciences in the 20th century as they contributed, through their fellowships programs, to select the 'best' or 'most promising' scholars. Although no gender restrictions were officially inscribed in their selection rules, and even though women were increasingly entering the scientific realm at that time, only few succeeded to be awarded with such fellowships.

By creating a fellowship program entirely dedicated to women scholars in the 1920s, the International Federation of University Women (IFUW) intended to provide a 'compensatory system' (Rossiter) giving the opportunity to those left by the wayside by most funding agencies to travel and pursue research. Conceived as a single-sex program, it aimed to help women integrate and get recognition from the scientific community.

This paper analyses the political purpose of such a program. By rewarding women scientists, not only was the International Federation among the first ones to offer recognition to women, but also intended to change the (male-dominated) professional *habitus* (Bourdieu) prominent within the scientific community by pressuring it to acknowledge the work and potential of women scientists.

Furthermore, this paper discusses the role the IFUW played in creating, or adapting already existent, convincing scientific *personae* for women. The selection of the IFUW's fellows, as ambassadors of the organization and of women scientists, was thus of prime importance for both the credibility of the IFUW and its gendered claim. Based on the analysis of the selection committee's archives and the fellows' files, this paper also intends to approach the definition of the 'ideal-type woman scientist' enacted in the selection process by looking at the (implicit) norms and expectations, and then to measure the impact of the fellowship in the former fellows' careers.

Keywords: scientific personae, International Federation of University Women, fellowships program, women scientists, funding agencies, scientific reward, scientific recognition, gender history

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Travel grants for female scholars in Belgium during the Interwar years (ID 25)

Kaat Wils *(University of Leuven, Leuven, Belgium),* ***Pieter Huistra*** *(Utrecht University, Utrecht, the Netherlands)*

With the advent of new funding agencies in the interwar years, scientific travel became an almost self-evident and to some extent standardized aspect of scientific life. Applying for travel grants, being judged by selection committees and having to report on the scientific results of stays abroad became standard requirements. For women, these requirements may have meant an additional obstacle to gain access to the academic establishment, while their travel experiences may at the same time have had an empowering impact. Selection and reporting practices which were part of the institutionalization of scientific travel were in any case not gender neutral.

This contribution focuses on two scholarship granting organizations during the inter war years: the Belgian American Educational Foundation (BAEF) and the Belgian section of the International Federation of University Women (BFUW). Although the general aims of both organizations differed – to develop Belgian scientific research and enhance Belgian-American relations through scientific travel on the one hand and to support the careers of female university graduates on the other hand – both associations allowed female scientists to obtain travel grants. The aim of our contribution is twofold: to map the Belgian participation of women in interwar scientific travel and – more importantly – to analyze how the different aims and institutional cultures of both organizations impacted on scientific persona. The BAEF in particular invested in the formation of models of being a scientist. These models were implicitly masculine but open to the small minority of women who were able to present themselves as candidates and ready to inscribe themselves in a 'sexless' discourse. The BFUW in its turn offered an important social space and financial support for female scholars, but was not focused enough on academia to develop a scientific persona which might have offered an alternative to the masculine models that existed.

Keywords: travel grants, Belgian American Educational Foundation, Belgian Federation for University Women, interwar years, female scientists, gender, scientific personae

Scientific Persona and the Catharine van Tussenbroek fund, 1926–2000 (ID 158)

Dineke Stam *(Cultuur&Co, Amsterdam, the Netherlands),* ***Mineke Bosch*** *(University Groningen, Groningen, the Netherlands)*

In her prize winning book *Women Scientists in America, Struggles and Strategies to 1940* (1982), Margaret Rossiter in her final chapter discusses the system of "compensatory recognition" that women scientists created in the absence of any fair chance in the reward system of 'normal science'. Interestingly, although she analyzed fellowship programs such as the Rockefeller Program of the National Research Council Fellowships and their exclusionary criteria for women scientists she discusses only women's clubs and special prizes, not fellowships. But we can infer what her opinion on them would be: palliative for individual women at best, but with no impact on the segregated system that science was. Be that as it may, the many fellowships for women that were created in the 1920s and 30s do testify of a rather collective effort to change the pattern. Not only may this form of recognition have helped them in their career, but we suggest that these fellowships may also have helped women to

socialize into 'scientists', be it as 'copies' of male scientists, or in the form of newly invented 'scientific personae'.

This paper studies the Dutch Catharine van Tussenbroek (1852–1925) Fund that was founded in 1926 with the aim to stimulate women scientists' careers, and that still exists. Which shifts over time can be detected in the long history of the CvT fund with regard to the bursaries? What is funded (travel, house hold assistance, unpaid leave), to whom and with how much money? What were the subjects and themes that received funding? What role did scientific quality, marital status, class and 'race' or 'character' play in the correspondence regarding the selection? Did the Catharine van Tussenbroek fund support women only financially, or did the fund have (changing) ideal-type images of women scientists that were awarded?

Keywords: scientific Personae, women scientists, Funding, Socialization, Compensatory recognition, fellowships

Symposium 29: Skulls and roses: natural history collections and their meaning in 18–19th centuries

Organizers: ***Anastasia Fedotova*** *(Institute for the History of Science and Technology, Russian Academy of Science, St. Petersburg, Russian Federation),* ***Marina Loskutova*** *(National Research University – Higher School of Economics, St. Petersburg, Russian Federation)*
Chair & Commentator: ***Marianne Klemun*** *(Universität Wien, Wien, Austria)*

The recent shift of attention from ideas to practices in the history of science alerted scholars to the importance of spatial and material aspects in the production of knowledge, promoting a growing corpus of literature on natural history cabinets, museums and botanical gardens. Some scholars even went further on by examining the 'spaces in between' the field and the museum, botanical garden or a pharmacy – the spaces where a natural object acquires a new status of a scientific specimen, while loosing some of its previous cultural attributes. This panel seeks to develop this line of reasoning and to enhance our understanding of the ways in which natural objects were transformed into specimens, assembled as collections and used in a broad variety of cultural, political, economic and social contexts of the 18th–19th century Europe. The panelists will examine a variety of purposes for which different actors used natural history collections and specimens – the ways in which these objects acquired a new cultural and scientific significance. The contributions to this panel will examine a broad range of natural history collections – from craniological specimens amassed by naturalists in the Caucasus to rose varieties cultivated by French horticulturalists. In particular, the panel will explore the function of natural history collections and specimens as a gift exchanged between academic and non-academic partners, a gift that is deeply embedded in social relations, that defines and binds together the giver and recipient and is deliberately intended to facilitate other transactions. Another aspect that we will examine is a complex interaction between collections on display and their various groups of viewers/users. The papers on the panel will consider the ways in which competing interests of these groups affected the selection of objects and the display of exhibits. Finally, this panel seeks to explore the relation between collections and specimens, on one hand, and associated practices of viewing, testing, describing and visualizing, on the other. How did these practices become associated with and disentangled from the objects themselves? What happens to these practices when the objects are moved to a different location? Who, why and how determines legitimate practices and rules out other possible ways of treating collections and specimens? By answering these questions, we hope to improve our understanding of the relations between advancement of knowledge in natural history in the 18th–19th centuries, on one hand, and a cultural practice of collecting.

Keywords: natural history, collections, 18th centuries, 19th centuries, botanical gardens, specimens

A national Forestry Museum and a Geographical Arboretum (1900–1970): Built to please the Belgian Ministers only? (ID 32)

Denis Diagre-Vanderpelen *(National Botanic Garden Meise, Sc. Coll. Free University of Brussels, National Center for History of Sciences, Brussels, Belgium)*

When the Catholic Party took over its liberal opponent in the national elections of 1884, heavy clouds began to darken the future of the Belgian State Botanic Garden, in Brussels. One good reason for it was that the scientific institution was regarded as too connected to the liberal milieu and the liberal University of Brussels. Another reason was that the Catholic Party immediately set up a new ministry that echoed its deep moral values, and that the Botanic Garden passed under its authority. The newborn Ministry of Agriculture was dedicated to applications and paid little attention to studies in plant systematic that the botanists of the Garden hoped to carry on. In the middle of the Nineties, the democratization of the Belgian society brought some financial hopes in the despondent State Garden, though. While the number of voters dramatically expanded, the Catholic Ministers had to design new ways to seduce them. Public collections for popularization were part of the Catholic propaganda

toolbox. This is how the Botanic Garden was urged to set up an attractive two folded (scientific collections and popularization display) Forestry Museum and Curator Ch. Bommer was asked to design a "phytogeographic" arboretum in the suburb of the capital. In his view, "dried collections" and living collections were supposed to support and complement each other. Suddenly, the Garden that suffered from severe budget limitations got extra money for what sounded like a politicians' whim. The Museum was inaugurated in 1902, as works in the Geographical Arboretum were still carried on. In 1912, foreign botanists looked in awe at the 20.000 trees planted in Tervuren and the Museum of Forestry was regarded as a must see of the State Garden. But, was it actually visited and, if so, who visited it? Did these collections ever impact research and education as they were supposed to do? How did the Botanic Garden manage to pile up its extensive collections so rapidly? How and why did the Curator select the exhibited objects? What has the future in store for the Forestry Museum? These are some of the questions we shall try to answer in this contribution.

Keywords: Botanic Garden, the late 19th century, Belgian State, Museum of Forestry, Ministry of Agriculture, popularization, the early 20th century

Plants and politics: power relationships in botany in the Russian Empire, second half of 18th – early 19th century (ID 35)

Olga Elina *(Institute for the History of Science and Technology, Russian Academy of Science, Moscow, Russian Federation)*

This paper analyses circulation of plant objects in the second half of 18th – early 19th century in the context of power game of the patrons of botany, on one hand, and social mobility of professional botanists, on the other hand. Focusing on the case of the Russian Empire, I will trace early history of botanic collection in terms of *gathering and expansion of the empire*, as well as a part of *noble culture*, that forced amateur patrons to invest in expeditions, botanic gardens, and professionals to manage these projects. Young graduates of West-European universities, who started working at private botanic institutions, later could successfully apply for high academic positions. Circulation of specimens had developed as key element of botanic collection and basis for networking of the professionals and amateurs around the world. I also argue that exchange/presenting of plant objects – seeds, specimens, herbarium sheets – became an important channel of foreign policy. "Plant diplomacy" demanded to recruit botanists for consulting purposes; these new responsibilities tremendously increased botanists' status as experts "at highest levels". Diverse group of personalities such as Empress of Russia Catherine II, aristocrat Alexey K. Razumovsky, mine industrialist Prokophy A. Demidov, member of St. Petersburg Academy of sciences Peter S. Pallas, director of St. Petersburg Botanic garden Friedrich B. Fischer, King of England George III, president of Royal Society of London Sir Joseph Banks, professor of medical botany Robert J. Thornton, all shared the passion for botanic collection. And most of them were engaged in power games using botany as a political instrument.

Keywords: the second half of 18th century, the early 19th century, Russian Empire, botanic collection, noble culture, plant objects, exchange

The role of Karl Ernst von Baer in the arrangement and growth of the craniological collection of the St Petersburg Academy of Sciences (ID 39)

Erki Tammiksaar *(Estonian University of Life Sciences; University of Tartu, Tartu, Estonia),* ***Ken Kalling*** *(University of Tartu, Tartu, Estonia)*

In 1775, Johann Friedrich Blumenbach, professor of the University of Göttingen, the founder of the science of anthropology, in his book *"De Generis Humanis Varietate Nativa"* divided the mankind into five varieties (Caucasian, Ethiopian, Mongolian, American and Malayan) on the basis of the colour of

skin. Differently from his contemporaries, he was convinced that mankind had a common initial home, it means, there did not exist lower and higher races. The initial home of mankind, he placed into Caucasus, i.e. the territory of Russian Empire.

Karl Ernst von Baer, former professor of comparative anatomy and director of the zoological museum at the University of Königsberg (1817–1834), started work for the St Petersburg Academy of Sciences in 1830. His discovery of the mammalian ovum in 1827 had laid the foundations of the science of comparative embryology. In 1846, he became responsible for the craniological collection of the St Petersburg Academy of Sciences. The theory of Blumenbach about the initial home of mankind had attracted Baer already during his Königsberg period and he had corresponded with him. Having taken over the craniological collection, Baer rearranged it following the geographical principle with the aim to establish on the basis of skulls the developmental stages of different nations. At the same time, he took active steps to increase the number of specimens in the collection in order to get an answer to the question of the initial home of mankind by Blumenbach. As it was rather complicated to obtain specimens of crania of different nations living in the empire (not all of them were represented in the collection), Baer had to apply to his numerous acquaintances all over the Russian empire. Skulls were obtained from battlegrounds as well as through opening tombs of members of certain nations.

Baer's achievements in the field of physical anthropology were impressive in the organization of respective research in Europe as well as in setting up the anthropological publication "Archiv für Anthropologie".

Keywords: Karl Ernst von Baer, Johann Friedrich Blumenbach, physical anthropology, craniology, craniological collection, Russian Empire, origin of mankind, St. Petersburg Academy of Sciences

Killing for museums: European bison as a museum exhibit (ID 30)

Anastasia Fedotova *(Institute for the History of Science and Technology, Russian Academy of Science, St. Petersburg, Russian Federation),* ***Tomasz Samojlik*** *(Instytut Biologii Ssaków PAN, Białowieża, Poland)*

Already in the early modern times European bison (Bison bonasus) disappeared from almost all its previous range. Until the 16th century, bison have survived only in the Central-Eastern Europe, especially in the vast forests of the Polish-Lithuanian Commonwealth. In that period, the species was considered an exclusively royal game and had a status of a natural curiosity and an expensive, royal gift. In the second half of the 18th century, European bison survived only in the royal Bialowieza Forest (nowadays on the border of Poland and Belarus), which fell under rule of the Russian Empire in the 19th century. Imperial government was well aware of its value, and it was interested in preserving both the European bison and the forest where they lived. Bialowieza's last free-ranging bison population became subject of interest of European naturalists already in the 18th century. In the 19th century, the interest in studying bison even increased with discussions on the identity of bison and aurochs (Bos primigenius). Skeleton of a bison from Bialowieza became an object of a detailed study by Georges Cuvier in 1823, however the discussions on the taxonomic position of the species continued until the 20th century. Until 1860, Russian emperors did not hunt personally in Bialowieza Forest. Still, if one wished to hunt bison in the forest, a special permission of the emperor was required. Such permissions were usually granted if the hunt was justified with "scientific" purposes (i.e. when one of the natural history museums wished to obtain a bison specimen as an exhibit). In this way, from a gift exchanged between early modern kings and princes, the bison turned into a gift of the Russian emperor to the international scientific community. To receive such a gift, the scientific community had to use its diplomatic and bureaucratic channels, to recruit a naturalist willing to travel to Bialowieza, to organize a hunt, to process the skin and bones, and finally, to deliver this massive package to a museum. Bialowieza bison were attractive for museums not only because of their ambiguous taxonomic status. This animal, the largest of surviving mammals in Europe, possessed the attributes both of a "native"

and an "exotic" beast at the same time, interesting for wide audience, as well as for scientists. Our presentation will address a broad range of scientific, organizational, diplomatic and logistic difficulties that museums confronted when they wished to obtain a Bialowieza bison. We will also discuss the reasons why museums were so interested in possessing it.

Keywords: European bison, museum exhibit, 19th century, Bialowieza Forest, Russian Empire

Texts, specimens and tests: bioprospecting in the late 18th century Russia (ID 31)

Marina Loskutova *(National Research University – Higher School of Economics, St. Petersburg, Russian Federation)*

Recently, historians of early modern science have been paying increasing attention to imperial or colonial contexts of natural history: the pragmatic interests of the European states and trading companies in encouraging the exploration of natural resources across the globe, and a complex interaction between European and indigenous knowledge in this process. So far, however, the case of the Russian empire has not been integrated within this analytical framework. In this paper we are going to examine a series of exploratory missions sent by the St. Petersburg Academy of Sciences in the 1760s–1770s to the eastern and south-eastern frontiers of the Russian empire, and their contribution to advancement of technology and medicine.

These missions led by a group of foreign and Russian naturalists employed by the St. Petersburg Academy of Sciences (Peter Pallas, Samuel Gmelin, Johann Falck, Johann Georgi, Ivan Lepekhin) are quite well known in the history of Russian science; scholars have invariably assessed their role through the prism of subsequent developments in the academic disciplines that emerged in the course of the next two centuries. Looking for the origins of a specific idea in life and earth sciences, historians have mostly ignored rich descriptions of local crafts and industries that occupied such a prominent place in the accounts left by the 18th century academicians. Yet it was not only a presentist perspective common to an earlier historiography that encouraged this approach. As we will show, the sources we have promoted the tendency to separate natural objects and cultural artefacts from local practices of using them: the missions dissected technologies under observation into textual descriptions and collections of specimens. These collections, as they were transferred to the museum(s) of the Academy of Sciences in St. Petersburg, acquired an independent existence as scientific objects, while very little is known about the ways in which indigenous technologies and practices were treated in the new milieu, as textual accounts transposed them from their localities to the imperial centre.

In this paper we will consider a few specific cases related to observations made by these missions on wild plants used as medicine or dyes by indigenous populations in the eastern frontiers of the Russian empire. We will consider the ways in which local practices and technologies were received in the imperial centre: the means by which 18th century *savants* tested medicinal or technical properties of these plants and the attempts to reproduce or improve the techniques of their cultivation.

Keywords: the late 18th century, St. Petersburg Academy of Sciences, bioprospecting, natural history, indigenous technologies, Russian Empire, museums

Rose Gardens and Scientific Debates on Heredity in 19th Century France (ID 33)

Cristiana Oghina-Pavie *(Université d'Angers, Angers, France)*

Horticultural collections were a special case of multiple cultural uses of natural specimens, crossing the circulation of plants and the acculturation of knowledge between communities of practitioners and academic circles. The example of rose gardens is particularly significant for at least three reasons: the extraordinary high number of rose varieties obtained in the 19th century; the great natural propensity

of roses to vary; and the practice of vegetative propagation (cutting and grafting), allowing the conservation of plants through time. The first extensive collection of roses was established in France by the Empress Josephine in her garden in Malmaison, where she collected about 250 rose varieties from the Napoleonic Empire, the Great Britain, and other European countries. This collection, and the figurative description given by P. J. Redouté in 1817–1821, stirred up a long-lasting passion for roses in France. Amateurs, nurseries, horticultural societies or public gardens started to collect roses in want of social prestige, plant propagation for trade, or only as garden decorations. In the late 19th century, also emerged the idea to preserve roses varieties as a living legacy of this rosomaniac century, as exposed by Jules Gravereaux, who gathered 6,000 varieties of botanical and horticultural roses at Haÿ-les-Roses in 1892.

This paper[1] will analyze rose collections as a common space of practice and knowledge. In fact, roses specimens circulated between horticultural collections and botanical gardens, especially roses newly introduced in culture from wild species discovered in North America and Asia. The main scope of horticultural collection was to provide the breeding living material. In the practice of plant breeding, rose growers used collections as primary resources for spontaneous and artificial fertilization and thus formulated observations and provided numerous examples of the variability in plants by buds and by seeds, of the transmission of characters in the offspring and the influence of gardening on the causes of variation. Roses collections therefore played the role of an experimental field for understanding the variability of cultivated plants. This paper will show how the horticultural observations were considered as empirical facts and how they influenced the conceptualization of natural inheritance. Simultaneously with the high diversification of rose varieties, horticulturists and scholars debated on the nature of hybrid roses, their place in botanical systems, as intermediate or as transitional groups in the transformation of species. The manner in which rose collections challenged systematics due to the difficulty to propose a unique and coherent classification for wild and garden roses will also be discussed.

Finally, this study on the variability and systematics of roses will reveal the place of garden plants collections in the "epistemic space of heredity" (S. Müller-Wille & H.-J. Rheinberger) in the 19th century.

[1]Supported by the research program FloRHiGe – *Facteurs de succès de l'innovation variétale du rosier aux XVIII^e et XIX^e siècle, démarche interdisciplinaire génétique et historique* – founded by Région des Pays de la Loire.

Keywords: rose gardens, plant variation, heredity, France, horticulture, plant systematics

André Thouin's (1747–1824) creation of seed collections at the Muséum National d'Histoire Naturelle of Paris (ID 34)

Stéphane Tirard *(Université de Nantes, Nantes, France)*

André Thouin began as the gardener-in-chief of the King's garden in Paris. In 1793 he was named professor of Culture at the Museum of Natural History. Throughout his carrier, he was one of the most important figures and organizers of his institution, which, according him, belonged to the Nation. He helped Bernard de Jussieu reorganize the School of Botany. He was particularly involved in the study and teaching of practices, publishing notable books on this topic. Thouin was a famous specialist in grafts. He also paid great attention to increasing living collections; he noticed that in 1788 there were 6,000 living species in the garden.

Thouin also has a keen interest in seeds, which he selected in an attempt to ameliorate or to acclimate plants. Based on Thouin's archives, this paper will focus on the collection of seeds that the French botanist created in 1822. It will analyze the conditions behind its creation and will show how it was linked to other of Thouin's activities. Furthermore, using the tables of the recipients of the samples left by Thouin, it will describe the manner in which the collection was organized, as well as its goals. One

of the most interesting aspects refers to the importance and the complexity of exchanges with numerous correspondents in the world. Finally, this paper will provide a survey of the destiny of this collection and will determine whether Thouin's goals were maintained.

Keywords: André Thouin, seed collections, Muséum National d'Histoire Naturelle, School of Botany, living collections

St. Petersburg Museums in the 19th century: From scientific laboratories to centers of educational activities (ID 36)

Tatiana Yusupova *(Institute for the History of Science and Technology, Russian Academy of Science, St. Petersburg, Russian Federation),* ***Nadezhda V. Slepkova*** *(Zoological Institute, Russian Academy of Science, St. Petersburg, Russian Federation)*

Today the museums of the Academy of Science make part of the cultural life of St. Petersburg. As early as 1920s the Academician A. Fersman noted that the museums of the Russian Academy of Sciences represented the research institutes which combined scientific and educational activities. Yet it took many years before such an alliance became possible, and it required a certain pressure to be exercised by the governmental structures on the Academy unwilling to make its museums accessible to public. According to the 1836 Statute of the Academy, the object of academic museums was to "serve as visual aids for academics". Hence the museum collections were accessible to scholars only. In the mid-19th century the Zoological Museum alone was open to visitors, if only once a week. In the early 1860s the minister of education required that the academic museums must be open daily "in order to serve the cause of public education". Yet the directors of the Zoological, Botanical, Mineralogical and Anatomical Museums opposed to such a demand; they argued that it was impossible to carry out scientific research and receive visitors at the same time. Therefore to make the academic museums truly public entities, a number of measures had to be taken intended to improve their work. Among these were the increase of their funding and staff. However it was difficult to change the general attitude of scholars to the educational activity of the museums. It was only at the end of the 19th century that the scope of this activity considerably increased. As a result the Zoological museum became a great public attraction. The government allocated some additional funds for its development hence the museum moved into a new building which accommodated its scientific laboratories and the new exposition of its exhibits.

The paper will examine the reasons why the directors of the academic museums refused to make these accessible to public, the problems they faced and the efforts made by the leaders of the Academy of Sciences and the Ministry of Education to introduce amendments into the Statute of the Academy to make the museums public.

Keywords: Russian Academy of Sciences, 19th century, Natural History Museums, public education, St. Petersburg

Scientific collections during the French Revolution: the power of minerals (1783–1839) (ID 513)

Maddalena Napolitani *(École normale supérieure, Paris, France)*

The period of the French Revolution sees the birth of national museums, which inherit the private cabinets of the émigrés and clergy, seized by the new republican state. These museums, and particularly science museums, have strong political connotations: they are a powerful symbol of the democratization of culture and knowledge implemented by the new Republic, which strengthens its democratic ideals around these new repositories for national heritage.

From the private cabinets of the Ancien Regime to the new "republican" museums, we propose to study the political issues of scientific collections in revolutionary France at the time of this transition.

How does the transition between these two states of political power – the Ancien Régime and the Republic – occur, through the creation and the consolidation of these institutions of knowledge, and what is their significance in this context?

In the aim of answering these questions we chose to base our analysis on the most important Parisian mineralogy collections: that of the École des Mines of Paris and of the Muséum d'Histoire Naturelle, the creation of the former having stemmed directly from the new challenges posed by the nascent mining industry in France.

From curiosity cabinets to scientific museums, minerals have always aroused both an aesthetical fascination and a scientific interest, upon which the Industrial Revolution superimposes its own specifically economic interests. We would like thus to analyse the way different types of power are crystallised in these collections: from the economic power, to that of scientific discoveries, to the politically charged sale of the French crown jewels in 1887.

Keywords: scientific collections, history of collections, history of museums, mineralogy collections, French revolution, natural history museums, Paris, minerals, 18th–19th century, heritage

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Symposium 37: The Principle of Energy Conservation: history, philosophy, education, digital humanities

Organizers: ***Fabio Bevilacqua*** *(University of Pavia, Pavia, Italy),* ***Muriel Guedj*** *(University of Montpellier, Montpellier, France)*

The Symposium aims at analysing some aspects of the energy conservation principle through its history, the various interpretations of its meaning and the numerous attempts at explaining it at university and school students. Today "energy" is one of the most widespread terms in popular and scientific use. Both enthusiasts and opponents of contemporary Western civilization recognize its foundational role. Eastern philosophies of Nature have terms that are related to it. "Energy" issues dominate social, political, technological, military discussions and events. However it is not at all clear if its various meanings are acceptable aspects of its polysemic nature or the result of deep confusion. Is there a way to clarify the field? Is it possible to establish a scientific consensus on how to interpret the concept of energy and the principle of energy conservation? The symposium aims at giving a contribution to the ongoing discussion on these topics through the rediscovery of classical texts, the analysis of some of the main issues, the use of modern digital technologies and an overview of the educational debate. It is not easy in fact to understand and teach a principle which at the same time is a precondition for the scientific experience; derives from early attempts at balancing Becoming and Being, potentiality and actuality; is based on the supposition of the equality of the cause-effect relationship; on the old ex and ad; on the impossibility of perpetual motion and of its opposite; on the old distinction between intensive and extensive quantities; on the attempts at measuring all the phenomena of nature through a unique unity of measurement; on the choice of work as a stable unity; whose primary (final) expression is impossible; whose specific formulations depend on the choice of the specific theory adopted; whose forms, if independent, obey a principle of superposition; whose conservation in quantity is associated with a principle of degradation in quality; which has been derived from a time symmetry and has pervasively influenced many disciplines.

Keywords: history, philosophy, education, digital humanities, Energy Conservation, Principle of Energy Conservation

Interplay Between Theory and Experiments in Some Classic 19th and 20th Century Formulations of Energy Conservation. (ID 139)

Fabio Bevilacqua *(University of Pavia, Pavia, Italy)*

Three historical periods will be dealt with briefly in analysing the Interplay Between Theory and Experiments in Some Classic 19th and 20th Century Formulations of Energy Conservation:

a) The contributions of Mayer, Joule, Helmholtz, Weber and Clausius show a variety of formulations for "energy" and "energy conservation" at the middle of the 19th century. It will be shown that in each of these contributions theoretical, experimental and mathematical aspects are deeply connected and cannot be separated. Interpreting some as theoretical and some as experimental is a bad old habit that should be rejected.

b) A second period at the turn of the century evinces a great effort towards a clarification of the issues. The masterpieces of Planck (1887) and Haas (1909) cast an interesting light on the historical and conceptual problems involved. Unfortunately so far these "classics" have not been translated from German and are not widely known.

c) The famous historical analysis of Kuhn (1959) when compared with the equally famous conceptual discussion of Feynman (1963) shows an interesting but paradoxical inversion of roles: the historian appears whiggish and "convergent" while the physicist is openly "divergent". An interesting moral results, useful in today's debates

d) Thus while the interplay is unavoidable in historical, foundational and educational approaches, it will be shown that through an analysis of the classics some relevant issues acquire a clearer perspective.

Keywords: energy conservation, Feynman, Mayer, Joule, Helmholtz, Weber, Clausius, Planck, Haas, Kuhn

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Energy: conservation versus equivalence (ID 184)

Ricardo Lopes Coelho *(Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal)*

Energy has been thought of as a substance (Lancor 2014). Mayer, Joule (Coelho 2014) and Helmholtz (Bevilacqua 1993) did not discovery any substance. This raises the question of what energy is (Bächtold and Guedj 2014).

In the first half of the 19th century, people thought that the quantity of heat was constant. Due to this, they understood heat as a substance. In the 1840s, Mayer and Joule showed that the quantity of heat changes. This finding, which was experimentally supported, was expressed by the mechanical equivalent of heat. To negate that idea of heat as a substance, they claimed that heat is a force, which can be transformed (Mayer 1842, 1845), or heat is motion (Joule 1843, 1850).

This period is crucial for understanding the concept of energy for the following reasons. The history of the energy conservation principle includes three lines of development: one is related with Mayer; another with Joule; and a 3rd one with equivalence. According to this last one, the principle of the energy conservation is a principle of equivalence. This concept appeared in the 1860s and was maintained for about 5 decades. The other two concepts have been more successful. We still say that energy cannot be created or destroyed but only transformed, which represents that which Mayer said about force. Force was a result of an interpretation. Therefore, the concept of energy presented in many textbooks is of the same type.

Keywords: conservation of energy, equivalence, Mayer, Joule

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Between a simultaneous discovery and construction: historical views on the emergence of energy conservation (ID 553)

Shaul Katzir *(Tel Aviv University, Tel Aviv, Israel)*

At least 13 individuals were identified as contributors to or anticipators of the principle of energy conservation. Historians, however, expressed diverse opinions about the relations between the contributions of these individuals, the energy principle and its historical emergence. This divergence followed different understanding of energy conservation and different requirements for regarding a scientist as a promoter of the principle (e.g. whether one expressed, believed in or applied the principle). Thus, while a few historians (e.g. T. Kuhn) regard energy conservation as a case of simultaneous discovery, others (e.g. C. Smith) regard it as a gradual construction to which the various contributions were retrospectively connected. Historians' views of the factors that led to the principle at the mid-nineteenth century diverge accordingly.

Historical studies in the last half a century significantly revised our views of individual contributors and of major developments in the history of related sciences, but no unified picture has been suggested. This talk will build on these studies to suggest a current comparative survey of the 'pioneers,' the differences and similarities in their contributions and the factors that led them to their findings. The new picture will be use to revisit the question of whether and in which sense one can speak of simultaneous discovery of energy conservation and the different causes that led different scientists to similar conclusions independently of each other.

Keywords: Energy conservation, Helmholtz, William Thomson, historiography, steam engine, animal heat, respiration, dynamic theory of heat

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Energy and Montgolfières: Europe in a balloon (ID 534)

Arnaud Mayrargue *(CNRS / SPHERE, Paris, France)*

The flying machines designed and constructed at the end of the 18th century by Etienne de Montgolfier (1745–1799) and his brother Joseph de Montgolfier (1740–1810), aroused considerable enthusiasm and generated a great many utopian projects in the literature and the arts. They also gave rise to a major new fashion in France, and more especially in England, known as *balloonomania*.

A vast amount of scientific and technical research took place prior to the invention of these engines viewed as « materialized theory »[1]. This research was undertaken in particular both by Antoine Laurent de Lavoisier (1743–1794), and by Joseph Black (1728–1799). So, the successful development of the hot-air balloon, a machine propelled by brazier-heated air, required careful research into the very concept of heat and more generally of energy.

Many balloons were constructed, first in France, then in England, and these were later flown in several European countries, including Germany, Italy, Spain, the Netherlands, Switzerland and Poland.

Far from being an exclusively French invention, only pioneered by the Montgolfier brothers Charles and Robert, the balloon therefore had more complex origins, reaching well beyond France's borders. Subsequent developments were only made possible by collaboration and competition, not only in France, but also in England, and later in other countries, too.

The aim of this presentation is to show that balloon flight in the Enlightenment constituted an important event in European history, from both a scientific, a technological and an epistemological point of view. It will be focused on the notion that the construction of balloons represented a scientific and technical achievement that was only made possible by the existence of comprehensive networks for exchanging knowledge within Europe.

1. *Bachelard, Le Nouvel esprit scientifique*, 1934, p.15

Keywords: energy, heat, power, science

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Safeguarding the historical heritage: The Italian CISE center of nuclear research (ID 491)

Leonardo Gariboldi *(Università degli Studi di Milano, Milano, Italy)*

The CISE (Centro Informazioni Studi ed Esperienze – Centre Information Studies and Experiences) was established in Milan, Italy, in 1946. It was a center of research, founded by private industries, with the aim to study the pacific applications of nuclear physics and technology and plan the production of electrical energy of nuclear origin for the whole country. In 1952 the State joined the private founders and guaranteed the necessary financial support. Four nuclear reactors were started in the 60s and 70s, but the 1987 referendum stopped any plan for future nuclear reactors, and the CISE was engaged in the closure of the four reactors. In 1998 the CISE was annexed by the former Italian Power Corporation and closed.

Some actors are now working together in safeguarding the survived historical heritage about the CISE:

a) A group of CISE former employees, coordinated by the CISE2007 association, have been gathering documents, technical reports, journal collections, etc. of their own. The collected documents were organized in an archive, named the CISE Historical Archive, currently hosted by the ISEC Foundation (Institute for the History of the Contemporary Age).

b) The History of Physics group of the Milan University made the archive's catalogue, a tentative scientific and technical bibliography, and is currently analyzing the scientific research in the first decade of activity.

c) The National Museum of Science and Technology is planning to exhibit the CISE Cockcroft-Walton accelerator and is collecting interviews with former employees in a project of oral history.

Keywords: Cultural heritage, Nuclear research, Archive, Oral history, Museum exhibition

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Symposium 38: The Power of the Knowledge of Geometry in the West and the East

Organizers: ***Zhigang Ji*** *(Shanghai Jiao Tong University, Shanghai, China),* ***Tatsuhiko Kobayashi*** *(Yokkaichi University, Yokkaichi, Japan)*
Chair: ***Zhigang Ji*** *(Shanghai Jiao Tong University, Shanghai, China)*

On the title page of the *On the Revolutions of the Heavenly Spheres* (1543), Copernicus wrote: *ἀγεωμέτρητος μηδεὶς εἰσίτω* (*Let no one ignorant of geometry enter here*), that is, according to a 12th-c. Byzantine legend, the sentence inscribed on the entrance to Plato's academy. This quotation echoes the impact of Antiquity on Renaissance authors, and it also illustrates the power early modern scholars associated with geometry. In 1570, Henry Billingsley got the first English translation of Euclid's *Elements* published. Four years later, Christopher Clavius contributed his Latin version of Euclid's *Elements*. The first six volumes of Clavius' *Elements* were translated into Chinese in 1607 by Matteo Ricci and Xu Guangqi. The last nine volumes of Billingsley's *Elements* were translated into Chinese in 1857 by Alexander Wylie and Li Shanlan.

In his *Mathematical Preface* to the Billingsley's version of the *Elements*, John Dee wrote: "But, unto God our Creator, let us all be thankful: for that, as he, of his Goodness, by his Power, and in his wisdom, have created all things, in Number, Weight, and Measure." Number, Weight, and Measure appeared to have been perceived as be the real grounds for the powers of geometry, not only in the West but also in the East. This is the theme this symposium intends to bring to light.

This symposium consists of the following four papers. Paper one considers the reason why John Dee chose Euclid's *Elements* to present his Mathematical Tree, and what role geometry, and more specifically Euclid's *Elements*, played in John Dee's research life. Paper two makes a comparative study of Commandino's and Clavius' Prolegomena to Euclid's *Elements*. Paper three relies on a cultural interpretation of Ricci and Xu' Prefaces to the Chinese translation under the title *Jihe yuanben*, to examine how this knowledge of geometry was transferred to China. Paper four will discuss the transmission and influence of the Chinese version of *Jihe Yuanben* in Japan.

Keywords: Elements, knowledge of geometry, John Dee, mathematical tree, Christopher Clavius, Matteo Ricci, Xu Guangqi, Jihe yuanben, transmission

Why John Dee chose the *Elements*: A New Discussion on the 'Mathematical Preface' of Henry Billingsley's *Elements of Geometry* of Euclid (ID 55)

Jingbo Cao *(Shanghai Jiao Tong University, Shanghai, China)*

In 1570, Henry Billingsley's *Elements of Geometrie of Euclid of Megara* was published as the first English translation of Euclid's *Elements*. The famous Mathematical Preface of this book, completed on February 9 of the same year by Dee, delivered a full image of mathematics in his *Mathematical Tree*, and represented the culmination of Dee's interest in natural philosophy. This article endeavors to show the reasons why John Dee chose Euclid's *Elements* to present his Mathematical Tree, as well as the roles geometry played in Euclid's *Elements through* John Dee's research life.

Besides a brief introduction to Dee's work in his Preface, this paper will primarily present Dee's view of the Power of Mathematics (especially Geometry) and his explanations of the nature of Geometry, bringing out a detailed table in which various branches of applied mathematics appeared. As he said, "This Science of Magnitude, its properties, conditions, and appurtenances: commonly, now is, and from the beginning, has of all Philosophers, been called Geometry." By means of this branch of mathematics the Road to Nature could be uncovered—"But, onto God our Creator, let us all be thankful: for that, As he, of his Goodness, by his Power, and in his wisdom, has Created all things, in Number, Weight, and Measure". According to his point of view, these are the Grounds of everything. Mathematics provides a ladder to a perfect understanding of the universe and all things within it.

Next, this paper analyzes various characteristics of subjects in the tree. Dissecting the cases of *Statike* and *Thaumaturgike*, it examines how Dee created his scholarly work through Euclid's *Elements* and how he got a new explanation. For instance, Dee imitated the pattern of *the Elements* to present the statics of Archimedes. He believed there would be some principle he could follow. Dee quoted propositions from *the Elements* to represent this subject.

Finally, the presentation attempts to reveal why John Dee chose *the Elements. It was because* the *Elements* embodied an Enormous Power, which constituted the foundation of Dee's natural philosophy. It brought materials profitable to his research. This urged Dee to help publish Billingsley's work, and spare no effort to introduce the nature of the topic and its applications. Certainly, John Dee accomplished this task fruitfully, as he explained that 'a way is had to the searching out, and understanding of everything, able to be known'. As Billingsley said: "Unto the knowledge of which no man can attain, without the perfect knowledge and instruction of the principles, grounds, and Elements of Geometry." Moreover, John Dee's work on The Mathematical Preface also transmitted the Power of mathematics of *the Elements* to later generations. His view as reflected in the *Mathematical Tree* provides a rudiment of modern applied mathematics, constructing the other side of the scientific revolution in Britain in the 1600s.

Keywords: Billingsley's Elements, Power of mathematics, Mathematical Praeface, John Dee

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The Power of Mathematics as an Art and as a Theory: A Comparative Study of the Prolegomena of Euclid's *Elements* between Commandino and Clavius (ID 45)

Hongchen Wang *(Shanghai Jiao Tong University, Shanghai, China)*

Until some decades ago, it was conventional to regard Clavius's *Elements* as a compilation without much innovation, which borrowed much from Campanus and Commandino [Murdoch, 1971], despite the fact that later editors of Latin *Elements imitated it*, and it was translated by Matteo Ricci and Xu Guangqi into Chinese. Things began to change when it was shown that Clavius had been innovative in his commentaries on the definitions of ratios and proportions in the *Elements* [Rommevaux, 2005]. Moreover, Clavius shows the same originality with respect to the utility of mathematics, and they had a great impact on Late Ming Society. This is what this paper aims to vindicate.

The paper goes through the power and utility of Mathematics as discussed in Commandino's and Clavius' prolegomena to the *Elements*. Commandino only showed Mathematics to be useful as *ars militeria*, Gnomonica, Meteoroscopica, and other practical arts. Instead, in his dissertation "Uses of various disciplines of Mathematics" included in the prolegomena, from a Platonists' perspective, Clavius focused on the value of Mathematics as a perfect example of logic and reason, praising them as a road to metaphysics. But, in other parts of the prolegomena, Clavius enumerated miscellaneous practical uses of Mathematics, quite like Commandino.

Furthermore, this paper investigates the historical context of humanism in Renaissance Italy in which both texts emerged, concluding that Clavius achieved a balanced view on the power of mathematics thanks to his double identity: a mathematician and Jesuit, which explained why his Chinese followers did not hold the same opinion as him.

Keywords: Euclid's Elements, Prolegomena, Commandino, Clavius

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How the Knowledge of Euclid's Geometry Affected China: A Cultural Interpretation of Ricci and Xu' Prefaces of *Jihe Yuanben* (ID 44)

Zhigang Ji *(Shanghai Jiao Tong University, Shanghai, China)*

The year 1607 saw the first Chinese translation of Euclid's *Elements* (*Jihe Yuanben*). This event is considered as part of the first encounter between the East and the West. The translation, undertaken by Matteo Ricci (利瑪竇, 1552–1610) and Xu Guangqi (徐光啟, 1562–1633), must have been a really hard task, especially because Euclid's *Elements* represented a type of knowledge alien to Chinese Scholars. This remark raises the question of how the translation was undertaken. How did Chinese scholars know about the *Jihe Yuanben* and what were their reactions to the *Elements*? And, also, what kind of influences did *Jihe Yuanben* have on the traditional Chinese mathematics and China's social culture?

We can approach these issues using the prefaces Ricci and Xu wrote for *Jihe yuanben*. These prefaces constituted an important medium in which they express their opinions about Western-Learning and why geometrical ideas should be promoted ideas to China. So if we want to know how this Knowledge of Geometry was transferred to China, and also how Chinese scholars perceived it, the best way might be to rely on their prefaces. This paper tries to explore the significance of the prefaces by Ricci and Xu in the following three aspects.

- **1. the Principle of Nature** At the beginning of his preface, Ricci pointed out that if a Confucian scholar wants to extend his knowledge, he should investigate into the principle of nature, but the natural principles are inherent in mathematics. "*So, in order to make the acquired knowledge deep and solid, nothing surpasses the knowledge of mathematics*." (其所致之知且深且固，則無有若幾何一家者矣 [1, Ricci])
- **2. the Practice of Geometry** To emphasize the practical dimension of geometry, Ricci listed more than ten domains in which geometry was essential. These included astronomy, measurement, creating instruments, architecture, agriculture, geography and so on. Therefore Ricci expressed the idea that *"all those skills fall directly under the realm of mathematics. [Moreover], as far as all the various professions are concerned, the important principles and the subtle touches depend on a considerable extent on the mathematical theory."* (此類皆幾何家正屬矣。若其餘家，大道小道，無不藉幾何之論，以成其業者 [1, Ricci])

- **3. the Power of Mathematics** Setting aside the civil situations and the military affairs, which are the basis of national security and the major affairs of the state, there are other things in great need of mathematics. Ricci even told the story that Archimedes, with a small and weakened group of soldiers, held back the Roman army. This story proves that only mathematics in power can win with a small and feeble army over a large and strong army. So Ricci declared, "*a wise and courageous general must give priority to the study of mathematics.*" (故智勇之將，必先幾何之學 [1, Ricci])

As a co-translator, Xu was the first among Chinese scholars who realized the utmost value of *Jihe Yuanben*. In his preface, Xu said "*Jihe Yuanben is the ancestor of measures and numbers, ……it is true that it can be called the paradise of the myriad forms, the erudite ocean of hundreds of schools*" (《幾何原本》者度數之宗，…，真可謂萬象之形囿，百家之學海 [2, Xu]) Xu even expressed his hope that "*hundred years from now, everybody will study it and will realize that they should have started earlier.*" (百年之後，必人人習之，即又以為習之晚也 [2, Xu])

This paper will present the echoes to Xu's enthusiasm in words spoken during the late Ming and the early Qing Dynasty.

Keywords: Jihe yuanben, Geometrical Knowledge, Matteo Ricci, Xu Guangqi, preface

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On Mathematical Terminologies in the Edo Period Borrowed from Chinese Calendrical Calculations (ID 68)

Tatsuhiko Kobayashi *(Yokkaichi University, Yokkaichi, Japan)*

In 1720, the 8th shogun Tokugawa Yoshimune (徳川吉宗, 1684–1751) decided to relax the prohibited book policy partially. In accordance with the introduction of the relaxation policy, *Complete books of calendrical calculations* (*Lisuan quanshu* 暦算全書) was imported from China in 1726.

The *Sanjiaofa Juyao* (三角法挙要), consisting of the initial 5 volumes of the *Lisuan quanshu* in 30 volumes, explains elements of plane trigonometry. In this book the lengths of the line segments were used to define the meaning of trigonometrical function, the author, the scholar Mei Wending (梅文鼎, 1633–1721), having adopted the term of 正弦 (sine), 余弦 (cosine) and tangent（正切) etc. as the names of those line segments. This terminology was made by Chinese mathematicians and Jesuit missionaries in the context of the collaborative translation movement that started in the beginning of the 17th century in China. Japanese mathematicians accepted these new terms and the related trigonometry immediately, and applied them all to surveying. Moreover, they learned the geometric meaning of the language of points (点), lines (線), surfaces (面), solids (体) and so forth through the study of the *Sanjiaofa Juyao*.

In addition, in the first half of the 19th century, Japanese mathematicians decided to adopt the following geometric terms: ellipse (楕円), area (面積), volume (体積) and so forth. Those terms were also used

in Mei Wending's *Lisuan Quanshu*. Japanese mathematicians appreciated them as a correct term expressing the form of a figure. Particularly Shiraishi Nagatada (白石長忠, 1795–1862) and his disciples strongly proposed using these new terms in their geometrical study. Their proposition was agreed to by the other members of the mathematician groups. The new mathematical words penetrated Japanese society rapidly. Moreover, Japanese mathematicians understood the meaning of 重心 (center of gravity) through the study of the *Lisuan Quanshu*.

In this symposium, we will discuss what geometric terms from the *Lisuan Quanshu* were accepted by Japanese mathematician in the 19th Century.

Keywords: Wasan, pre-modern Japanese mathematics, Trigonometry, Geometric term, Lisuan quanshu, Shiraishi Nagatada

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Symposium 40: Revisiting the Marie Curie effect: "Invisibly powerful" women in science – Challenges of Empowerment for Women in Science: A Transnational Perspective

Organizer & Commentator: ***Isabelle Lémonon*** *(EHESS – Centre Alexandre Koyré, Paris, France)*
Chairs: ***Maria Rentetzi*** *(University of Vienna, Vienna, Austria & National Technical University of Athens, Athens, Greece),* ***Anne-Sophie Godfroy*** *(Université Paris Est & Université Paris-Sorbonne, Paris, France),* ***Annette B. Vogt*** *(Max Planck Institute for the History of Science, Berlin, Germany)*

In the male-dominated world of science, women were often marginalized and perceived as seemingly powerless. Clearly, their "career" opportunities in the academic field were scarce, especially until the middle of the 20th century. Still, a few women scientists were able to position themselves at the top of their respective discipline. Unfortunately, their cases did not always facilitate women's way into academia.

Margaret W. Rossiter described in her famous book *Women scientists in America* published in 1982, the so called *Marie Curie Effect*: Contrary to what would have been expected, the "sanitized and heroic version of the Curie saga" presented during the scientist's tour to the United States in the 1920's, turned "to mean less an «opening of doors» for women in science […] and more […] a «raising of the thresholds» to almost unattainable heights" (1984, p.125&127). The next generation of heads of scientific departments were expecting the same ability as Marie Curie's from their female colleagues, and the recruitment standards became even higher for women.

This session aims to reassess Rossiter's work after more than three decades of additional research on the history of women in science. Wherein lies the power of "pathbreaking" women such as Marie Curie and their influence on women, science, society and policy? Do these «heroines of the past» serve as an incentive, a justification, a validation or a renunciation to pursue science for other women? What is their influence on local and international science policy? We will also determine essential factors responsible for the image shaped by women scientists themselves, the scientific community, feminists, the media and historians of science, and evaluate the role of gender stereotypes in this process.

These results will be contrasted with the discussion about "ordinary" or mostly forgotten female scientists. For this purpose, it is of particular importance to question the aspects commonly considered as indicators for women's success in science, such as exceptional achievement, visibility or a prominent status. The session will try to analyze the ways these "ordinary" women exercised power compared to "heroines", and how the established scientific community dealt with both groups of female scientists. It will also examine women's involvement in social, ecological, gender, economical or political issues as a form of gaining influence, thereby providing an overview of the scope of power issues encountered by women in science in general.

This symposium was sponsored by the Women's Commission of the DHST.

Keywords: Women, Gender, Icons, Invisibility, Empowerment, Science's policy

Contrasting Strategies of French Women in 18th Century Science: Submissiveness to Empowerment (ID 220)

Isabelle Lémonon *(EHESS – Centre Alexandre Koyré, Paris, France)*

Marked by the spirit of the Enlightenment, the 18th century offered women new opportunities to gain power in the production of scientific results. French books and journals signaled their visibility as authors of texts in mathematics, chemistry, botany and astronomy. Women also figured in the correspondence of famous male savants, such as Jean Jacques Dortous de Mairan (1678–1771) or Jérôme Lalande (1732–1807), as contributors to many types of scientific products including tables, drawings, maps, and interim reports. Some of them, e.g. Nicole Reine Lepaute (1723–1788) and Marie Louise

Dupiéry (1746–1830) were associate members of provincial academies of science. The best known among them, Émilie Du Châtelet (1706–1749), even became the symbol of the "femme savante des Lumières", as an author of books in mathematics and physics and the only (even to this day) French translator of Newton's *Principia*. She was also a participant in the competition for one of the Paris Académie des Sciences's prizes, as well as an associate member of foreign academies of science (Academy of Bologna, King Stanislas's Academy).

This talk aims to shed light on forgotten French women "scientists" who managed to conduct an "invisible career" in science by submitting themselves to the then prevailing social rules of partial gender segregation. Essentially, they agreed to work as sub-contractors for male mentors who were themselves direct contractors of the formal institutions of scientific knowledge. In this manner, the women often remain "invisible" though their work was incorporated in major projects which conferred power upon their formal scientific producers. Still, the women's rise to authorship and membership in provincial academies of science, however rare, signaled a measure of relative empowerment in comparison with previous periods. Their significant role in scientific production was made possible by the fact that prior to the intense professionalization of science in the 19th Century most men and all women continued to do science from a base in their households, or sites into which women were more easily included. The talk will further examine the impact of Mme Du Châtelet's achievements on her female contemporaries, or prior to her acquiring an "iconic" status in feminist historiography.

Keywords: Enligtenment, 18th Century, scientific academies, Academie des Sciences de Paris, Jérôme Lalande, Mme Dupiéry, Mme du Châtelet, iconic status, "femme savante"

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'Utter Failure', 'Isolated Miracle', and 'Inspirational Heroine' – Discrepancies and Changes in the Perception of Sofja Kowalewskaja as a Role Model for Women in Science (ID 155)

Eva Kaufholz-Soldat *(Johannes Gutenberg Universität Mainz, Mainz, Germany)*

At a time, when the admission of women to institutes of higher learning was still in its fledgling stage, Sofja Kowalewskaja (1850–1891) earned her doctoral degree in 1874 with three theses in complex analysis and subsequently became one of the first female professors, teaching at the newly founded Högskola in Stockholm from 1883 until her death.

With her unusual career in mathematics during the 19th century, she is exclusively presented as a role model for girls or an eponym for honors for women in mathematics nowadays. This, however, stands in stark contrast to the multifaceted picture that was painted of her in the discussions about the so called woman question at the turn of the last century. While her name was frequently brought up, she was not always presented as an inspiration or as proof that women were able to succeed in the academic field. On the contrary, she was often seen as a counterexample or as a singular phenomenon that didn't allow for any conclusions about women's abilities in general.

Each of these contrasting images, including her modern portrayal as a heroine and pioneer for women in mathematics, originated through an interdependency of contemporary theories about the nature of women and biographies about Kowalewskaja written in the respective spirit of their time. My talk thus aims to highlight some of the factors that played an important role, both in shaping those diverging representations and the reasons for the shift of perception.

Keywords: History of Mathematics, Women in Science, Historiography

Out from the Shadow of Men and into the Light of Lecture Halls: Women Entering Central European Universities, 1880–1900 (ID 119)

Milada Sekyrková *(Charles University in Prague, Prague, Czech Republic)*

My paper will explore the routes that Central European women took to enter the lecture halls of academia in pursuit of diplomas qualifying them to work in scientific professions, including medicine and architecture. Until the last couple of decades of the nineteenth century, women who aspired to enter the sciences lived in the shadow of their husbands and fathers, but this began to change as they gained access to higher education on equal terms as men. To highlight the institutional and political conditions involved in this change, I will consider the potential that exists in a range of neglected documentary sources.

The journey of Czech women, in particular, had not been an easy one. Within the male-dominated world of higher education, they put forward their demands to provincial political and cultural institutions. Among their individual and collective strategies, they sought male allies to mediate their requests for permission to study. Often invisible, their individual efforts gradually succeeded after much unremitting effort by many applicants.

Keywords: female university education, history of education, Charles University in Prague, gender studies

Marjory Stephenson: Right Place, Wrong Time (ID 163)

Soňa Štrbáňová *(Institute for Contemporary History, Czech Academy of Sciences, Prague, Czech Republic)*

M. Stephenson (1885–1948), British biochemist was institutionally attached to the Medical Research Council and simultaneously to the Sir William Dunn Institute of Biochemistry at the Cambridge University. She can be considered a typical influential "pathbreaking" woman scientist of her time: for about 25 years she directed research teams; became an acknowledged founder of the chemical microbiology, field which prepared the ground for the rise of molecular biology; was co-founder and second President of the Society for General Microbiology; was one of the first two women elected Fellows of the Royal Society, etc. She was teacher of several future leading scientists and became incentive to a number of women and men to pursue scientific research. In spite of all these circumstances, she has never become an "icon" in any sense; neither her influence on further development of science has been officially acknowledged in historical treatises.

The case of a typically "forgotten" scientist which in her lifetime belonged among the few prominent and influential women scholars, raises the question what conditions might be determinative in recognition of a scientist in his/her lifetime and permanent acknowledgment by the future generations; why do some scientists become "icons" while others are "forgotten" and later even "rediscovered". To discuss these problems, the paper will analyze Stephenson's scientific accomplishments from the viewpoint of their circulation, appropriation, and impact on the formation of new scientific ideas. The other angles from which this issue will be questioned are Stephenson's position in the scientific community, role of her own motivation to act as a leading personality and the possible impact of social and political environment of the period on her recognition.

Keywords: History of biochemistry, History of chemical microbiology, Women in science, Marjory Stephenson, life and work, Medical Research Council, Dunn Institute of Biochemistry, Cambridge, Society for General Microbiology

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Participation and exclusive networking – Ida Smedley's dual strategy for empowering women scientists (ID 133)

Robert Freedman *(Warwick University, Coventry, UK)*

Ida Smedley (1877–1944) was a British biochemist, respected for her studies of fat metabolism, including identification of essential dietary fatty acids, and regarded by many as a role model woman scientist. She was also the most prominent member of her generation in fighting for the equal involvement of women in all aspects of scientific life in Britain. From 1904, she campaigned for admission of women to the Chemical Society, and when this long struggle succeeded, she was among the first women to join the Society and the first to join the Society's Council. As an early woman academic at Manchester University, she campaigned for women's right to access the Student Union and other exclusively male informal societies. She was one of the first women to be elected a member of the Biochemical Society and the first to chair this Society. Clearly, full participation of women in the core institutions of academic life was a major aim of her public activism. But there was another strand, focussed on the development of exclusive women's networks. Ida's sister, the writer Constance Smedley, was the driving force in establishing the 'Lyceum Clubs' for women, places where professional women could meet in congenial surroundings on the same basis as the exclusive gentlemen's clubs of the day. Ida supported the Lyceum Clubs but went further in her role as founder of the British Federation of University Women, a successful campaigning and networking organization in advancing the interests of women academics and women graduates. Ida remained committed to the BFUW throughout her career, and was also active in establishing the International Federation of University Women. The paper will review Ida Smedley's scientific contributions and her career of public activism and will explore possible origins of her dual strategy for advancing the interests of women academics.

Keywords: Ida Smedley Maclean, biochemistry, Manchester University, learned societies, Lyceum Clubs, British Federation of University Women, International Federation of University Women

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Piedad de la Cierva: A Spanish woman in a military laboratory during the Franco Regime (ID 51)

Ana Romero de Pablos *(Instituto de Filosofía. Consejo Superior de Investigaciones Científicas, Madrid, Spain)*

In 1954, the chemist Piedad de la Cierva y Viudes was awarded the annual prize in scientific and technical research given by the Franco regime for her research on "Ensayos de fabricación de vidrio optico" (Manufacturing Trials for Optical Glass). The work had been done in a military laboratory – el Laboratorio y Taller del Estado Mayor de la Armada (LTIEMA) – and was also signed by three women and five men, all of them researchers working under her guidance.

In 1931, Marie Curie went on her second trip to Spain. At that time, Piedad de la Cierva was a young science graduate, barely 20 years old, who had arrived at the Instituto Nacional de Física y Química (National Institute of Physics and Chemistry) to work on her doctoral thesis. Marie Curie visited the centre, which at the time had been recently inaugurated thanks to sponsorship from the Rockefeller Foundation. Given that, at the time, de la Cierva was the only female scientist at the Institute, and also because she spoke French and English, the physicists hosting the visit asked her to look after Marie Curie. Piedad de la Cierva related the story that she put sugar in the woman´s tea. There was no doubt to anyone, not to the researchers who asked her to be there nor to the young scientist who accepted the invitation, that she was the correct person to serve the tea. The men saw a woman; and Marie Curie saw a multilingual woman; but nobody saw a researcher.

What I propose to show here is what happened between 1931 and 1954, between serving tea and winning the award, so that Piedad de la Cierva would be recognized as a researcher and as the director of a military laboratory (given that women did not enter into the armed forces in Spain until 1988). I will outline a unique career path in dialogue with the family´s socio-economic situation, the political and economic interests of the early Franco years, and the role that this regime allocated to research.

Keywords: Woman in Chemistry, Franco dictatorship, Military laboratory

Spanish female geneticists during Franco's regime (ID 77)

Marta Velasco-Martin *(Consejo Superior de Investigaciones Científicas, Madrid, Spain)*

This paper deals with the emergence of a community of geneticists in Spain during the second half of the 20th century through the research done by four women geneticists: María Dolores Angulo, María Monclús, Ángela Casado and María Teresa Pérez Ureña. Focusing on their contributions allows me to show the genetics research done in their laboratories, the gendered hierarchies and relationships there. They tackled *Triticum*, *Drosophila*, human beings and bacteria, in disciplines between botany, agronomy and the origins of biomedicine.

These women geneticists and their study objects show a heterogeneous community that challenges the conventional narrative in which men remain the main characters. Through an analysis on authorship, my reconstruction will reveal the gender norms that women faced not only in science and laboratories but also in society, getting agency and power as scientists that were sometimes publicly recognized through high institutional and academic positions. I will present the set of professional strategies that these women used as compared to their male peers and also between them as woman scientists: some of them published alone or with woman colleagues while others did so with their male partners, sometimes their husbands. These women refute the Western trend of sending women back home after WWII, which was reinforced in Spain by Franco dictatorship's policy against married women's work. Territorial factors and hierarchical factors -in Margaret Rossiter's words-played every day, by gestures and attitudes at the workplace with a long standing influence in the distribution of labor in both the laboratory and the academic space.

Keywords: Women, Genetics, Spain, Power, Agecy, Gender hierchaies

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Women and the workplace. The case of the first unit on human genetics in Mexico (ID 62)

Ana Barahona *(National Autonomous University of Mexico, UNAM, México, Mexico)*

My talk will address the gendered organization of the scientific work at the first Unit on Human Genetics of the Mexican Institute for Social Security (IMSS). This workplace had been founded in the 1960s by Mexican physician-turned-geneticist Salvador Armendares, who spent two years in Oxford under Alan Stevenson´s tutoring. There, women and men had different tasks, duties and authority according to their gender, and individual and professional skills. I will focus on Mexican virologist-turned-geneticist Leonor Buentello who studied medicine at the National University of Mexico and graduated on virus genetics at Freiburg, Germany under the supervision of Richard von Hass. By the time she returned to Mexico to work with Armendares, he was performing the cytogenetic techniques he had brought back to Mexico from Oxford. Virologist Buentello began her career in medical cytogenetics alongside Armendares, learning cytogenetic techniques and joining him in their practice. Given her skilful handling of these techniques, she conducted tissue cultures and karyotyping of the hospital's patients, and was responsible for the supervision of blood sampling to ensure the correct identification of children, and for monitoring patients. Her work was of crucial importance inasmuch as she was the contact between the patients and the laboratory, between the bed and the bench in a two-way-traffic. Although this gave her power in the clinical setting, the gender order in the workplace did not grant her equality. Only Armendares along with other young male researchers were responsible for the conception, elaboration, writing and conduction of the research projects, meanwhile Buentello, besides her role at the hospital, was more involved with the standardization of the experimental techniques in the laboratory. This narrative intends to return her to the forefront of the history of cytogenetics in Mexico and to illustrate the contribution of women to scientific developments and the dissemination of ideas on cytogenetics and medicine when research on human genetics was becoming a medical domain for diagnosis at an international level.

Keywords: Women and workplace, Leonor Buentello, Karyotyping, Cytogenetics, Salvador Armendares, Medical genetics in Mexico

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The "cooling out" effect is, was, and ever will be? (ID 75)

Nicola Oswald *(University of Wuppertal, Wuppertal, Germany)*

Can contemporary reasons for women dropping out of the academic system the higher they climb up the career ladder be transferred to the situation of women in mathematics in the initial period of coeducational universities? In our analysis we follow a modern approach (cf. [Clark, 1959] and [Kahlert, 2015]) distinguishing hard and soft influence factors and put emphasis on subtle conditions: for example, we contrast the official structure of a research institute with its unofficial organizational culture. As case study we consider the autobiography of Hel Braun (1914–1986) [Braun, 1990]. Analyzing the mathematician's self reflections about her situation at the Universities of Göttingen and Frankfurt with the help of an ego-centered social network study, we compare current and historical influence factors. Hereby, we present the software VennMaker as visualizing tool for her socio-mathematical environment (see comparable qualitative historical studies for example in [During et al., 2011]). Finally we try to answer the question, whether in some cases women mathematicians could have also taken benefit of career influence factors, like political, social or institutional circumstances, to bring themselves into direct or subtle powerful positions.

Keywords: social network analysis, Hel Braun, career influence factors

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Should all women researchers be inspired by Marie Curie? (ID 317)

Anne-Sophie Godfroy *(Université Paris Est & Université Paris-Sorbonne, Paris, France)*

This paper is based on the results of c.a. twenty interviews conducted during the GenderTime project (2013–2016, funded by EU during FP7) at the university Paris Est Creteil in France in the science, engineering, humanities and social science departments. The aim of the project is to implement a gender equality plan to improve gender academic equality. The interviews focused on identifying the specific issues in each discipline or sub discipline in order to propose taylor-made specific policies.

The outcomes of the interviews demonstrate the diversities of issues and needs from a discipline to another. At micro level, mobility, work life balance, publications, access to the lab facilities, importance of experimental equipment, balance between teaching, research and administrative duties, career strategies, local, national and international networks may vary a lot.

Thinking women careers on one model, based on very internationalized subfields in physics, more or less inspired by an idealized Marie Curie's career at the beginning of the twentieth century, does not

fit all types of careers. The paper will present the diversity of career issues described during the interviews and will recommend a better attention to the context and the actual needs of academic researchers, in relation to their disciplines, profiles and local settings.

Although Marie Curie is an inspiring figure, she should not be the only career model and it should not prevent us to analyze actual career paths with their specific issues.

Keywords: Gender equality, Marie Curie, Equality policies, Organisational cultures, Institutional cultures, Academic career paths

America's Third Nobel Laureate – the "Controversial Madame Curie of the Bronx" (ID 192)

Margaret W. Rossiter *(Cornell University, Ithaca, USA)*

Until the mid-1960s the prevailing political view among U.S. women scientists was probably still the "Madame Curie" approach—women had to do more, work extra hard, and achieve more in order to be counted or to be considered "equal." This view was last best espoused by the medical physicist and 1977 Nobel Laureate, Rosalind Yalow (appropriately called "The Madame Curie of the Bronx" by the New York Times). She did not protest inequality, as was becoming the norm at the time, but instead claimed that women had to expect to do more both on and off the job (as running a kosher household for her family). Her views began to be criticized, especially when she declined a WOTY ("Woman of the Year") award in 1979. Having by then been elected to the National Academy of Sciences and received an honorary degree from Princeton University, she herself did not need the boost a WOTY provided. But in her self-absorption she did not recognize that other women might benefit from one.

Despite Yalow a lot had happened since the late 1960s, as a kind of feminist fever or contagion spread quickly. No longer was it enough to be silent and stoic. It was better to collect statistical data to document women's lack of advancement (Betty Vetter made a career out of it), to publicize discriminatory practices, hire a lawyer and join others in suing one's employer, raise funds for others' lawsuits, urge professional societies to hire staff to prepare rosters and generate opportunities for women scientists.

By the late 1970s the prevailing view among vocal U.S. women scientists (as far as one can tell) was that the "system" was unequal and so discriminatory and had to be changed (by government legislation if necessary). Various steps were underway to bring this about, as in the formation of many "consciousness-raising groups" and "women's caucuses" with their newsletters, rosters, and "networking" and even lobbying events. (The Women in Science Bill of 1981, which set up various programs for women at the National Science Foundation, grew out of a lot of this fervor.)

Keywords: Curie effect, Women scientists, Rosalind Yalow, Discrimination, Empowerment

Symposium 41: Textbooks and Handbooks as an Instrument of Power

Organizers: ***Marianne Klemun*** *(University of Vienna, Vienna, Austria),* ***Ana Carneiro*** *(New University of Lisbon, Lisbon, Portugal)*

Historians of science have until recently paid little attention to handbooks and textbooks. No doubt the neglect of these publications reflects the relatively low academic status of this genre, for scholars have other priorities, which derive from their research topics, rather than from standard and codified knowledge. But both genres need a history of their own and they need to be analysed with reference to significant changes they have undergone. The 19th century, in particular, could be expressed as a time of the development of handbooks and textbooks, in accordance with the differentiation of distinct fields of knowledge. Various authors have reflected on textbooks. Thomas Kuhn considered the role of textbooks as a means of securing credibility, fundamental to his concept of 'normal science'. In addition, he argued that textbooks have shaped our image of the nature of science and of the role played by discovery and invention in its progress. Historians of science, however, have subsequently envisaged textbooks not as instruments of 'normal science' and a means for the transmission of uncontroversial knowledge. It has been increasingly recognised that textbook authors are not neutral or passive actors, but they actually play a creative role in writing textbooks and consequently in the development of a scientific discipline.

Stichweh's concept about the process of establishing disciplines gives handbooks and textbooks a special role as one element in his sample of conditions. He argues that a corpus of knowledge represented through these books is one aspect of defining the differences and negotiation between disciplines. Thus both genres have acquired a significant power in terms of the way of establishing different fields of knowledge. They functioned as an important instrument for the self-definition of a field. At the same time, textbooks have been part of the framework of teaching and their choice has depended on those in power, be it the State, education ministries, institutional leaders and other public rulers. In this perspective, the selection of textbooks were influenced or even determined by these political powers.

In this session, special attention will be given to Ludwik Fleck, in particular his concept of 'thought collective' in analysing handbooks and textbooks. In this context, they will be envisaged as a medium to ensure success and legitimation of disciplines or special fields, particular topics, theories and distinctive methods. Thus, if on the one hand they have contributed to ensure disciplinary stability, they can also be an impediment to progress whenever their degree of standardisation and adoption over many decades conditions observation and ways of thinking, therefore constituting an obstacle to new concepts and ideas. Have these particular kind of books, with their specific selection of concepts, theories, methods and facts, acquired significant power in the dissemination of knowledge across more than one generation, within educational systems and public instruction? The relationship between these books and power will be analysed with reference to the differentiation of disciplines or special fields, and as a means of disciplinary control in the broader public domain given their role in education.

Keywords: textbooks, handbooks, establishing disciplines, selfdefintion of fields, 19th century, teaching

From the laboratory to the field: textbooks in building up Portuguese Tropical Medicine (1902–1935) (ID 54)

Isabel Amaral *(Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Caparica, Portugal)*

This paper addresses the power relationships entertained by the first generation of physicians committed to creating a new medical field, tropical medicine, based on the analysis of the textbooks used by Portuguese doctors in the training for clinical practice in temperate zones, during the first decades of the twentieth century.

Tropical medicine emerged as a research field in the transition from the nineteenth to the twentieth century, with the creation of State- or private-funded specific medical schools, as it was of paramount importance colonizing successfully, especially Africa. The Portuguese School of Tropical Medicine was founded in 1902, to provide doctors with specialized training. There was a gap, however, between training in mainland Portugal and clinical practice in the tropics. In this context, textbooks were both instruments of learning and guides as they contained the basics to face the challenges posed by tropical diseases.

In this paper, two foreign tropical medicine textbooks will be analyzed: the 1st edition of *Tropical diseases: a manual of the diseases of warm climates*, published in 1898, by Patrick Manson, founder of the London School of Tropical Medicine, which today is in its a 23th edition entitled *Manson's Tropical Diseases*; the 2nd edition of the *Précis de médecine coloniale*, published by Charles Joyeux and Adolphe Sicè, in 1937.

The pocket edition of Manson's book presents detailed information on signs and symptoms, allowing both beginners and initiated to identify each tropical disease; Joyeux and Sicè, both Pasteurian, present a "survival" manual to be used by Europeans in the tropics, namely Portuguese doctors in Africa. Each of these books addressed two distinct kinds of doctors: not only the languages differed, but also the depth in which tropical diseases were addressed; above all, they show a different rationale in legitimizing western and consequently Portuguese tropical medicine and colonialism.

Keywords: Textbooks on tropical diseases, Medicine and colonialism, Portuguese tropical medicine, Climate and diseases, Medical practices

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J. J. Rousseau's Letters on botany: A subversive take on a non-elite science (ID 118)

Alexandra Cook *(University of Hong Kong, Hong Kong, Hong Kong)*

An elementary botany text would not seem to have much to do with power. However, for Jean Jacques Rousseau the study of botany, is above all, a democratic activity, and hence one pursued in contrast with and in opposition to the elite, gentlemanly study of physics and chemistry that rely on affluence and/or patronage. Unlike elite sciences embedded in the relations of power and the cash nexus, studying botany is inherently free—it is the poor man's science, with no strings attached, accessible to anyone with some leisure and the ability to purchase a few inexpensive instruments. Furthermore, it has nothing to do with the transmutation of base metals into precious ones, the focus of chemistry's ancestor, alchemy.

Rousseau's botany is inclusive; he explicated botany to a female correspondent and her children in his posthumously-published *Lettres élémentaires sur la botanique* (1782). These ranked among the most popular botanical learning texts of the last quarter of the eighteenth century and remained so into the nineteenth century.

Rousseau's approach has also been called 'revolutionary' (Cohn, 1886) because he took as his framework not the widely-used artificial sexual system of Linnaeus, but rather, six of the seven core plant families of Antoine-Laurent de Jussieu's natural method of classification. First published in full in 1789, shortly before the French Revolution erupted, Jussieu's method was a system under development at the time Rousseau was writing in the 1770s.

That in teaching botany Rousseau resisted using hegemonic Linnaean taxonomy has hardly been recognized. Indeed, Rousseau's English translator, Thomas Martyn, presented not only the original eight letters explicating natural families, but also an additional twenty-four expounding the artificial system of sexual classification; he thereby helped prolong the life of Linnaean classification and at the same time, bury the 'revolutionary' and even subversive character of Rousseau's text.

Keywords: Botany, Epistolary education, Classification, Carl Linnaeus, Thomas Martyn, Translation

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Textbooks and the making of the new biomedical sciences in Italy after its unification (1860–1899). (ID 50)

Ariane Dröscher *(University of Bologna, Bologna, Italy)*

In 1860–61, after centuries of political fragmentation and twelve years of almost complete isolation in the aftermath of the 1848 revolts, the university system of the unified Italian kingdom had to face a great amount of fundamental challenges. My talk will focus on the role of textbooks for two of these challenges, namely the creation of a national scientific community and the bridging of the gap between the level of science and higher education in Italy and that of the rest of the world. Textbooks were of special importance because they are significant sources of authority and because the politics of the Italian ministry of education concentrated its hope of a quick return to international standards on the new generation of graduating students. In particular, numerous translations of English, French, and especially German textbooks were expected to succeed to a task that the older generation of Italian scientists was still not able to accomplish, i.e. the quick and broad diffusion of the most recent doctrines and theoretical innovations. The final part of my talk will pay special attention to the cytological content of the biomedical textbooks circulating in this period and how they (positively and negatively) influenced the development of cell theory in Italy.

Keywords: textbooks, translation, Italy (19th century), history of the biomedical sciences, history of histology, history of cell biology, science and politics

The books by Nerée Boubée (1806–1863) travel to Brazil: how and why? (ID 102)

Silvia Fernanda de Mendonça Figueirôa *(University of Campinas – UNICAMP, Campinas, Brazil)*

About a decade ago, John Issit published a provoking article encouraging researchers to pay attention to textbooks as a relevant object of investigation. In the history of science, however, textbooks continue to be a somewhat neglected object, although many classical books deserved detailed studies. Several questions may arise from the apparently simple and 'natural' fact that scientific textbooks were published, and many will be addressed in the symposium "Textbooks and Handbooks as an Instrument of Power". During the nineteenth century, publishers started considering textbooks as 'the flesh' of the

production of books, due to the commercial importance they acquired, while literature was 'the bone'. Considering the Brazilian case in specific, it is well known that scientific education in Brazil, since colonial times, has shown a significant influence of French science, especially of French textbooks. Throughout the nineteenth century, until the first decades of the twentieth, French authors of textbooks on geoscientific topics were dominant, whether for elementary and secondary school, or for higher education, as shown by specific syllabuses. We may quote, as (some) examples, Ours-Pierre-Armand Dufrénoy, Nerée Boubée, François Sulpice Beaudant, and Albert de Lapparent. In this paper I shall discuss the book *Géologie élémentaire appliquée à l'agriculture et à l'industrie*, by Nerée Boubée (1806–1863) (1st French edition, 1833). Published in 1846, the book adopted was a translation of the fourth French edition, to which were added, as appendixes, papers previously published on the geology of Brazil by José Bonifácio d'Andrada e Silva (1763–1838), Martim Francisco Ribeiro d'Andrada (1775–1844), Wilhelm Ludwig von Eschwege (1777–1855), Charles van Lede (1801–1875) and George Gardner (1810–1849). This characteristic reveals the concern to ensure an education that incorporated contents specifically about Brazil. At that time, local disputes were arising between Brazilian and foreign scientists, because the former claimed expertise on local matters, and did not want to continue behind the scientific scene. The inclusion of all the appendixes, including some by longstanding authors as the Andrada brothers, might be seen as dispute of power within the geoscientific territory. Moreover, the choice of Boubée may not be considered to have happened by chance: he was a prolific, active author living and teaching open geoscientific courses in Paris, owner of a Natural History shop in the Quartier Latin. And who, through his books and lectures, aimed at finding more space for geology within the sciences. In this sense, his books were 'instruments of (em)powering' geological sciences.

Keywords: Textbooks, Brazil, France, Geology, Mineralogy

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Disciplining Interdisciplinarity: The Development of Speleology as a "Handbook Science" (1870–1920) (ID 464)

Johannes Mattes *(University of Vienna, Vienna, Austria)*

The development of speleology or cave study as one of the early integrative fields of science goes back 150 years, when its first handbooks were published by both established scholars and scientific laymen like William Boyd Dawkins (1874), Franz Kraus (1894) and Édouard-Alfred Martel (1900). These first steps in cave study were taken not only in academia alone, but also in nature research societies, museums, and schools. By synthesizing a scientific and popularized approach and organizing the information hierarchically for instructional purposes, early handbooks in speleology brought together different communities of knowledge and practice. Going through printing after printing, these handbooks deeply influenced the field's collective identity.

According to Foucault's concept of power, disciplinary institutions as well as academic disciplines tend to freeze specific relations of power and enforce social discipline as a specific practice of control to constrain discourse. In this context, speleological handbooks also limit discourse by policing specific ways of thinking, introducing a compulsory terminology, norms and methods of measuring deviations. In cave study, the influence of handbooks was even stronger than in other fields of research due to 1) the absence of academic teachers and university training; 2) the instability of speleological institutions;

3) its interdisciplinary approach and broad audience; 4) the integration of popular images and photos; and 5) the lack of established international journals, that could struggle with handbooks for epistemological primacy. Therefore, until the 1920s speleology can be described as a "handbook science" (Ludwik Fleck).

Using the method of historical discourse analysis, the paper examines the normalizing function and influence of speleological handbooks on the field's interdisciplinary approach. Further, special attention will be dedicated to the epistemological interaction between handbooks and journals, when speleology got institutionalized in form of academic departments, laboratories and professorships in several European universities between 1920 and 1930.

Keywords: power, interdisciplinarity, handbook, normalizing, discipline, control, speleology, cave, identity, popularization

"Have we ever been geologists?" Images in geology textbooks in Portuguese secondary education, 1836–1974 (ID 605)

Teresa Salomé Mota *(Centro Interuniversitário de História das Ciências e da Tecnologia, Lisbon, Portugal)*

Scientific textbooks have been studied both by historians of education and historians of science for some time. Special issue 15 of *Science & Education* published in 2006 which was entirely devoted to scientific textbooks in the so-called 'European periphery' is but an example. The study of scientific textbooks allows to approach a diversity of questions: their role in pedagogical and training practices of future scientists; the development of scientific ideas and practices; the formation of scientific disciplines and associated power issues, among others.

Martin Rudwick has already enlightened the importance of images in science and his studies dedicated to visual language in geology became seminal. In fact, geology is a scientific discipline where the use of images has been intrinsically linked to the very construction of geology as a scientific discipline.

Bearing in mind the role of visual language in the construction of geology, this presentation intends to trace the development of geological ideas and practice in Portugal through the analysis of images present in textbooks for secondary education between 1836 (establishment of the Portuguese public teaching system) and 1974 (end of the *Estado Novo* dictatorship). By resorting to reflections on the establishment of disciplines by Rudolph Stichweh and Ludwick Fleck but also by historians of education such as André Chervel, this paper also aims to co-relate the conclusions stemming from the analysis of those images with the 'place' of geology in Portugal during the period under consideration.

Keywords: Textbooks, Geology, Visual language, Teaching, Discipline, Power relations, 19th and 20th centuries, Portugal

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The Hungarian Translation and Reception of David Page's Introductory Textbook of Geology (1872) (ID 42)

Katalin Straner *(Central European University, Budapest, Hungary)*

The aim of this paper is to engage with questions of translation and reception in the production of natural science textbooks as instruments of power. Using the case study of the Hungarian edition of David Page's *Introductory Textbook of Geology* (1872) to examine the role of the translator and his agenda of translation in disseminating knowledge about geology, the paper will engage with the role of knowledge transfer in attributing power to learning and knowledge – and through this, to the nation. The book in question was translated and adapted to Hungarian by László Dapsy, who also produced the first full Hungarian translation and edition of Charles Darwin's *Origin of Species* (1873), and who initiated the establishment of the book publishing company of the Hungarian Society for Natural Science with the aim to facilitate the progress of the Hungarian nation to be able to catch up with more powerful ones. Dapsy, a teacher of natural history in the Calvinist secondary school, was an important figure in the dissemination of natural history and natural science in the 1860s and 1870s through his translations and articles in the scientific and popular press. The paper will examine his agenda in using translation as a tool in the production and dissemination of scientific knowledge. Since Dapsy's edition of Page was reviewed in the press, the paper will also examine the reaction of the scientific community and the public to Page's work. Moreover, the paper will engage with questions of scientific translation and adaptation as well as Dapsy's project to publish Western works of science in Hungarian, and on a broader level, with the translation and circulations of scientific knowledge as instruments of power.

Keywords: scientific translation, public reception, geology, textbooks, knowledge as power

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Chemistry, expertise, and scientific disciplines: the treatise of chemical analysis by José Casares Gil (1866–1961). (ID 53)

Ignacio Suay-Matallana *(Centro Interuniversitário de História das Ciências e da Tecnologia (CIUHCT-UNL), Lisbon, Portugal)*

This work studies one of the most influential treatises on chemical analysis in Spain: the *Tratado de Análisis Químico* by José Casares Gil (1866–1961). This textbook was firstly published in 1897, followed by other ten editions (from 1911 to 1975), and two popular editions (in 1905, and 1918). Its author was a well-known Spanish chemist, chair of chemical analysis in Barcelona, and Madrid, director of the customs laboratory of Madrid, member of the Senate, and president of different Royal Academies and scientific societies. This work studies how José Casares employed the textbook to consolidate chemical analysis as a discipline in Spanish universities. Simultaneously, the wide diffusion of this text was extremely important to reinforce the prestige of Casares and his recognition as expert. First, this paper shows the active role of Casares in the shaping of his textbooks, selecting their contents, and adapting them to his local context. It also shows the relationship between his travels of learning to Germany during the late 19th century and the publication of his book. Second, this work considers the evolution of this treatise considering not only its physical features (pages, organization, distribution of contents, etc.), but also his efforts to adapt it to new and different publics, and to integrate new research lines and collaborators he had in his laboratory. Finally, this work studies the different strategies employed by Casares to consolidate analytic chemistry as an academic discipline in Spanish universities. The Casares´ treatise played an essential role to reinforce the disciplinary identity of chemical analysis in Spain, while at the same time promoted Casares as a key figure and expert on this subject.

Keywords: textbooks, analytical chemistry, José Casares-Gil, Spain, experts, academic discipline

Johann Matthäus Bechstein's Manual on Cage Birds and its Significance for Nineteenth-Century German Bird-Keeping Literature (ID 86)

Thomas Tretzmüller *(University of Vienna, Vienna, Austria)*

Until the 18th century, printed information on songbird-keeping was typically contained in natural histories, household and hunting literature. After specialized tracts, usually focusing on one or a few popular species like canaries or nightingales, had started to appear, the Thuringian naturalist Johann Matthäus Bechstein (1757–1822) wrote the first comprehensive manual exclusively devoted to this subject. His "Naturgeschichte der Stubenvögel" ("Natural History of Chamber Birds") went through five editions from 1795 to 1870 and enjoyed even greater success in its English and French translations.

While the above mentioned forms of bird-keeping literature by no means disappeared, this handbook became its principal reference in the early 19th century and prompted authors across the German-speaking countries to publish their own accounts or supplements in a variety of mostly smaller treatises. The book thus contributed to the proliferation of a genre that was apparently in demand and accordingly also commissioned by publishers. Later authors increasingly questioned some of Bechstein's ornithological findings and methods of bird handling, sometimes explicitly deplored the sway of his plagiarists, but not every attempt at a replacement proved equally successful with the audience. Bechstein's book was eventually superseded by other manuals of similar scope, yet it remained an oft-quoted classic in the field.

In this paper, I will first sketch the book's design and content, with emphasis on the rhetorical and conceptual devices Bechstein employed to recast the available literature and his own ornithological writing. The second part will consider its influence on a body of instructional literature that was at once of practical use for the owner of the casual cage bird, who was often a woman, arguably played its part in the vindication of bird-keeping as a respectable pastime with educational overtones, and in its further emergence as a special field with clubs, competitions, journals, traders, and breeders.

Keywords: bird-keeping, natural history, handbooks, instruction, 19th century

Societal and Political influences on the development of Geoscience and Astronomy related textbooks in Central Europe and vice versa (ID 564)

Barbara Mohr *(Museum für Naturkunde Berlin, Berlin, Germany),* ***Annette Vogt*** *(Max Planck Institute for the History of Science, Berlin, Germany)*

Besides specialist knowledge, general beliefs and political views can be detected in school books on astronomy and geosciences even if they seem to be at first sight apolitical. Our study is based on ca. 400 books on astronomy and geosciences published in Central Europe between the 18th and 20th centuries. Benedictine monks in monasteries, and enthusiastic pedagogues created the first 'readers' on astronomy and geosciences at the end of the 18th Century. Both worked in institutions that were part of the enlightenment movement, which had identified childhood as a crucial time for learning about the universe and our world, which would thereby better enable them as adults to meet cultural and economic expectations. During the 19th Century geosciences became a standard subject at newly founded science-focused gymnasiums, though for boys only. While during the first decades of the 19th Century the subject was presented just as enumerations and classifications of crystals, rocks and fossils, from the mid-19th Century on more linkages between the non-living and living world were shown. This trend, based on a more dynamic view of the earth, was coupled at the beginning of the 20th Century with descriptions on local conditions, serving as guidebooks for excursions into the local surroundings, reflecting what is known as the "Wandervogelbewegung" (e.g. Johannes Walther, 1921, Geologie der Heimat). This came to an end when Nazi governments removed geosciences and/or astronomy from the school curricula and replaced these lessons/text books with NS "biology" curricula. After WWII teaching in these subjects in the two German States developed differently. In West-Germany (BRD) biology remained the only science subject while in East-Germany (GDR) the curriculum

included again geosciences, now more focused on mineral resources and for the first time astronomy for which textbooks were developed. Global societal challenges such as climate and environment suggest that geosciences will be and should be included much more in school curricula in the future.

Keywords: Geosciences, Planetary science, (School)Textbooks, 18th–21st Century, Political implications, Global change

Symposium 46: Disciplining Knowledge: The Emergence of Learned Journals and The Consolidation of Scholarly and Scientific Disciplines in the German lands

Organizers: ***Anna Gielas*** *(University of St Andrews, St Andrews, UK),* ***Dominik Huenniger*** *(Georg-August-University Goettingen, Göttingen, Germany),* ***Martin Gierl*** *(Georg-August-University Goettingen, Göttingen, Germany)*
Commentator: ***Noah Moxham*** *(University of St Andrews, St Andrews, UK)*

The learned journal is an instrument that both scholars and scientists have in common. But there is more to this particular kind of periodical. This academic self-documentation is an expression of perceived commonalities and collective identities.

The learned journal is of interest to historians because it is an artefact of collective memory—and yet, we have paid surprisingly little attention to it. Thereby we ignore the powerful influence which these journals had on the formation of scientific and scholarly communities as well as disciplines. Instead we have developed truisms which obstruct our understanding of the history of the learned periodical. The idea, for example, that the era of learned journals began with the *Philosophical Transactions* (1665) has become axiomatic to historians of science. Yet, for over a century after the English periodical first appeared, just a few journals existed in Europe. Only beginning in the 1760s, the German lands became the first European territory to experience an unprecedented rise in the numbers as well as the significance of learned periodicals.

Our panel focuses on the emergence of learned periodicals in the German lands and provides explanations to questions such as: how did the growing importance and number of learned journals relate to emerging disciplines? Who were the editors and who the addressees of these new journals? What functions and features distinguished these periodicals from other modes of learned communication? And what kind of power over the course of scientific research did editors of these early publications have?

This panel illuminates the emergence of today's academic journal, thereby shedding light on a crucial instrument of creating and spreading scholarly and scientific knowledge.

Keywords: History of scientific publishing, Institutionalisation of scientific fields, academic journals

Plan for an entomological republic – scholarly journals and the establishment of entomology (ID 48)

Dominik Huenniger *(Georg-August-University Göttingen, Göttingen, Germany)*

The second half of the eighteenth century witnessed a growing interest of German researchers in insects. The advancement of Linnaean systematics in botany and zoology caused paradigmatic changes in the perception, systematization and classification of insects. The later decades of the century became an important era for the development of entomology as an academic subject. Specialised journals played a key role in the process of both the establishment as well as the diversification of this field.

This paper will provide an analysis of this key role by looking at natural philosophical journals from the German lands devoted solely to entomology that appeared in the last decades of the eighteenth century.

These periodicals are the *Magazin für die Liebhaber der Entomologie* (1778/79), the *Neues Magazin für die Liebhaber der Entomologie* (1782, 1785, 1786), *the Archiv der Insectengeschichte* (1781–1786), *Beiträge zu der Insekten-Geschichte* (1790, 1791, 1793), *Journal für die Liebhaber der Entomologie* (1790, 1791), the *Neuestes Magazin Insektenkunde* (1791) as well as the *Magazin für Insektenkunde* (1801).

Moreover, the role of the learned periodical for the field of entomology will be contextualized against the background of the rising importance of academic journals as venues for international scholarly exchange. Here, the paper will focus on, for example, the papers of the Danish scholar Johann Christian Fabricius in German periodicals.

Keywords: Entomology, journal, publishing, German lands

Constructing law: the typology of legal literature and the Göttingen legal journals from 1760 to 1800 (ID 49)

Martin Gierl *(Georg-August-University Göttingen, Göttingen, Germany)*

The growing numbers and different topics of learned periodicals in the German lands in the second half of the eighteenth century attest to a process of increasing differentiation between fields of knowledge as well as a standardization of expectations.

This paper on the German juridical periodicals between 1760 and 1800 will trace the development of juridical literature from an active means of practicing jurisprudence–from practiced scholarship, so to speak–to the foundation of a reflexive and analytical discipline in the German lands, the "Rechtswissenschaft".

More concretely, this paper will illustrate how legal knowledge was planned, constructed, and organised within the context of written scholarly debate, from journals such as the *Göttingische Anzeigen von gelehrten Sachen* in which jurisprudential topics were presented and discussed alongside other scholarly and scientific topics, to the journals devoted solely to the topic of "Rechtswissenschaft".

The paper will describe the development of the journals side by side with the development of their articles. Here, it will elaborate on the text typologies which became characteristic for journals of "Rechtswissenschaft": the specific functions of the different text genres will be discussed by focussing on the development of the interior design of legal journals.

The Bulletin of the Association of Portuguese Physicians (1899–1919). Regulating the Profession and its Prerogatives (ID 28)

Ana Carneiro *(Faculty of Sciences and Technology, New University of Lisbon, Monte de Caparica, Portugal),* ***Teresa Mota*** *(Faculty of Sciences, University of Lisbon, Lisbon, Portugal),* ***Isabel Amaral*** *(Faculty of Sciences and Technology, New University of Lisbon, Monte de Caparica, Portugal)*

This paper focuses on the Bulletin of the Association of Portuguese Physicians (BAPP), which was published quarterly between 1899 and 1919. Following a period of discussions of the Association's statutes, between 1897 and 1898, on 15 April 1898, a meeting took place at the headquarters of the Lisbon Society of Medical Sciences. The name of the association was approved together with its governing bodies presided by leading Lisbon doctors, most teaching at the Medical-Surgical School, from 1911 Faculty of Medicine.

The BAPP was part of the publishing apparatus composed of around 36 journals created by Portuguese doctors aimed at various audiences, in a period spanning from the 1880s to 1926, that is, from the last decades of the liberal monarchy to the end of the First Republic (1910–1926). This period was marked by doctors' commitment to the development of laboratory-based medicine and later biomedical research; the reform of medical teaching in 1911 and 1920; the construction of new medical infrastructures, especially in Lisbon, and consequently by doctors' social and political ascendancy, which culminated in the First Republic.

The analysis of BAPP will be based on the analysis of the contents, including advertisements, its public as well as the evolution of its membership and geographic distribution nationwide. The BAPP shows that although sharing some characteristics with other coeval Portuguese medical journals, it naturally presents specific features. As the journal of a nationwide professional association by its very nature BAPP was overtly corporative and provides important clues on how the Portuguese medical profession built its power by regulating the profession and thereby establishing the rules for the legal practice of medicine as the Association oversaw the application of legislation; creating benefits and the basis of a doctors' welfare system; concomitantly, it contributed to building the doctor's figure as an intellectual leader in Portuguese society from the standpoint of Lisbon's doctors, as the city was then undergoing the process of becoming the country's intellectual centre, in addition to being the political and administrative capital.

Keywords: medicine, medical press, Association of Portuguese Physicians, liberal monarchy, First Republic

Symposium 67: Algebra, Humanism and Cultural Policies

Organizers: ***Veronica Gavagna*** *(University of Florence, Florence, Italy),* ***Pier Daniele Napolitani*** *(University of Pisa, Pisa, Italy),* ***Sabine Rommevaux-Tani*** *(CNRS - Université Paris Diderot, Paris, France)*

At first sight, the history of algebra seems to be completely foreign to the so-called Mathematical Humanism as to content, methodology and social environment.

Algebra came from the Arabic culture into the Latin West where it found a fertile ground inside the Italian abacus schools, the institutions that provided the education for the growing middle class. Just in this world of cossist algebra, Tartaglia discovered the solving rules for the cubic equation, the first original result of the Western mathematics with respect to the Ancient Greek mathematics. Subsequently, Cardano's *Ars Magna* disseminated the rules for solving formulas of cubic and quartic equations all over Europe and furthermore Bombelli "invented" the complex numbers: apparently, algebra was ready for the 'symbolic' revolution without any other external suggestion.

On the other side, it seemed that the Renaissance Courts, whose political, economic and cultural influence was dominant at that time, promoted only the restoration of Greek Classics. The mathematical humanism encouraged the reawakening and the reinterpretation of the Archimedean tradition: Luca Valerio and Bonaventura Cavalieri's reworking of the Archimedean geometry of measure brought it to a higher level of abstraction and the humanist Galileo tried to interpret the Book of Nature in Mathematical terms.

In the 'received wisdom' of the great part of the scientific literature the previous were considered two separated worlds, both from social and intellectual viewpoint, but are we sure this is correct?

We propose to focus the discussion mainly on the following points

- Did the different cultural policies in Europe (especially in Italy and French) have any influence in the flourishing of mathematical humanism?
- Could the arabic-abachistic algebraic tradition have the possibility of a further autonomous development in the Late Cinquecento?
- Could we recognize any kind of relationship between Medieval and Renaissance algebra -- seen by practitioners as a problem solving tool – and the restoration of Classics promoted by influential Courts and humanistic circles?
- What was the role played by Diophantus and Pappus' translations in the emergence of Viète's *ars analytica*?
- What was the role played by Viete's *logistica speciosa* in the creation of new mathematical objects?
- Could we recognize a kind of influence of scientific institutions or centre of power in the diffusion of symbolic algebra in the Late Renaissance?
- Did the Renaissance reworking of the Archimedean geometry influence the emergence of a new concept of 'mathematical object' (e.g. the curve-equation of Descartes)?

Keywords: History of mathematics, History of Algebra, Humanism, Renaissance History

On the interaction between algebra and arithmetics in 11th–13th century Arabic mathematics (ID 224)

Eleonora Sammarchi *(CNRS, UMR 7219 / Univ. Paris Diderot-Paris 7 / Univ. Paris I, Paris, France)*

When algebra was founded as a theory for second degree equations, arithmetics was still a sort of practice rather than a properly science. The Egyptian mathematician Abu Kamil (9th cent) prepared the ground for a fruitful interaction between algebra and arithmetics. In his work, arithmetics could be used as a tool in algebra and gave contents to the new discipline. At the same time, many arithmetical

problems could be solved in an algebraic way. The study of this interaction was subsequently developed by a group of mathematicians, who started to conceive a coherent and exhaustive system of rules for calculating with algebraic entities. The focus of their research was on the notion of operation, and their aim was to become able to manipulate unknown quantities as the arithmetician manipulates the known ones. Among the mathematicians of this tradition, two names must be mentioned: al-Karaji (11th cent.) and al-Samaw'al (12th cent). In 13th century the Persian mathematician al-Zanjani followed this same tradition and his *Book of algebra* accurately recalls and elaborates on al-Karaji's work.

A short comparison of these last three mathematicians' approaches to the problem of constituting an arithmetics of unknowns will be followed by the analysis of al-Zanjani's collection of problems, whose origin is, implicitly, Diophantus's *Arithmetics.* Finally, it will be shown if, and eventually in which way, there is an evidence of the transmission of the Arabic "arithmetical-algebraic" approach to Latin and Renaissance algebraists.

Keywords: algebra, arithmetics, Arabic mathematics

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Humanism and Mathematics in the Duchy of Milan (ID 74)

Nadia Ambrosetti *(Università degli Studi di Milano, Milano, Italy)*

During the XIV-XV centuries, in Italy the cultural renewal movement known as Humanism was taking place, sponsored mainly by the lords of the most important regions, who had become patrons of the arts, of literature, and of sciences. Besides the interest for classical Greek works, the tradition of Arab mathematics survived, although marginalized to practical calculation and to the commercial field. In our study, we will firstly focus on the territory of Milan, and on the Visconti's patronage in the field of edcation and in particular, of mathematical education. Then we will consider the surviving manuscripts about abacus, or calculation by some masters, whose links with the Arab tradition are unquestionable, though possibly mediated through the knowledge of Sacrobosco's Algorismus. A remarkable case is given by the work attributed to an abbacus master from Lombardy, Zohanantonio da Como, "Opera de fare de razone" (Book on calculation) whose manuscript, housed in Bologna, copied in the XV century, was studied at least until 1661, and known to Cardano and Pacioli, according to an owner's note. In order to complete our study, we will also take into consideration the existence of a manuscript of a Latin version of al-Khwarizmi's algebra, copied at the middle of the Xv century in Lombardy, an actual witness of the surviving interest on the topic of Arabic algebra.

Keywords: calculation, al-Khwarizmi, Lombardy, Milan, manuscripts

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Renaissance Italian algebraists and Humanism (ID 93)

Veronica Gavagna *(University of Florence, Florence, Italy)*

In the Middle Ages and in the early Renaissance Italy, algebra was mainly considered a practical art, that provided useful tools to solve problems. It belonged to the world of practical mathematicians populated by merchants, engineers, architects, craftsmen. For the same reason, algebra was quite out of the interest of the powerful courts (in a wide sense) where humanistic circles flourished.

The abacus teacher and famous algebraist Niccolò Tartaglia tried to bridge the gap between his world of practitioners and the humanistic circles and courts. He devoted himself to the translation of Euclid's *Elements* into vernacular and he published some works of Archimedes (in Latin). But, as far as we know, his 'humanistic' project did not involve algebra. On the other side, the polymath Cardano pursued the very ambitious project to publish an arithmetical encyclopedia, whose tenth volume is the well-known *Ars Magna*, where practical issues were merged with a theoretical approach. Cardano's 'Opus perfectum' had to be, not by chance, written in Latin because it was conceived as the work fated to go beyond the abacus environment so to become the main reference for the whole community of scholars.

Finally, the case of the engineer Bombelli is even more interesting. At first, he decided to write his *Algebra* in order to make clear the state of the art of the discipline, especially after the discoveries on the third and fourth degree equations. But a Diophantus' manuscript came into his attention and fired his imagination so to inspire the reworking of the draft. The existence of such a manuscript gave to Bombelli a strong argument to claim that even algebra had classical roots. But what kind of influence did Diophantus and classical texts definitely exert on Bombelli's work? I attempt to answer to this question.

Keywords: Renaissance Mathematics, history of algebra, Humanism, Mathematical Humanism, Girolamo Cardano, Niccolò Tartaglia, Rafael Bombelli

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Viète' School in Italy and France. A Comparison (ID 186)

Pier Daniele Napolitani *(Università di Pisa, Pisa, Italy),* ***Paolo Freguglia*** *(Università dell'Aquila, l'Aquila, Italy)*

The epistemological revolution operated by the new *ars analytica* of François Viète, spread itself in Italy and in France in the first three decades of XVII century. In Italy, Marino Ghetaldi had a seminal relevance in order to make known the algebraic-geometrical vieteans techniques; in France a similar role was played by the Aleaume's and by Alexander Anderson who published in 1615 the *Recognitione et ementatione aequationum*, one of the most important Viète's unpublished treatises.

However, the destiny of the *ars analytica* was very different in the two countries. In Italy the vietean techniques were cultivated by B-series mathematicians (Gloriosi, Santini and others) who kept like a secret the texts received by Ghetaldi. Moreover, the new symbolic algebra had apparently no influence at all on leading scientist like Galileo, Cavalieri or Torricelli.

By contrast, in France the work of scholars like Vaulézard, Vasset, Hume, Beaugrand and others allowed a more vast and precise diffusion of Viète's treatises (translation from Latin into French of some parts of Viète work). At the same time was put in evidence certain methodological aspects of the analytic art, in particular through Euclidean geometric interpretations (Vaulézard) or the analysis and the improving of some Viète theorems or problems (Hume). This background -- or at least this backstage -- made possible the new triumphantly devastating approaches of Pierre de Fermat and Réné Descartes.

We will try to answer to the following question: to which extent were the different traditions, and the different academic structures responsible of such a dramatic branching?

Keywords: François Viète, Algebra, Early XVII century, Marino Ghetaldi, Jean de Beaugrand, Hume, Vasset, Galileian School, Cavalieri, Torricelli

Algebra and Humanism in John Wallis's work (ID 261)

David Rabouin *(Université Paris Diderot – CNRS, Paris, France)*

In this talk, I will present John Wallis's views on the history of Algebra, as they appear in his treatises *Mathesis universalis*, *sive arithmeticum opus integrum, tum philologige tum mathematice traditum* (ex typis Leonis Lichfield, Oxford, 1657) and *A Treatise of algebra, both historical and practical* (Playford, for Richard Davis, Bookseller, in the University of Oxford 1685). The original mixture of historical and conceptual presentation given by Wallis will be analyzed in the light of his institutional position and of his own conception. Since 1649, Wallis held the chair of Savilian Professor of Geometry at the University of Oxford. In February 1657, he was also elected as *custos archivorum (*Keeper of the Archives). I will detail the conception of Algebra which arises from this position and the subtle ways in which Wallis tried to reconcile a humanist heritage, a national (if not nationalistic) scientific Policy and the promotion of modern mathematics in England (symbolical algebra, conceived as a purely arithmetical discipline). I will put particular emphasis on the way in which he relied on Ancient Mathematics, especially through his references to Indian and Arabic mathematics. I will show that Wallis was able to strategically use some institutional constraints to defend a very original and powerful view on. Starting from a philological point of view (in 1657), he moved in the 1670's toward more precise historical inquiries, with long lasting effect on the history of mathematics.

Keywords: John Wallis, History of Algebra, Humanism, Arabic Mathematics, Indian Mathematics

The manuscript of Bombelli's Algebra Book III (ID 550)

Alessandra Fiocca *(University of Ferrara, Ferrara, Italy)*

In 1572 Rafael Bombelli published in Bologna the *Algebra*, a work divided in three Books. It contains a synthesis of the existing knowledge of the subject and it is enriched by Bombelli's fundamental contributions to the discipline.

A manuscript of the *Algebra* of Bombelli, in five books, was found by Ettore Bortolotti in the Biblioteca Comunale dell'Archiginnasio in Bologna in 1923. Book I and Book II are much the same as Books I and II in the printed work. Books IV and V were not published by Bombelli and they had been published by Bortolotti in 1929. Book III has its own story: it is a collection of problems some of which of applied arithmetic not found in the printed version of *Algebra* where, on the other hand, it could be found several problems taken from Diphantus'Arithmetic. In fact the manuscript had been written before Bombelli had seen a manuscript of Diphantus'Arithmetic in the Vatican Library. The 156 problems of the Book III in the manuscript had been classified according to their content by S.A. Jayawardene in

1973, but until now a comparison with Book III in the printed work is missing. Aim of this paper is to provide such comparison and to outline the historical background of Bombelli's *Algebra*.

Keywords: Rafael Bombelli, Algebra in XVI century, applied arithmetic

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Symposium 69: Forgotten Pages in the History of Genetics

Organizers: ***Georgy Levit*** *(University ITMO, St. Petersburg, Russian Federation),* ***Sergey Shalimov*** *(Saint-Petersburg Branch of S. I. Vavilov Institute for the History of Science and Technology of Russian Academy of Sciences, St. Petersburg, Russian Federation)*

The 20th century was arguably "the century of the gene" (as Evelyn Fox Keller put it). A lot has been done to reconstruct the growth of genetics. Yet, despite the great efforts of historians of science across the world, there are still many "white spots" in the history of genetics. Partly, it can be explained by the complexity of social-political circumstances and theoretical peculiarities, which determined the paths of genetics in various national contexts. Our panel targets to contribute to the elimination of some of these "white spots". Our concentration will be on the crucial episodes of Eastern-European and German hereditary biology underrepresented in the current historiography. We are going to discuss applied science in the Nazi Germany taking as an example forest Genetics in Bohemia and Moravia between 1939 and 1945. German "high church" genetics of the 1st third of the 20th century will be approached as well. We will be taking as an example a zoologist and geneticist Ludwig Plate (1862–1937). Plate was a pupil and successor of the "German Darwin" Ernst Haeckel as the director of the Institute of Zoology at Jena University. He campaigned for a revival of the "original" Darwinism. His research program, which he labelled "old-Darwinism", proclaimed the synthesis of selectionism with "moderate Lamarckism" and orthogenesis. Besides, we will outline the history of genetics in the USSR after the downfall of Lyssenkoism paying special attention to the controversial role of an outstanding but controversial geneticist Nikolai Dubinin (1907–1998) in the post-Lyssenkoist era. Finally, we will make a jump into the modern times and ask whether genetic engineering is a promise of power by considering example from the very recent history of genetics. We proceed from the assumption that all these case studies are not just isolated episodes in the history of genetics, but can be discussed in a more general methodological framework.

Keywords: genetics, the history of genetics, Lyssenkoism, Plate, Dubinin, the Soviet Union

The "old-Darwinian" genetics of Ludwig H. Plate (1862–1937) (ID 104)

Georgy Levit *(University ITMO, St. Petersburg, Russian Federation)*

The German zoologist and geneticist Ludwig Plate was a successor of the "German Darwin" Ernst Haeckel (1834–1919) as the director of the Institute of Zoology at Jena University (Germany). Plate campaigned for a revival of the "original Darwinism" as opposed to neo-Darwinism. He was seen by many contemporaries worldwide as a proper advocate of Darwinian evolutionary biology. Both Plate's empirical as well as theoretical works had an enormous impact on the growth of genetics and evolutionary theory.

Plate proposed a concept combining all valuable theoretical movements and new disciplines of the biology of his time. He promoted a research program which he called 'old-Darwinism' during more then thirty years of experimental and theoretical investigations. In addition to Darwin and himself, Plate counted Ernst Haeckel, Richard Semon (1859–1919), Wilhelm Roux (1850–1924), Richard Hertwig, Fritz v. Wettstein (1895–1945), Berthold Hatschek (1854–1941), Jan Paulus Lotsy (1867–1941), Franz Weidenreich (1873–1948) and even the future 'co-architect' of the evolutionary synthesis Bernhard Rensch (1900–1990) among the "old-Darwinians". According to Plate, old-Darwinism follows exactly the initial ideas of Darwin while at the same time adapting and processing all healthy and empirically verifiable scientific achievements. Plate aimed to combine all fruitful theoretical approaches (Lamarckism, selectionism, orthogenesis) with the most innovative field of the experimental genetics.

I will reconstruct and analyse Plate's "old-Darwinian" genetics as well his views on the mechanisms of biological evolution.

Keywords: Ludwig Plate, History of Genetics, neo-Lamarckism, Orthogenesis

German Forest Genetics in Bohemia and Moravia, 1939–1945 (ID 239)

Michal Šimůnek *(Institute of Contemporary History of the Academy of Sciences of the Czech Republic, Prague, Czech Republic)*

Historically, Bohemia and Moravia played an important role in the development of the modern science of heredity/genetics. During the 20th century there were several phases, which were highly determined by the political circumstances. One of them was the period of German occupation of Bohemia and Moravia, when genetics expanded in several areas. Relatively high priority was given to the applied biological research including forestry. It is the aim of this contribution to give an overview of the attempts to establish the Reich Institute for Cultivation of Forest Plants in Stará Boleslav/Brandýs nad Labem (Altbunzlau/Brandais an der Elbe) between 1942 and 1945 first under the Reich Office of Forestry and then under the Kaiser-Wilhelm-Society. It starts with the overview of the plan relating originally the forest program in the Warthegau and then it continues by the so called Prague Plan. The particular institutional history is analysed in a broader context of the Nazi scientific policy in Central and Eastern Europe. Another important aspects are i. the question of effectiveness of the basic biological research during the period of total war (*Totalkrieg*) after 1943, which was characterised by general shortages in material, staff, and financial sources, and ii. the question of continuities of this particular genetical practice after 1945 in Germany itself.

Keywords: genetics, forest, 20th century, Bohemia and Moravia

Nikolai Dubinin and the revival of Soviet genetics (ID 160)

Sergey Shalimov *(Saint-Petersburg Branch of S. I. Vavilov Institute for the History of Science and Technology of Russian Academy of Sciences, St. Petersburg, Russian Federation)*

The revival of Soviet genetics in the "post-Lysenko" epoch was due to the activity of many outstanding scientists. One of them was the famous Soviet biologist, a fighter with Lysenkoism, the founder and the director of two major genetic institutes, – Nikolai Dubinin (1907–1998). The paper is devoted to the less studied and most interesting stage of N. Dubinin's biography – his contribution to the overcoming of Lysenkoism and his role in the foundation and development of the Institute of General Genetics of the USSR Academy of Sciences. As is known, in the period of reorganization of the Soviet biology (since the middle of the 1960s), N. Dubinin was in the forefront of the revival of genetics. However, many of N. Dubinin's contemporaries strongly criticized him primarily for his activity in that period. For example, in the 1970s – first half of the 1980s, he had a resonant conflict with another well-known Soviet geneticist Dmitry Belyaev. According to some authors, N. Dubinin's position on the human genetics hindered research in this field. Besides, N. Dubinin could not consolidate the staff of the Institute of General Genetics founded as the main research center of genetics. However, it did not achieve the "required" level of research because of N. Dubinin's conflicts with his colleagues. A significant milestone in his life was the memories "Vechnoe dvizhenie" ["Eternal Movement"] (1973), which provided a conception of the history of Soviet genetics acceptable for the Soviet authorities. At the same time, the main part of the genetic community condemned his book. Thus, despite of N. Dubinin's contribution to science and uncompromising struggle with Lysenkoism in 1930s–1950s, his activity in the following decades was contradictory and needs a special historical research. Acknowledgments: The research project has been supported by the Russian Foundation for Humanities, grant no. 15–33-01225.

Keywords: genetics, the history of genetics, Lysenkoism, Dubinin, the Soviet Union

Genetic engineering as a promise of power? (ID 87)

Jérôme Pierrel *(University of Bordeaux, Bordeaux, France)*

In the early 1970s, genetic engineering reaped the fruits of twenty years of basic research in molecular biology. The knowledge of the genetic code, combined with emerging nucleic acids sequencing techniques and, last but not least, restriction enzymes, allowed scientists to design a whole new set of experiments and applications. News drugs, mostly recombinant proteins, as well as, as some feared, new weapons could now be designed in the laboratories. Many scientists were concerned by the biological hazards of this new technique and first, asked for voluntarily deferring several types of experiments in 1974, then gathered the famous Asilomar Symposium in 1975. This event is well-known as a concrete instance of precautionary principle applied by insiders of the field. However, perhaps because of this focus on the biological hazards, promises of genetic engineering have been less studied either from a quantitative point of view, or from a qualitative one. This study aims at assessing these promises. We first have to investigate how genetic engineering techniques entered molecular biology journals, both in USSR and the western world. How many papers were affected? What was expected by scientists from this new technique? Can one notice differences between journals and scientific fields in respect to these promises?

Keywords: genetic engineering, molecular biology, DNA, proteins, restriction enzymes, GMO

Symposium 70: Pugwash and the communism question: Perceptions and Realities

Organizers: ***Alison Kraft*** *(University of Nottingham, Nottingham, UK),* ***Geoffrey Roberts*** *(University College Cork Ireland, Cork, Ireland)*
Chair: ***Alison Kraft*** *(University of Nottingham, Nottingham, UK)*

Into the present the Pugwash Conferences on Science and World Affairs ('Pugwash'; founded in 1955/57) are based on the idea that the language of science would be the ideal medium to overcome political antagonisms. Arising from the Russell-Einstein Manifesto of July 1955, Pugwash sought to bring together scientists from across the east-west divide, and from the non-aligned countries, to confront the dangers of nuclear weapons. Seeking to become a 'strong force for peace', its stated aims were: to influence governments, to form a channel of communication between scientists, and to educate public opinion. By the 1960s, it was serving as an unofficial 'back channel' for east-west communication and valued as a site for 'second track' diplomacy. However, from the outset, Pugwash was perceived by governments in the west as a 'communist front', while Eastern governments, especially Moscow, saw in Pugwash opportunities to further their claims to leadership in the Cold War choreography of peace initiatives. This panel seeks to consider the different and shifting components of Western perceptions of Pugwash as communism's fifth column, to examine how and why this view came about, and to explore its consequences for the development of Pugwash in different national settings. To what extent can the charges of communist leanings and sympathies levelled at Pugwash be seen as anti-communist propaganda? Alternatively, the reality that many senior figures involved in creating and leading Pugwash had connections to leftist and communist organizations, begs questions about the extent and nature of its political character, salience and agenda. Was there any basis for the criticisms of Pugwash as another strategy of communist infiltration? Surviving beyond difficult and tentative beginnings, Pugwash forged a novel role as a channel of communication between east and west during the Cold War. By the mid-1960s it had become a nodal point in second track diplomacy as well as in transnational networks of scientists, each of whom stood in different relation to political power in very different national settings. As such, Pugwash affords a rich site in which to explore the experience of scientists operating at the interface between science and politics, and for analysing the problems of science and power, and science as power.

Keywords: Pugwash, nuclear weapons, Cold War, transnational networks, communism, Bertrand Russell, Joseph Rotblat

Simple Scholars or State Agents?: Scientists and Chinese Relations with the Pugwash Conferences, 1960–1985 (ID 98)

Gordon Barrett *(University of Bristol, Bristol, UK)*

Mao-era Chinese foreign policymakers were never fully sold on the Pugwash Conferences on Science and World Affairs. Theoretical physicist Zhou Peiyuan had their blessing to attend four conferences between 1957 and 1960, but for the following twenty-five years policymakers in Beijing articulated official positions on Pugwash ranging from ambivalence to outright hostility. This shift emerged out of discussions between science and foreign affairs officials, focusing on the issue question of weighing the effectiveness of participation in Pugwash as a means to increase the reputation and widen the influence of the People's Republic of China. After abandoning the conferences, Chinese scientists' international activities instead centred on alternative forums for reaching out to foreign activist scientists, such as through participation in the World Federation of Scientific Workers.

Nevertheless, this was far from the end of Chinese relations with Pugwash. Through their other international activities, PRC-based scientists continued to maintain contact with foreign scientists still involved in the conferences. Pugwash networks proved remarkably durable in the intervening years,

resulting in China's formal reengagement with the conferences by 1985. This paper deconstructs the underlying factors for this trajectory of relations, situating Chinese scientists as actors in both structures of power, both domestic and international. Chinese Communist Party officials sought to use these scientists as proxies and propagandists to recruit 'foreign friends' and conduct international 'united front' work in order to circumvent the country's diplomatic isolation and improve its international position. In doing so, these officials empowered a small cohort of prominent, foreign-trained, and cosmopolitan scientists to act as high-level interlocutors linking the PRC's political elite with transnational epistemic communities. Through examining the Chinese case, this paper therefore also situates the Pugwash Conferences within this wider context of organisations and networks involving activist scientists from across the Cold War blocs.

Keywords: transnational networks, propaganda, state-scientist relations, Pugwash Conferences on Science and World Affairs, World Federation of Scientific Workers, People's Republic of China, Cold War

East-European Scientists for Peace: Scientists and mass media campaign for peace (ID 81)

Doubravka Olšáková *(Academy of Sciences of the Czech Republic, Prague, Czech Republic),* ***Michaela Kůželová*** *(Academy of Sciences of the Czech Republic, Prague, Czech Republic)*

The Soviet Union and the countries of the Eastern bloc saw their fight against non-Communist countries as a "struggle for peace" and consequently appropriated notions of themselves as being "fighters for peace," which became an integral part of their Cold War rhetoric until 1989. At an international level, the new regime's ideological ambitions were promoted by the Cominform and resulted in the creation of the World Peace Council. The organisation was born in Poland as a child of the Cominform. The idea took hold at a September 1947 meeting in Szklarska Poreba. The creation of the WPC was a result of an expansive international policy of the Cominform. During the 1950s, the WPC gained wide support all across Europe. More than 273,000,000 persons signed the Stockholm Appeal initiated by Frédéric Joliot-Curieand realised by the WPCl in March 1950. An important element that later contributed to the decline of the WPC was also the fact that the WPC and its leaders acting under the supervision of the Soviet Union did not sufficiently appreciate the threat their movement faced in 1955 when the Pugwash movement was born. Some communist countries even went on to promote the Pugwash initiative and disseminated information about it through their mass media. For example Czechoslovak Communist leaders found it necessary to present the Pugwash movement to the citizens and to explain it in more detail, and that is where the mass media played a crucial role. And yet, though it may seem that the origins of the Pugwash movement are well-known and there is no space there for any alternative interpretation, the Czechoslovak media managed just that. The official history of the Pugwash movement significantly differs from its history as it was presented in Czechoslovakia. So for example, in 1964 an article linked the origins of the Pugwash movement mainly with Professor Joliot-Curie, who was better known to the Czechoslovak society than other founders. Also in other texts, and they are not few in number, Frédéric Joliot-Curie is referred to as the main initiator and founder of the movement, and only later there appears some remark on Bertrand Russell's and Albert Einstein's contribution. In Poland, on the other hand, one would look for any note of Joliot-Curie's role in vain; there, credit was given mainly to Bertrand Russell. This shift in perception reflected the confusing situation and the inability of the mass media and people to distinguish between the two types of movement. The existing Soviet monopoly over the peace ideology led to the – erroneous – perception that the Pugwash movement joined the WPC. The proposed paper traces the various modifications of their (self)presentationin mass media and focuses on the role of East European scientists in the peace movement(s) and the extent to which they shaped its structure and character during the 1960s. Not only the leafing figures of international science but even 'local' representatives of East European states were presented as 'ambassadors of peace and science', thus becoming an important part of the communist campaign.

Keywords: Pugwash, World Peace Council, Peace Movement, Communism, Cold War, Eastern Europe, USSR, Czechoslovakia, Poland

Frédéric Joliot-Curie, the Struggle for Peace and the Pugwash Movement (ID 92)

Geoffrey Roberts *(University College Cork, Cork, Ireland)*

The communist-led peace movement of the 1 940s and 1950s was an important bridge to the Pugwash movement. The peace movement's campaigns for nuclear disarmament and arms control helped bring together Soviet and Western scientists. A key figure was Frédéric Joliot-Curie, a renowned scientist and scientific administrator, who was President of the World Peace Council. Joliot-Curie promoted the independence of the peace movement from Moscow and warned of an existential nuclear threat to humanity that demanded common action across the cold war divide. In July 1955 Joliot-Curie signed the Russell-Einstein manifesto and it was his lobbying for an international conference of scientists to discuss the nuclear danger that eventually led to the first Pugwash meetings.

Often depicted as a Soviet stooge, Joliot-Curie was, in fact, quite an independent figure, more intent on lobbying the Soviets on peace and disarmament issues than subverting western capitalism. For Frederic Joliot-Curie the dialogue and collaboration among scientists that became the Pugwash movement was far more than a mere propaganda exercise: it was essential step towards averting nuclear armageddon.

Based primarily on Russian archives, this paper will explore the paradox of a pro-Soviet peace movement led by a prominent communist scientist that struggled to loosen his ties to Moscow and to engage with independent initiatives like Pugwash, a movement that sought to transcend the cold war and to create an anti-nuclear infrastructure of scientist activists who would facilitate nuclear disarmament and arms control.

Keywords: Frédéric Joliot-Curie, Pugwash movement, communist peace movement, anti-nuclear campaiging in the 1940s and 1950s

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American Scientists in "Communist Conclaves": Pugwash and Anticommunism in the United States (ID 106)

Paul Rubinson *(Bridgewater State University, Bridgewater, USA)*

In the United States, the Red Scare of the early 1950s muted opposition to nuclear weapons. But during the late 1950s, fears of nuclear fallout reignited antinuclear opinion. Amid this revival, Pugwash occupied an important niche, linking antinuclear scientists with government policymakers. This influence allowed Pugwash to play a tremendous role in bringing scientific expertise to bear on the problem of nuclear tests.

But although the Red Scare had ended, anticommunist politicians continued to use Red Scare tactics to smear scientists as communists and stifle efforts at arms control. Most notably, in 1960 Senator Thomas Dodd issued a report that denounced the Pugwash conferences as "communist conclaves" and U.S. Pugwash scientists as unwitting dupes of the Soviets. Dodd's report surprisingly had little immediate effect. As the Kennedy administration entered office in 1961, Pugwash played an even more active role and worked to help bring about the 1963 Limited Nuclear Test Ban Treaty.

But just as quickly, Pugwash fell from favor when Lyndon Johnson became president. Johnson notoriously feared domestic anticommunism and criticism from Senator Dodd, and quickly cut off connections between scientists and the government with the result that Pugwash increasingly struggled to influence U.S. policy.

Having marginalized Pugwash in the United States, government officials even encouraged their British counterparts to do the same. This hostility from western governments weakened Pugwash at a time

when the group's existence was already tenuous. The U.S. government's efforts to distance itself from Pugwash was never about actual communist influence among scientists, but rather reflected a desire to silence opponents of the arms race. This analysis of U.S. Pugwash shows how scientists maneuvered in the power dynamic between science and the state, as well as the suppression of dissent in an ostensibly democratic nation.

Sustained Ambivalence: The Max Planck Society and Pugwash 1955–1989 (ID 101)

Carola Sachse *(University of Vienna, Vienna, Austria)*

When the Federation of German Scientists (VDW) was founded as the West German section of the Pugwash Conferences on Science and World Affairs (Pugwash) in the late 1950s, several high-profile scientists from the Max Planck Society (MPS), especially nuclear physicists, were involved. Well into the 1980s, institutional links existed between the MPS, the Federal Republic's most distinguished scientific research institution, and Pugwash, the transnational peace activist network that was set up in 1957 in the eponymous Nova Scotia village following the Russell-Einstein Manifesto presented two years before. In the beginning, the two organisations' relationship was maintained primarily by the physicist and philosopher Carl Friedrich von Weizsäcker. However, it was difficult right from the start, and the distance between them grew during the rise of détente in the 1970s, when the scientific flagship MPS was deployed more and more frequently in matters of foreign cultural policy, not only for the Federal Republic of Germany but for the western alliance as a whole. This contribution explores the resources and the risks of transnational political engagement – not only as the individual strategies of top-ranking researchers, but also in terms of policy deliberations within a leading scientific organization at one of the Cold War's sharpest divisions: the front line between two Germanys.

Keywords: Max Planck Society, Pugwash, Carl Friedrich von Weizsaecker, cultural diplomacy, Cold War, social responsibility, peace activism

Symposium 72: The Big Brother Role Model? Soviet and American impulses for Central and Eastern European academic systems, 1945–1989

Organizers: ***Martin Franc*** *(Masaryk Institute and the Archives of the ASCR, Prague, Czech Republic),* ***Johannes Feichtinger*** *(Austrian Academy of Sciences, Vienna, Austria),* ***Jakub Jareš*** *(Charles University, Prague, Czech Republic)*
Commentators: ***Johannes Feichtinger*** *(Austrian Academy of Sciences, Vienna, Austria),* ***Jakub Jareš*** *(Charles University, Prague, Czech Republic)*

In the 19th century and at the beginning of the 20th century, Europe, and in particular Germany, became the cradle of influential scientific system models, which were spreading worldwide, also to Russia and the United States of America. The end of the Second World War and the profound changes in the social and economic structures in many countries led to principal changes in the prevailing scientific and educational system in Central and Eastern European countries and the situation reversed in many respects. The influence of two great powers, whose importance had rapidly grown during the conflict, played a key role in the emergence of new mechanisms and institutions: Most countries in Eastern and Central Europe found themselves in the sphere of hegemonic influence of the Soviet Union; Austria and Germany also massively adopted impulses from the USA, supported by the administration in the US sectors of these countries. In the second half of the 20th century the so-called Eastern Bloc was dominated by the Soviet model of organizing and managing science, with a central academy of sciences playing a representative role as a coordinator of its own basic research sites. However, the degree of adoption of the Soviet model, in some ways inspired by the aforementioned German and Austrian traditions of the 19th century and the beginning of the 20th century, differed in the individual countries and periods. Even Central European countries which were outside the hegemonic influence of the Soviet Union reflected on the Soviet? models of science management and institutionalization.

The symposium investigates (1) to what extent this situation marked, in both cases, the return of the original German models complemented with additional elements and (2) to what extent this concerned the building of entirely new traditions. In this context it analyses the establishment of the so-called Soviet model in the interwar period. Major questions are: How did the mechanisms of the Soviet influence on the establishment of the scientific system differ from the mechanisms of enforcement of American models; and vice versa, what are the parallels there? Did the Soviet and American scientific policies also influence each other in Central and Eastern Europe? Where did the impact by any of the imported models show the most and where did local traditions play the most important role? To what extent did the adoption of foreign impulses result in an actual transformation of the local system, and when did it only add a political "touch" without any actual impact on the key mechanisms of scientific management and institutionalization? What were the dynamics of acceptance of stimuli from the USA and the Soviet Union in the region between 1945 and 1989? Was the openness to incentives from the "other side of the Iron Curtain" growing or were, conversely, the Central and Eastern European scientific systems fixed in the shape they had taken just after the war and during the 1950s?

Keywords: scientific system models, educational system, Soviet and American influence, Academy of Sciences, Eastern Bloc, Central Europe, 20th century

Czechoslovak Academy of Sciences and accepting Soviet experiences and models 1956–1968 (ID 141)

Martin Franc *(Masaryk Institute and the Archives of the ASCR, Prague, Czech Republic)*

The paper analyses transformations in the mechanisms of adoption of Soviet experience and models by the Czechoslovak Academy of Sciences between 1956 and 1968, an era when the attitude of Eastern Europe toward Sovietization was clearly changing. The development if the forms and mechanisms of Sovietization is illustrated primarily in two key areas of science – chemistry and biology. There was a huge wave of Sovietization in Czechoslovakia virtually in all areas of social life at the end of the 1940s and in the early 1950s. It had a significant impact on the overall system of sciences and its institutions. Its core components included establishment of the Czechoslovak Academy of Sciences (CSAS) according to the Soviet model, i.e. as an institution combining a representative function with the role of coordinator of an extensive network of its own scientific sites. After the death of JV Stalin, and especially after the 20th Congress of the Communist Party of the Soviet Union, where the crimes of Stalinism were partly disclosed, however, the original enthusiasm for adopting all the Soviet experience noticeably faded and made way to rather differentiated approaches. Even some leading representatives of the CSAS started opening up for ideas coming from other models, including Western European. On the other hand, however, staunch supporters of the adoption of all elements of Soviet science and its institutional models still played a major role in the leadership of the CSAS. In many cases this resulted in quick and drastic changes of opinion in connection with the development of attitudes taken by the Soviet leadership. The influence of the Soviet Union remained crucial virtually until 1962, when Zdeněk Nejedlý, the then President of the CSAS and big supporter or Sovietization, died. His successor, the chemist František Šorm, was one of those scientists who looked for new impulses in Western Europe and the USA to a growing extent. Efforts to adopt the experience and models from the USSR more critically climaxed at the end of the 1960s, but they were brutally cut by the occupation of Czechoslovakia in August 1968 and the following political purges. After them, the hegemony of Soviet models was restored and any attempts at their weakening were considered as ideologically unacceptable.

Keywords: Czechoslovakia, Sovietization, Czechoslovak Academy of Sciences, 1950s and 1960s, Institution, Life Sciences, Chemistry

Sovietization of historical and archival sciences in Czechoslovakia in the first half of the 50s? Institutions and actors, discourses and codes, transfers and projections (ID 260)

Miroslav Kunštát *(Czech Academy of Sciences, Masaryk-Institute and Archives of CAS, Prague, Czech Republic)*

This paper is a brief attempt to apply the modified concept of "Sovietization" (including critical sketches of the career of this concept) to a particular complex of social sciences, i.e. the historical and archival sciences. In a review of existing research on the history of individual disciplines, institutions and personalities after 1945 will be formulated question of the usability of its results for the problem of Sovietization. The core of contribution should be the wording of some research questions that this research took into account only partially. These include the question of the influence of Soviet patterns for the transformation of the network of scientific institutions and their personnel background and for the gradual stabilization of normative Marxist-Leninist discourse in historiography, which is very different from non-dogmatic beginnings of Czech Marxist historiography in the pre-war period (Bohumír Šmeral, Kurt Konrad, Jan Slavík, Miloslav Volf, Záviš Kalandra, Václav Husa, Oldřich Říha et al.), but also opened some new perspectives for further research, eg. an emphasis on the history of industry, workers and the labor movement, generally referred to the "history from below" or "history of the urban and rural poor people" in the middle Ages in the concept of early František Graus. At the institutional level it will be distinguished between the general centralizing tendencies of the communist science policy (in the emergence of new central institutions, in the popularization of science, in the newly defined network

of State Archives) and the real Soviet models. The need to differentiate the only declared inspiration by Soviet patterns from the actual cultural transfer (though in this case the transfer with imperial features) is urgent in all disciplines, not only in those where the forced reception is obvious at first glance, e.g. in biology and genetics (forced dominance of the theories J. T. Lysenko´s and O. Lepeshinskaya's). It seems that in the case of "canonical" works of Soviet historiography of this period there was only a formal, rather declaratory reception, which was part of the initial stabilization of historiographical discourse. There does not alter the fact that some of the works of Soviet historians were published in this time in mass editions (e.g. Ivan I. Udaltsov, Yevgeny V. Tarle et al.). The fundamental redefinition of national historical master-narrative, that thanks to Zdeněk Nejedlý and Josef Macek was based on the original Czech sources in the Marxist rectified spirit (Palacký's concept of the history of the Czech nation), did not occurred in the early period of the Communist government. Rather we can talk about loud "projection" of Soviet models, less actual "reception" or "transfer". This lacked real experience of cooperation with the Soviet historical science, which was limited to rare internships Soviet experts, the exchange of official delegations or relatively infrequent conference contacts.

Keywords: Sovietization in Czechoslovakia, Historical and archival sciences, institutions and actors, discourses and codes, transfers and projections

Scientific state institutes and their transformation in 1948–1953 (ID 96)

Adéla Jůnová Macková *(Masaryk Institute and the Archives of the ASCR, Prague, Czech Republic)*

State institutes started emerging shortly after the establishment of the first Czechoslovak Republic (1918) in the form of institutions affiliated to the Ministry of Schools and National Education (with influence of the Ministry of Foreign Affairs and the Ministry of Trade). They were independent scientific institutions receiving regular state subsidies and their scientific focus and budgets were approved by the state. The Institute of Archaeology and the National Institute for Folk Songs were founded in 1919, the Institute of History in 1921, while the Institute of Oriental Studies and the Institute of Slavic Studies were planned to be established under the law as early as in 1922, even though they were actually set up a few years later, in 1928; we can already observe their activities in the 1920s. The paper aims to show in particular the organizational transformation of these institutions (as an example I chose mainly the National Institute for Folk Songs and the Institute of Oriental Studies) from 1948 until 1952 or 1953, when they "voluntarily" became part of the Czechoslovak Academy of Sciences, using the incorporation of state institutes into the Academy of Sciences to give a clearer picture of the centralization of sciences in the 1950s, arranged according to the Soviet model.

Keywords: state institutes, Czechoslovak Academy of Sciences, 1948–1952, National Institute for Folk Songs, Institute of Oriental Studies, centralization of sciences

Academies of Sciences in Central Europe during the Cold War. Towards a comparison of transformation processes in different political systems (ID 76)

Johannes Feichtinger *(Austrian Academy of Sciences, Vienna, Austria),* ***Heidemarie Uhl*** *(Austrian Academy of Sciences, Vienna, Austria)*

Academies of Sciences in Central Europe during the Cold War. Towards a comparison of transformation processes in different political systems (working title)

Johannes Feichtinger, Heidemarie Uhl (Austrian Academy of Sciences, Vienna)

Our contribution aims at a comparative approach towards the question of how central European Academies of Sciences acted within the context of the East-West conflict and its rivaling systems – discussed

by means of selected examples (e.g. Austria, Germany, Hungary, Slovak Republic, Slovenia, Poland). We will focus especially on the processes of transformation during the early phase of the Cold War in which the Academy's scopes of action were re-negotiated and new organizational structures were implemented in between the conflicting poles of autonomy and political intervention. These processes of transformation in the Academies of Sciences are to be comparatively investigated in the selected examples regarding the following three issues:

1. institutional changes on both sides of the "Iron Curtain" or beyond it, and the development of new organizational structures such as the conjunction of learned society and research institutions ("Soviet model")
2. composition of the personnel (continuities and/or replacement of elites), and
3. strategic orientation of scientific fields and the consequences of the rivaling of systems for the Academies' characteristic traditions of communication and cooperation (e.g. scholar exchange)

Keywords: Academies of Sciences, Central Europe, Cold War

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Post-War Reform of Higher Education in Czechoslovakia, 1945–1950: Origins, Implementation, and Legacy (ID 132)

Jakub Jareš *(Institute of the History of Charles University and Archive of Charles University, Prague, Czech Republic)*

In Czechoslovakia, much like in other countries of the Euro-Atlantic region in the immediately post-war era, academic institutions, politicians, and broader public tried to find a way of reforming universities and other institutes of higher education so as to meet the demands of changed social and political conditions.

These discussions were in a sense a continuation of debates which started already between the two world wars and, in a broader perspective, their origin can be traced all the way to the beginning of the 19th century. They focused on issues such as whether and to what extent universities should be autonomous or under state control, whether they should function as centres of science and research or focus on preparing students for future careers, and what proportion of population should be given access to university education. In the form of discussions about a Humboldtian, French, or American model, these discussions are still ongoing.

In the 1930s, Czechoslovak government's attempts to reform higher education met with strong opposition from universities. In 1939, the Nazi authorities ordered Czech universities closed. They reopened only in May 1945, with the result that in the first post-war years, universities had to deal with unprecedented numbers of students. The government thus focused on dealing with this issue and established new universities in provincial towns. Aside from that, a lively public discussion went on in 1945–1948 about a future reform of higher education, which drew among other things on reform proposals prepared during war either in the Protectorate or in exile. A new element in these discussions was the amount of attention paid to the Soviet model of higher education.

In 1945, university administration and studies in Czechoslovakia were still regulated by old Austro-Hungarian legislation. The main aim of the reform was thus to replace the old legislation with a new Universities Act. The Ministry of Education prepared the first proposal in February 1948, but a Communist takeover prevented any discussion of its adoption. Thereafter, Communists in the government and at universities started working on their own reform plans. The first result was a change in the curricula. In 1950, that was followed by the adoption of a new Universities Act, which did not quite

end all good research and education, but brought higher education under state control, applied political controls, brought academic research under a State Plan of Research, and limited freedom in teaching and study according to ideas strongly influenced by Soviet models.

This contribution analyses the post-war reform of Czechoslovak higher education within the broader context outlined above, maps its roots all the way from the beginning of modern higher education in early 19th century, looks at the turning points in the development of higher education in the Habsburg Empire, investigates the influence of Soviet models, and reviews Czechoslovak discussions about a reform of higher education from the interwar period until the 1950s. The author's main aim is to present the Communist reform, however politically skewed it was, as part of modernisation of higher education.

Keywords: university reform, Czechoslovakia, Humboldt, Soviet model, Universities Act

Science societies and the soviet power during the 1920s (ID 73)

Elena Sinelnikova *(St. Petersburg Branch Institute for the History of Science and Technology, St. Petersburg, Russian Federation)*

Science societies always play a very important role in the organization of science. During the 1920s a new model of relations between the Soviet regime and science was formed. The relationship between political power and science societies was especially tense and contradictory in this period and went through several stages.

The first stage (1921–1925) was characterized by the adjustment of relations between science societies and Soviet power, as science societies sought to continue working under the Soviet regime. The Soviet government provided material and financial support to those associations that it found expedient. By the mid-1920s a crisis in the relations between the authorities and science societies appeared. Government supervision of the scientific and economic activities of science societies increased. Societies had to be accountable at the same time to the Commissariat of Internal Affairs (NKVD), Glavnauka and to the agencies of financial control. Some science societies were transformed into "state" societies in 1925. As a result they completely lost their independence.

During the second stage (1926–1930) government control over all aspects of life and activities of science societies became pervasive. The increasing regulation of the activities of societies, as well as the detailed and voluminous reporting, caused dissatisfaction among scientists, who had to constantly respond to inquiries about personnel and to provide detailed personal information for every member of the organization. The Soviet government was primarily interested in the social origin of the members of science societies and in the presence in their membership of Communist Party members.

In addition, the minutes of general meetings and of meetings of the executive board, budgets, financial reports, work plans, quarterly and annual reports on the activities according to a particular form, and so on, had to be regularly sent to a number of regulatory authorities. Moreover, in the great turning point for the country beginning in 1929–1930, the authorities repeatedly conducted investigations of science societies.

As a result, in the late 1920s regulatory documents were adopted, according to which science societies were to be converted into mass organizations that were obliged to accept a large number of workers and peasants as members, thereby leading to the elimination of any remnants of their independence.

During the 1920s the relations between the Soviet regime and science societies were strained. In the late 1920s and early 1930s science societies lost their independence and were transformed into mass organizations.

Keywords: the soviet power, science societies, government control, NKVD, Glavnauka, model, stages, organization of science

Associations in Times of Political Turmoil: Science Societies and the Bolshevik Regime, 1917–1921 (ID 117)

Joseph Bradley *(University of Tulsa, Tulsa, Oklahoma, USA)*

Much of the literature on European associations focuses on their appearance in the eighteenth and nineteenth centuries and on the factors that facilitated or inhibited their growth. Scholars have examined the connection between associational culture and political liberalism and have speculated whether civil associations are a cause or a consequence of the development of civil society. More recently, the idea of associational culture leading to open, pluralistic and liberal societies has been questioned; Nancy Rosenblum, Jason Kaufman, and other scholars have shown that illiberal associations can exist in democratic politics.

However, scholars have given much less attention to the demise of civil associations and to the factors that made their existence difficult or impossible. Our understanding of the link between associational culture and political regime may be enhanced by an examination of the fate of associations under conditions of political turmoil. This paper will examine the fate of independent science societies in Russia under conditions of war and revolution in the years 1917 to 1921. Although Russia before 1917 certainly did not possess a liberal political regime or a democratic society, an associational culture was growing rapidly. The paper will focus on a handful of prominent, so-called "bourgeois" associations that, after a brief "springtime" following the overthrow of the monarchy, struggled to cope politically with the Bolshevik regime and materially with the dislocations and deprivations of the civil war. How did associations that existed under one political regime cope when that regime was overthrown and replaced by a new regime with different political goals and organizational models? Through the efforts of these associations to chart a course of existence and action under the new regime, we can see from a different angle the connection between political regime, economic structures, and associational culture. By analyzing the factors that stifled the growth of civil associations, we may understand better the factors necessary for their vitality.

By telling the story of the resistance and accommodation of Russia's most famous pre-revolutionary science societies, the paper will also offer a preliminary inquiry into the "life cycle" of the European learned society. The science societies of imperial Russia imitated a particular model of associations whose origins go back to Great Britain and France of the eighteenth century, when free and independent learned societies, sociétés libres, vied with academies and universities to become decentralized sites for the creation and dissemination of knowledge. However, by the beginning of the twentieth century, the age of the independent learned society was beginning to pass from the scene, as the creation of knowledge was more and more becoming R & D at universities and specialized institutes linked to the agencies of centralized states. The learned society competed with new bureaucratic and professional organizational models. In this context, the fate of associations under the Bolshevik regime is more than a story of change of government and ideology. It is also the story of changing institutional strategies for the pursuit and dissemination of natural knowledge.

Keywords: science societies, the Bolshevik regime, associations, Russia, revolution, the civil war

The Influence of the Soviet model of science policy and its abandonment in Slovenia (ID 274)

Aleš Gabrič *(Inštitut za novejšo zgodovino / Institute of Contemporary History, Ljubljana, Slovenia)*

In Yugoslavia (and Slovenia as part of it) communist party in 1945 already controlled the levers of power and turned science in the direction of imitation Soviet science policy. The presidents of the three academies of science, Serbian, Croatian and Slovenian, have been sent in the summer of 1945 the Soviet Union to become familiar with their organization of scientific sphere. Most of the cultural and scientific institutions were nationalized and the majority of the budget, devoted to science have received those of the engineering sciences. The privilege for the technical science was reflected in the

investment plans for the institutes, which were made by government authorities without the participation of scientists. The country has set itself the role of the sole patron of science, and thus got into the hands of all the levers of control over the program policy of the scientific institutions.

Change of the science-policy occurred after a dispute between Yugoslavia and the Soviet Union, when Yugoslavia started to open to Western influence and from there import the scientific literature, what was almost impossible from the beginning of the 2nd World War in Yugoslavia. Engineering sciences have begun to lose privileged position, which they had before. But the criteria for the sharing of science intended appropriations still remained unclear.

The change in science policy occurred in the middle of the fifties. In 1953 it was established Boris Kidrič Fund, Slovenian state fund for financing research and development activities in Slovenia. In 1954 Fund for the first time divided the assets Slovenian scientific institutions in a more transparent manner. In the following years were established special Slovenian authorities for scientific work. In July 1957 it was adopted a federal law on the organization of scientific work, in January 1958 Slovenian law on scientific institutions. The state apparatus has otherwise maintained control over the planning of scientific work, but science policy and financing of institutes took place under increasingly transparent samples. From the mid-fifties we can already follow a precise indication of the state funding of science, as for prior periods is not possible.

Keywords: Yugoslavia/Slovenia after 1945, copying Soviet science policy, financing of scientific institutions, privileges for the technical science, change of science policy after Yugoslav-Soviet dispute, law on scientific institutions

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American inspirations for socialist science. Unsuccessful proposals for better effectiveness of the Slovak Academy of Sciences (1968–1989) (ID 190)

Adam Hudek *(Slovak Academy of Sciences, Bratislava, Slovakia)*

The proposed paper focuses on attempts and plans to achieve a better work effectiveness at the Slovak Academy of Sciences during the last 20 years of the Czechoslovak communist regime. The Slovak Academy is used here as an example of the central research institution established to promote the socialist science. The paper compares reform efforts during three different situations: the liberalization era of the Prague Spring, the subsequent "Normalization" and years of the "Perestroika". In all three periods, specific proposals for the new politics of science were introduced. All of them strongly accentuated the importance of effectiveness in the modern science and research. To achieve it, the authors of these proposals always, although for different reasons, also reflected the Anglo-Saxon management of science. In the "bottom-up" reform attempts of the late 1960s, the inspiration by Western models was seen as a way how socialist science can become a part of the globalized scientific network after

twenty years of forced isolation and ideological deformations. The "top down" visions of the real socialism technocrats used American inspirations to define a politics of science able to compete with the western development through the international scientific cooperation of the Eastern Bloc. During the late 1980s, the pragmatics at the Academy saw the Anglo-Saxon model of science management not only as a way to overcome the stagnation, but also to make the socialist science able to create instant financial profit. The analysis deals with the strategies used to justify the Western inspirations ideologically, either through sheer pragmatism or by referring to the politics of science in other communist countries. The conclusion deals with the question why (Czech)Slovak attempts to adopt certain "effectiveness supporting" aspects of American organization of science and research failed or were implemented only formally.

Keywords: Slovak Academy of Sciences, politics of science, science management, effectiveness, socialist science

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Symposium 78: Anti-authoritarianism in natural philosophy: radicalism and folk intuitions

Organizers: ***Charles Wolfe*** *(Ghent University, Gent, Belgium),* ***Enrico Pasini*** *(University of Turin, Turin, Italy)*
Chair: ***Anne-Lise Rey*** *(Université de Lille 1, Lille, France)*

We are familiar with the figure of the scientist or natural philosopher as a solitary seeker for truth, grinding lenses and rejecting the invitations of learned Academies (Garber 1998). Equally well-known as an Enlightenment persona is the scientist 'in the service of the nation/kingdom' (Koerner 1999), including in the sense of Bacon's hope to extend the "power and empire of the human race itself over the universe of things," to enlarge "the bounds of human empire, the effecting of all things possible" (*Novum Organum* and *New Atlantis*, respectively, in Bacon 1996). But how do these reassuring figures sit with the popularity of the Radical Enlightenment ethos, in the sense of Jonathan Israel's much-discussed idea (Israel 2001)? That is, should we add to this gallery of portraits of the early modern scientist, the anti-authoritarian scientist or, to modify an Althusserian expression, the "spontaneous scientist" (e.g. the materialist)? There is an uneasy 'folk intuition' which equates intellectual and political radicalism, for instance in the context of the Enlightenment, but there are clear counter-examples to this: La Mettrie was a radical materialist but politically an elitist and a cynical determinist in terms of social theory (Wolfe 2013); Rousseau, a direct influence on the French Revolution, was a strident anti-materialist. In this panel we examine some cases of science-power relations under the rubric of 'Natural Philosophy and Anti-Authoritarianism' to further evaluate this common intuition. Enrico Pasini examines the case of geology, in which a scientific project has direct anti-authoritarian consequences; Vera Szanto examines the case of Margaret Cavendish, who is both an opponent of the Experimental Philosophy of the Royal Society and politically an authoritarian – except she has a vitalist metaphysics which is often read in radical-democratic terms (Rogers 1996). Charles Wolfe discusses cases of early-modern free-thinkers (a.k.a. *libertins érudits*) who use scientific (including social-scientific) input, less to create a stable, cumulative body of knowledge than in order to destabilize forms of existing knowledge. Here the common intuition of an anti-authoritarian force of science is restored, except in a fictitious form involving travel narratives, false proclamations of the Spinozism of Confucian China (as in Henri de Boulainvilliers) and projects for sending orangutans to school (as in La Mettrie) (Benítez 1996).

Keywords: anti-authoritarianism, geology, vitalism, materialism, Cavendish, free-thinking

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History of the earth as a laboratory of revolutions and a critical discipline (ID 403)

Enrico Pasini *(University of Turin, IT, Turin, Italy)*

With the exception of the astronomical and cosmological debates of the 16th and 17th centuries, Geology is the scientific discipline that, in early modern and modern European history, seems to be most entangled with politics and authority. Born as the "history of the earth", a label under which a vision of an abysmally long time past was inaugurated in natural science, it developed contemporarily to the birth of the philosophy of history and of materialist theories of the origins of life. It is the field in which (pace Reinhard Koselleck) for the first time the meaning of "revolution" changed from circularity to linearity, and the one in which some of the most anti-authoritarian stances of the 18th century were held. Historiography has mainly considered, and independently, either the clash between "scientific" and "scriptural" tellings of the origins of the world (see for instance Paolo Rossi's, or M.J. Rudwick's works), or on the early 19th-century phase of this process and in particular on its connection with theories of the origins and development of life (see for instance Alan Desmond's famous "The Politics of Evolution"). A more continuist approach will be suggested and the Early-Modern history of Geology up to mid-19th century will be singled out as one of the most telling cases of the anti-authoritarian role of natural science both in itself and in the public debate, and of the social investment in a scientific discipline as a progressive political opportunity.

Keywords: History of Geology, Politics and Geology, History of the Earth, Anti-authoritarianism and Science

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"A General Agreement of All the Parts": Hierarchy and Organization in Margaret Cavendish's Philosophy (ID 397)

Veronika Szántó *(Institute of Philosophy, Budapest, Hungary)*

It has been argued that in early modernity the language describing modes of organization and action in natural philosophy inevitably had political connotations. A stronger, more substantive version of this claim attributes decentralizing, democratic implications to what is sometimes (although perhaps not entirely properly) called 'monistic vitalism,' epitomized in the seventeenth century by such diverse figures as, among others, John Milton, Gerrard Winstanley, James Harrington, Margaret Cavendish and Anne Conway. The most elaborate version of this thesis has been but forward by John Rogers in his book 'The Matter of Revolution.' In contrast to this interpretation, I try to show that the interrelationship between seventeenth-century natural philosophy and political discourse is much more subtle and complex, and sometimes shows an opposite pattern to what is suggested by the strong thesis. In my paper I focus on Margaret Cavendish who is often represented as a paradigmatic case of the "vitalistic" philosopher whose philosophy of agency and organization appears to be built on consensual transactions and arrangements, in sharp contrast with her "master" the arch-mechanist authoritarian Thomas Hobbes. Challenging this interpretation, I intend to show that although Cavendish's ideal of organization and action is indeed based on the mutual compliance and general agreement of the parts involved,

yet she is clearly aware of the inherent vulnerability of this scheme, which seems to be rescued only by an underlying inalterable natural hierarchy.

Keywords: vitalism, Margaret Cavendish, natural philosophy, political philosophy

Perverting the course of natural philosophy: free-thinking as deterritorialization in the early Radical Enlightenment (ID 79)

Charles Wolfe *(Ghent University, Ghent, Belgium)*

The early modern radical *savant* invents and appropriates fictions, but also chunks of experience, from Montaigne's cannibals, Cyrano's journey to the moon, Locke's talking parrot, to Diderot's utopian *Voyage de Bougainville*, in a kind of 'science fiction' or 'deterritorialization' of the narrative of the familiar, Eurocentric narrative of Western philosophy. The radical *savant* here is neither the solitary meditator, nor the participant in communal knowledge-gathering projects for national glory (Bacon, Linnaeus). He is less a producer of a stable, cumulative body of knowledge than a destabilizer of forms of existing knowledge, in which science plays an anti-authoritarian role but also a self-destructive one, not so much because *la revolution dévore ses enfants* as because the goal is destabilization (of social norms, of nationalism, etc.) rather than building scientific glory. One might see the common intuition of an anti-authoritarian force of science as confirmed here, except it is in a fictitious form involving travel narratives, false proclamations of the Spinozism of Confucian China (as in Henri de Boulainvilliers) and projects for sending orangutans to school (as in La Mettrie). In that sense it is not the project of natural philosophy itself which is demystifying or deflationary with regard to authority, but its appropriation by the free-thinker who lacks either institutional affiliation or membership in the 'brotherhood' of the learned. This, I argue, is the message of at least one significant cross-section of the Radical Enlightenment.

Keywords: radical Enlightenment, materialism, science fiction

Mastering the method of experimentation: Projects of natural history in the mid seventeenth century England (ID 445)

Oana Matei *(Vasile Goldiş Western University of Arad, Arad, Romania)*

My paper will discuss the reception of Bacon's experimental methodology in the mid seventeenth century. My focus will be a wide circle of correspondents spread all over Western Europe, namely the Hartlib Circle. In this paper, my aim will be to highlight the importance of the practice of experimentation for the members of the Hartlib Circle and to show that they have tried to organize their experimental pursuits according to a specific method. This paper will argue that a group of experimenters of the Circle (those whose efforts are concentrated around experiments with plants) took very seriously into account the task of experimentation, according attention not only to the goal of amelioration, but insisting on framing a proper method of experimentation. In doing so, they dealt with several sources and, among these sources, Bacon's works are closely followed and his advices put into practice. Also interesting is the manner in which the Hartlibians read several Baconian works. Although *Sylva sylvarum* was very popular in the Circle, other Baconian works received significant attention (such as *Novum organum* and *Descriptio globi intelectualis*). Attention has been given so far to the topic of cultivation in the Hartlib Circle (Law 1985; Leslie and Raylor 1992; Greengrass 1994; Greengrass 1998, Smyth 2004) and to the Baconian reception (Webster 1975, Trevor Roper 1999; Hunter 1981, 1986; Giglioni 2013; Jalobeanu 2015) but there is still work left to be done in respect to the used sources and to the Hartibians's quest for experimental method. The paper will look into how the Hartlibians used their experimental and methodological sources, claiming that, although Bacon's *Sylva sylvarum* offered them a handbook for experimental activities in the garden, when they needed structure in their

attempts for finding a method, they also assumed the Baconian language and methodological divisions expressed in theoretical works such as *Novum organum* and the appended *Parasceve*. I will exemplify this claim by presenting three cases: Ralph Austen's *Observations upon some part of S^r^ Francis Bacon's Naturall History* (1658), John Evelyn's gardening literature and his projects of compiling natural histories, and one anonymous and undated letter addressed to Hartlib.

Keywords: natural history, experiments, experimental method, the Hartlib Circle, Francis Bacon, Ralph Austen, John Evelyn

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Symposium 82: Pariah sciences. Episteme, Power and Legitimization of Knowledge, from Animal Electricity to Low-Energy Nuclear Reactions

Organizers: ***Jan Surman*** *(Herder Institute for Historical Research on East Central Europe – Institute of the Leibniz Association, Marburg, Germany),* ***Borbala Zsuzsanna Török*** *(University of Konstanz, Konstanz, Germany),* ***Friedrich Cain*** *(University of Konstanz, Konstanz, Germany)*
Chairs: ***Borbala Zsuzsanna Török*** *(University of Konstanz, Konstanz, Germany),* ***Friedrich Cain*** *(University of Konstanz, Konstanz, Germany)*

If history should be the history of winners, much is lost in the process of writing it. Our session aims at looking consciously at precise moments at which modern disciplines, research programs or scholars cross the threshold of legitimacy, one way or another. We intend to analyze via microstudies how science is made legitimate/illegitimate, who are the actors behind this process and which strategies have led to achieving the quality of crossing this strong discursive boundary. Cold fusion, 19th century natural law, astrology, Lyssenkoism, Soviet sociology, are known examples of how knowledge once regarded legitimate turned into "pariah science" (Goodstein 1994), the two latter fields also going the other way round. But the ways their stories are told differ greatly, ranging from references to obstacles presented to them by political power to failure to bring reliable results. We feel, however, that the canvas is more complex, and can be unwoven best through case studies, which will include cultural, religious, political and epistemic factors.

Regarding the political framework, our panel addresses not only absolutist, despotic, totalitarian and semi-totalitarian regimes, which, as recent studies have accentuated, allowed lot of individual freedom and thus manipulation, but also constitutional monarchies and liberal democracies where science has been a field closely interwoven with politics. Moreover, recent works in anthropology (Proctor/Schiebinger 2008) have focused on a field that spans between politics and scholarship on the one hand, and provable and not provable information on the other. In this highly politicized arena, notions of ambiguity become central to discourses transgressing science and politics. Indeed, the field of exclusion and delegitimization is a particularly tangled one: governments and (un-)enlightened despots used religious claims to legitimize the banning of politically unwanted knowledge, while the Church (re-)connected with politicians and political activists to achieve its epistemic aims (e.g. Roman Catholic Church in the anti-modernist struggle). Scholars often played a key role in these struggles helping to sustain their research programs by cutting off their competitors with the help of non-academic actors. Visualizing the strings and actors pulling them, will give, as we believe, a detailed and dynamic view of science as an endeavor involving manifold actors, not only those confined to academia.

Keywords: History of Science, Epistemic regimes, Pseudoscience, Norms, Legitimization, Academicisation/Institutionalisation, Disciplinisation, Boundaries of Science

Positivism, Psychology, Occultism: Julian Ochorowicz and his quest for scientification of the spiritualism (ID 83)

Jan Surman *(Leibniz Graduate School "History, Knowledge, Media in East Central Europe", Marburg, Germany)*

Julian Ochorowicz (1850–1917) belong to the first generation of psychologists who regarded this discipline as a scientific, positive endeavor. At the same time, he widely researched on medium, spiritualism and unconscious, following, however, strictly positivist attitude to these phenomena. In this he was neither alone not internationally a pariah – just in contrast, he was well linked internationally and his books were translated contributing to the new emerging discipline. His 1881 published Projet pour un congrès international de psychologie, is now regarded as founding piece of psychology's internationalization (Nicolas, Söderlund 2005).

In my talk I will concentrate on the strategies Ochorowicz implemented to gain support for legitimization of his research. While recognized internationally, his standing in Galicia and Russian Empire, where he mostly worked, was mediocre and he struggled to gain respectable position in the academic world. At the same time, as a scholar from the "periphery", he implied various strategies to be accepted in Paris. Variety of the projects he was involved in – including early radio research – did ironically hinder him in this respect, since it stood in tension with professionalization and academicization of psychology.

This simultaneity of this processes required a diligent argumentation skills and playing with the language of presentation. Ochorowicz had to learn to write different things for different publics, adapting rhetoric and scholarly vocabulary of the intended publics. In this sense, the question of pariah science is an issue of playing with norms of the prevalent scholarliness and molding one's own object of research into the normative mashes. Even if his quest for scientific spiritualism finally failed, it gives good insight into processes of disciplinization and professionalization of psychology around the fin de siècle, where objects of inquiry has been regulated, leaving to exclusion of many objects previously included into the psychologist interest vanish from the textbooks.

Keywords: Legitimization, Psychology, Occultism, Positivism, Epistemic regimes, Disciplinisation

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Science vs. superstition? William James, Leonora Piper, and the American psychological profession (ID 91)

Andreas Sommer *(University of Cambridge, Cambridge, UK)*

William James' preoccupation with the alleged occult phenomena of animal magnetism and spiritualism is well known but has attracted remarkably little systematic attention from historians of the human sciences. This paper reconstructs William James' discovery and investigations of the Boston trance medium, Leonora Piper, the reception of these and related studies by fellow psychologists in the US, and the demolition of the Piper case by Amy Tanner and G. Stanley Hall during the formation of psychology as a modern university discipline. Paying close attention to the methods employed by James and other elite psychical researchers in the investigation of the contested phenomena of spiritualism and related traditions, as well as competing theoretical interpretations of the case by psychical researchers, it will challenge the simplistic standard narrative about this episode as an example of the victory of scientific psychology over superstition and wishful thinking. It is argued that case studies of major boundary disputes concerning psychical research during the making of modern psychology offer rich opportunities to revisit ingrained habits of writing the more recent history of science and the occult, and to gain a more qualified and nuanced understanding of epistemological and metaphysical positions, sentiments and worries that have determined the limits of permissible scientific enquiry.

Keywords: Discipline formation, Demarcation, Psychology, Psychical research, Historiography

Quantum Narratives of Omission: The Demarcation of the Pilot Wave Theory (ID 140)

Jose Perillan *(Vassar College, Poughkeepsie, USA)*

The pragmatists rallying cry: "Shut up and calculate!" has been wielded for decades as a way of focusing and sharpening the quantum physics community's research interests. But for some, this rallying cry has had the chilling effect of marginalizing and dampening non-orthodox views. John S. Bell, one of the most celebrated physicists of the 20th century, openly questioned the dominance of an orthodox quantum interpretation that had raised the principle of indeterminism from an epistemological question

to an ontological truth in the late 1920s without proper justification. As a physicist Bell was at a loss for explaining the omission of Louis de Broglie's alternate deterministic Pilot Wave theory from all theoretical and pedagogical discourse during the 1930s and 40s. This paper contextualizes the Pilot Wave theory's place in the history of quantum mechanics and sheds light on the mechanisms by which the narratives of omission arose and became canonical within the physics community. What emerges is not a straightforward story of victimization and hegemonic marginalization. It is a nuanced story of demarcation involving: an international physics community transitioning from a politically fractured and scientifically divergent community to one embracing a somewhat forced pragmatic convergence; the individual agency of physicists grappling with an emerging quantum toolkit forcing them to question their fundamental understanding of the natural world; and of a rising rhetoric of ontological certainty about the impossibility of determinism.

Keywords: Quantum, Interpretation, Narratives, Omission, Demarcation, Determinism, Pedagogy, Physics, Textbooks, J. S. Bell

On clever horses and trustworthy professors. Rise and fall of the Gesellschaft für Tierpsychologie (1912–1934) (ID 195)

Marco Stella *(Charles University in Prague, Faculty of Humanities, Prague, Czech Republic)*

The case of Clever Hans, a wonder-horse from *belle-époque* Berlin, along with other cases of "thinking animals" in pre-war Europe such as the "Elberfeld horses" or "Rolf, hound of Mannheim", became the cornerstone in the development of psychological theories and behavioural research. Hans and other „animal intellectuals" were successfully tested on different skills, such as maths, reading and spelling. The debate on animal intelligence also shaped the debates on rules and forces causing evolutionary change. Examples of reason in animals were used to underpin Darwinian explanations of mental continuity between man and other animals. The above mentioned cases appeared exactly on time and on the right place to become a major topic of academic and public discourses. These were highly polarised and used as battlegrounds in a deeper ideological and cultural struggle. Clerics, idealistic and anti-Darwinian biologists, academic psychologists and right-wing politicians formed an unusual alliance seeking to discredit clever animals and their supporters, disprove results, neglect experiments and the discredit underlying cultural and theoretical background. The opposite alliance was centred around the *Gesellschaft für Tierpsychologie* (GfTp, Society of Animal Psychology) founded in 1912 Elberfeld, Germany, by Karl Krall, a wealthy amateur animal psychologist and parapsychologist. It consisted of a highly improbable hard-core academic Darwinians (such as Ernst Haeckel), supporters of the *Lebensreform* movement, avant-garde artists, writers and bourgeois amateur pet keepers. This paper will follow two decades of (failed, in the end) attempts of the GfTp to institutionalise "new animal psychology" as a legitimate scientific field and analyse different strategies used to either support ones' alliance or discredit the opposite one. Ways of delegitimization of knowledge and its' bearers, along with the construction of disciplinary mythologies (such as the "Clever Hans story" as told by psychology textbooks) will be taken into account.

Keywords: history of biology, history of animal psychology, Ernst Haeckel, Karl Krall, animal intelligence

Marxist Sociology in Communist Hungary (ID 131)

Borbala Zsuzsanna Török *(University of Konstanz, Konstanz, Germany)*

In 1950 sociology was officially banned from Hungarian university education as a "bourgeois science." Due to a series of political factors however, most prominently the legitimacy crisis of the post-1956 Kadar regime and the political de-Stalinization introduced by Khrushchev, a so-called Marxist sociology started to institutionalize in the scientific field as the banned discipline's proxy. The paper focuses on

the epistemological status and methodological dynamics of this Hungarian adaptation of Soviet "concrete" sociology in the 1960s–1970. The hypothesis is that similar to its Soviet model, Marxist sociology started out as a "social technology" (Liah Greenfeld) with the purpose to increase the ideological and administrative efficiency of the Communist Party, rooted in historical materialism. At the same time, it also aimed at the status of a social theory with specific fields of analysis (industrial and agrarian production, rural population) that made it receptive towards other fields of social science, esp. demography, and the methods of "Western" "bourgeois" sociology (micro- and macro analyses, computation, pattern analysis). The paper argues that the methodological experimentation, which also implied a diverse institutional anchorage, led to a rapid methodological diversification of the incipient social research and to the adaptation of mainstream international sociological theories. This process came to challenge and eventually marginalize the theoretical claims of Marxist sociology, which by the eighties became a pariah science.

Keywords: history of social sciences, epistemology, Communism, Eastern Europe, Marxism, pariah science, scientific communication

Towards a comparative, quantitative account of the pariah sciences: three case studies (ID 219)

Christopher Donohue *(National Institutes of Health, Bethesda, USA)*

The post-Second World War development of both the biological and the social sciences in the United States and Britain has resulted in the deep penetration of tools and methodologies (game theory, demography and statistical methods) across a number of specialties (sociology, anthropology, biology, genetics) AND the fragmentation of disciplines. In this talk I will first outline how the fragmentation of both the biological and social sciences after the Second World War has given rise to a number- an ecology- of pariah sciences, which have rendered traditional distinctions between science and pseudo-science problematic. I will then take three pariah science case studies: public choice theory as represented by Gordon Tullock (using game theory and natural population modeling to explain economic behavior), behavior genetics (using genes to mechanistically explain intelligence, and differences in occupational and educational attainment of individuals and groups) in the work of Robert J. Plomin and human behavioral ecology (explaining differences in social status and social stratification using biological modeling and population genetics and tying differences in social status to biological fitness) in the work of Napoleon Chagnon.

Each of these three "pariah sciences"-public choice economics, human behavioral ecology and behavior genetics- have developed historically at a distance from a number of mainstream positions in the biological and the social sciences. Each of the three has also borrowed and adapted a number of insights, methods and tools from theoretical population biology, genetics and statistics, appealing to quantification and biology as grounds for their superior rigor.

Each of these sciences has engaged in fundamental "boundary work" as part of their historical self-definition, fully aware of both the pseudo-science issue, but also deeply critical of more mainstream positions in their respective fields. All three consider themselves to be "sciences" with strict quantitative methodologies, peer-review, disciplinary history, social networks, journals, conferences. All three have constructed extraordinarily rich "forefather accounts" and intellectual genealogies. All three enjoy degrees of acceptance by "mainstream" biologists and social scientists. All three inquiries have been subject, to differing degrees, to significant public controversy and politicization. All three challenge traditional accounts of disciplines and criteria of demarcation. All three also employ reductionism and use biology and statistics to legitimize the conclusions of their inquiries.

I will explain how one can "map" the position of each of these pariah sciences through network analysis and prosopography. I will use the idea of "social distance" (traditionally used to underscore the social

position and social role of the individual vis a vis others in a class, strata or occupation) to plot the "social position" of a pariah science and its adherents vis a vis a mainstream position in a discipline.

Keywords: 20th century science, pariah science, human behavioral ecology, public choice theory, behavior genetics

Science on the Fringe: UFO Studies in Cold War America and the Contestation Over Scientific Legitimacy (ID 189)

Kathryn Dorsch *(University of Pennsylvania, Philadelphia, USA)*

For nearly twenty years, the United States Air Force's investigations into "unidentified aerial phenomena" (colloquially known as UFOs) existed as a series of quintessentially cold war projects. In later years, it drew money and manpower as an object of scientific inquiry. But by the late 1960s, the UFO became a location for contestation of the American Cold War ideology, specifically regarding the relationship between military and science, and became a site for the expression of mistrust toward the scientific establishment. Over its lifetime, the UFO came to embody concerns about national security, scientific advancement, and public outreach. And yet, the meaning of this object never remained fixed for long. My paper will explore the history of the UFO in Cold War America as a case study in the legitimization and de-legitimization of a scientific object and broader line of scientific questioning. From the very start, battles over serious scientific inquiry into the UFO question divided the scientific community. Over time, the UFO was supported, debunked, redefined, revived, and debunked again. Meanwhile, it came to be a touch-point for larger political and cultural battles – for example, it became a site where scientists and the American public came together to express their distrust of the cold war relationship between science and the military. Scientists battled over which questions to ask, what constituted evidence, and where the burden of proof lay. With ufology now generally classed as a pseudoscience, serious analysis of UFO investigations has been avoided due to the "pseudoscientific taboo," but as recent scholarship (Gordin 2012, Kaiser 2011, Buhs 2009) has demonstrated, these fringe cases have much to reveal about how the meaning and mission of Science is negotiated along scientific, political, and cultural lines. My paper will suggest that the UFO's power as an object of historical analysis lies in its ability to demonstrate how the boundaries of science are demarcated, how scientists navigate those boundaries, and how those battles find larger meaning, in this case, within the American public at large.

Keywords: Cold War, United States, UFOs, scientific authority, boundary, demarcation

The Rise and Fall (and Rise) of the Psitron: A Genealogy (ID 136)

Derek Lee *(Pennsylvania State University, University Park, USA)*

What ever happened to quantum ESP (extrasensory perception)? In the 1960s, the British microphysicist Adrian Dobbs and other researchers proposed a new program of parapsychological inquiry dedicated to both theorizing and locating the fundamental unit of human consciousness. Alternatively known as "psychons," "mindons," or "psitrons," these elusive particles promised to not only explain the hidden mechanics of the brain but also to unlock the awesome powers of telepathy, precognition, and even telekinesis. Inspired by the discovery of the neutrino and other "ghost particles" in contemporary physics, quantum ESP researchers were further bolstered by Gerald Feinberg's hypothesis in a 1962 issue of *Physical Review* of "tachyons," faster-than-light particles that provided a materialist backbone to an increasingly mystical field of possibility. It would seem that Dobbs' program never came to pass, though, as the search for his so-called psitron has long since waned as an active field for scientific inquiry. However, in this presentation I will argue that quantum ESP research is still ongoing—and even flourishing—although it has transmuted itself within a radically different medium

for theoretical inquiry, namely literature and the arts. This paper will follow the rise of psitron studies across twentieth-century physics, psychical research, and neurophysiology, and its eventual decline among the hard sciences. It will also trace the rise of literature as a new mode of epistemological critique over the twentieth and twenty-first centuries; in particular I will follow the theoretical expansion of psitrons in Philip K. Dick's writings on VALIS and the concept of the Force in Star Wars discourse. This presentation consequently touches upon several pressing questions on pariah sciences: How long can theoretical fields exist without empirical evidence? How do they evolve in the absence of scientific praxis? What are the different epistemological roles of the scientist and the writer?

Keywords: consciousness, mind, paranormal, telepathy, psychical, psychology, ESP, parapsychology

The Benveniste Affair: dynamics and epistemic structure of a scientific controversy (ID 85)

Pascal Ragouet *(University of Bordeaux, Bordeaux, France)*

The controversy on the "water memory" begins with the publication of an article in *Nature* in June 1988 by a scientists' team headed by Jacques Benveniste. Benveniste, physician and biologist, director of research in Inserm (*Institut national de la santé et de la recherche médicale)*, is recognized for his work on the PAF-acether – a mediator of the allergy – he discovered in 1972 with the collaboration of M. Henson and C.G. Cochrane.

In the beginning of the eighties, Benveniste's laboratory signs agreements with homeopathic laboratories. While continuing his classical researches on the PAF, Benveniste's team undertakes a range of experiments on the molecular effects of the high dilutions. These researches are also extensively reported in international scientific publications, among which an article in *Nature*. The aim of this publication is to demonstrate that the degranulation of the basophils – a kind of blood cells – can be triggered by very dilute antiserum of anti-immunoglobulins E. In other words, a molecular effect could be obtained without presence of the corresponding molecule. The description of the controversy can be made from two point of view.

1. We can describe the dynamics of the dispute. There is, first, two years of trading with the gatekeepers of *Nature* (the debate is therefore restricted in the academic field). Then, a second phase begins with the media coverage. And, third, another phase of restriction of the debate in the academic field begins: Benveniste is sanctioned by the academic space (he loses the direction of his laboratory and receives a Ig-Nobel prize) and decides to devote himself to conceive new experimental protocols. But he did not fully obtain the expected results.
2. We can also describe the controversy by asking questions on the epistemic conditions enabling the debate. Bourdieu demonstrated that their belonging to the scientific field requires scientists to respect epistemic norms. The analysis of a controversy allows to circumscribe the three epistemic norms of the normal science: the realism, coherentism and organized skepticism norms. By taking account these three norms, we can report arguments of the skeptics towards the Benveniste' contribution.

Keywords: controversy, scientific field, epistemic norms, scientific ethos, sociology of science, Benveniste, biology, water memory

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Symposium 88: European Physicists and Chinese Physics in the 20th Century

Organizers: ***Xiaodong Yin*** *(Capital Normal University, Beijing, China),* ***Danian Hu*** *(The City College of the City University of New York, New York, USA)*

Histories of modern Physics often focus on the development of the Europe and America since the modern physics stem from the Western Europe. From the perspective of global transmission in modern physics, they are not sufficient to explain the rich spectrum of approaches to and forms of knowledge production in the twentieth-century in China. European physicists were major contributors to the development of Chinese physics in the 20th century through their visits to China, nurturing Chinese students in Europe or America, or even personally working in China. During the 1950s, the Royal Society played a crucial role maintaining the communication between Chinese physicists and their Western colleagues. In this proposed symposium, five historians of science from both China and America wish to present their recent discoveries concerning issues mentioned above. Xiaodong Yin of Capital Normal University will discuss the visits of Heisenberg (1929), Dirac (1935) and N. Bohr (1937) in China and their impacts; Danian Hu of the City College of New York examines the legendary wartime experience of William Band, a British physicist teaching at American funded Christian Yenching University in Peking; Liu Jinyan of the Chinese Academy of Sciences (CAS) will investigate the association between H. W. Peng and M. Born, E. Schrödinger, and W. Heitler, an experience that contributed to Peng's later accomplishments as a leader in China's nuclear weapons program and in the Chinese study of theoretical physics; Zhang Zhihui of CAS will explore the professional training and support provided by Theodor von Karman to his Chinese students at Caltech, from whom emerged a group of distinguished space scientists such as Hsue- shen Tsien, Yung-huai Kuo, Chien Wei-zang; and Liu Xiao, also from the CAS, will analyze the exchanges between the Royal Society and the Chinese Academy of Sciences, which eventually helped Chinese physicists return to international scientific community.

Keywords: European Physicists, Chinese Physics, in the 20th Century

The Impact of the Visits of Heisenberg, Dirac and Bohr to China (ID 89)

Xiaodong Yin *(Capital Normal University, Beijing, China)*

The early years of the 20th century saw the rise of quantum theory and the theory of relativity in Europe. The contemporary development of modern physics in China was still in its infancy. By the late 1930s, however, Chinese physicists had begun to make original contributions to physics research. One of the significant reasons for such great Chinese progress was the impact of the visits of leading European physicists to the country. In this paper, I will discuss the visits of Heisenberg in 1929, Dirac in 1929, and Bohr in 1937.

Through his Chinese post-doc Peiyuan Chou, Werner Heisenberg was invited to visit China in 1929. He was the second internationally renowned physicist who set his feet on Chinese soil after Albert Einstein. Heisenberg visited Shanghai and Hong Kong and presented his discoveries to his Chinese colleagues. He was made an Honorary Fellow of Institute of Physics, Academia Sinica during he stay. He trained Chou Pei-yuan, Wang Fou-shan, and several other Chinese students over the next two decades.

Paul A. M. Dirac visited China in 1935. He spent about two weeks in Peking and gave several public speeches on his recent work. Dirac's China journey attracted many Chinese physicists, such as J. S. Wang, T. S. Chang, to come to study with him at Cambridge University. He also had influence and built up friendship with many other Chinese physicists like Y. H. Woo, P. Y. Chou, T. Y. Wu, and C. N. Yang.

Niels Bohr had an early interest in Chinese culture. In summer 1937, he visited several major cities in China with his wife and son Hans and presented many lectures to Chinese scientists and public, which had great impact on not merely physicists but also intellectuals in general.

Based on newly discovered primary sources, I will present detailed stories of these significant visits and analyze their impact on the contemporary development of Chinese physics study. It should deepen our understanding of the dissemination of modern physics knowledge in early 20th-century China.

Keywords: influence, Werner Heisenberg, Paul Dirac, N. Bohr, visited China

H. W. Peng's Association with Born, Schrödinger, and Heitler (ID 178)

Jinyan Liu *(Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China)*

W. Peng (1915–2007) was an eminent Chinese theoretical physicist who studied nuclear physics and particle physics. He played an important role in the theoretical design of China's atomic bomb and hydrogen bomb. Later, he was appointed as the first director of the Institute of theoretical Physics, Chinese Academy of Sciences. He made great contributions to the theoretical physics development in China. All the above mentioned accomplishments of Peng's are more or less rooted in his many years of experience studying abroad.

Between 1938 and 1947, Peng studied in the University of Edinburgh and did research in the Dublin Institute for Advanced Studies in Ireland. Peng's doctoral supervisor was M. Born. He also collaborated with other distinguished physicists, such as E. Schrödinger, W. Heitler, etc. Peng's early researches were mainly on solid physics, meson theory, and quantum field theory.

Based on archival and other primary materials, this paper makes a special inquiry into the relationship between H. W. Peng and M. Born, E. Schrödinger and W. Heitler. In addition to this, I will also summarize and analyze Peng's early works completed in Europe.

Keywords: H. W. Peng, M. Born, meson theory, quantum field theory, E. Schrödinger

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The Royal Society and the Early Chinese Academy of Sciences (ID 399)

Xiao Liu *(University of Chinese Academy of Sciences, Beijing, China)*

Historians often overlook the scientific and technical exchanges between the United Kingdom and China but in fact these were very important, especially in many areas of physics. During the first half of the 20th century, many Chinese students studied physics in the UK and some of them later became leading Chinese nuclear scientists. They transmitted important technology, such as nuclear-emulsion technique, from the U.K. to China. Moreover, both countries shared an outlook in the nuclear industry policy-making. The special Sino-British political and economic relations in the 1950s made it possible to maintain the scientific exchanges between the two countries, which was the only channel between China and Western powers. As the official representatives of both sides, respectively, the Royal Society and the Chinese Academy of Sciences continued their exchanges in various forms, including official visits; personnel exchanges, and study abroad from the 1940s onwars. These exchanges were valuable for Chinese sciences, especially those in theoretical and experimental nuclear physics, optics, metallurgy, radios, aviation, etc. Furthermore, they not only helped build up the relationship between the CAS and other European Academies, but also paved the way for Chinese scientists to be admitted to international scientific organizations.

Keywords: the Royal Society, Chinese Academy of Sciences, Sino-British relationship, nuclear physics, Tsien San-Tsiang

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Symposium 94: The power of tropical biology: Creating epistemic spaces in the long twentieth century

Organizer: ***Sonja Walch*** *(University of Vienna, Vienna, Austria)*
Chair: ***Carola Sachse*** *(University of Vienna, Vienna, Austria)*

Historians have studied the political and economic, as well as epistemological, dimension of European botanical research in the tropics from a diversity of perspectives. In recent years, most discussions on tropical botany were brief and followed a similar narrative: research was conducted in order to expand economic, military, and political networks, in connection with experimental biology taking over global networks of natural history outside Europe. In recognition of the rapid changes in our understanding of the connection between biological knowledge and power, this panel aims to reexamine this story for the long twentieth century by concentrating on the creation of epistemic spaces in tropical regions around the globe, far away from the academic centers in Europe and the United States. The objective is to show that the genesis, dissemination and transformation of knowledge on life and living things in different climatic, geographical, and conceptual spaces reorganized structures of meaning that lead to the adaptation of facts, methods and institutions within and beyond tropical landscapes. It is this power to create new approaches and frameworks that this panel is planning to investigate.

Our panel has a prominent transnational perspective as it focuses on key actors from different locales in Continental Europe (the Netherlands, Switzerland, and Austria) and the United States, conducting research in Pacific and Caribbean islands. The examples described in the four papers are taken from different emerging subfields within tropical botany and in the context of allied sciences such as geology and even ethnology, yet all papers concentrate on research conditions in constructed tropical regions that empowered them not only to re-conceptualize data and scientific facts, especially in forms of collaboration with colleagues in the laboratory or the field as well as members of international communities offering transnational cooperation and support in times of political upheavals.

Two main questions – referring to two major conference topics – will structure our presentations and discussions: Firstly, looking back to American, Dutch, and Swiss scientists in the long 20th century, a dominant pattern of scholars' involvement in power structures and institutions in the Pacific and Caribbean is obvious. An important part of their endeavor was securing access to regions of interest during periods of colonization and trying to overcome losing access in times of decolonization, revolution, and war. In a diachronic and transnational comparison we identify the political, structural, and epistemic implications that framed the scientist's construction of knowledge and practices in order to overcome this obstacle. Secondly, by exploring scientific knowledge and practices as sources of power, we challenge an established narrative that determines early research in the tropics mainly as natural history with focus on collecting and cataloging local knowledge and species in accordance to mostly economic and political considerations. Our case studies indicate more diverse and complex epistemologies that also shaped (socio-)political and scientific discourse. Researching the epistemic spaces in terms of concepts, communities, boundaries, and practices under adverse conditions provides a framework in which to examine the interplay between science and power.

Keywords: tropical sciences, Pacific area, Biological stations, Biogeography, Biodiversity, epistemic spaces, (post-)colonial frontier, Tropical botany, local knowledge

Epistemic Spaces and Divisions at the Colonial Frontier. Looking for Biogeographical Boundaries on the Island of Celebes around 1900 (ID 100)

Bernhard C. Schär *(ETH Zürich, Zürich, Switzerland)*

When the Swiss naturalists Paul and Fritz Sarasin travelled through the highlands of Dutch Celebes (now Sulawesi in Indonesia) around 1900, they did this as members of a trans-national epistemic community stretching from Berlin, London, Amsterdam, to Basel and Buitenzorg (now Bogor). Botanists, zoologists, and geologists in these places were all interested in the question of where to draw the line separating the Asian from the Australian bio-geographical region: Was it West or East of Celebes? Crisscrossing through Celebes and collecting vast amounts of botanical, zoological, geological (as well as ethnographical and anthropological) data, the Sarasins hoped to 'solve' this intricate problem. As it turned out, however, the Sarasins had no immediate access to 'Nature' in Celebes. Rather they depended on expertise and knowledge of various 'local informants' on the ground. In trying to retrieve 'indigenous knowledge' and translate it into the language of their western epistemic community, the Sarasins encountered several problems: their 'native informants' spoke incomprehensible because they were chewing betel nuts; Dutch missionaries, who were familiar with the local languages, criticized the Sarasins' translations of 'local knowledge' as inadequate; local guides refused to lead the Sarasins to where they wanted to go.

The case of the Sarasins, thus, illustrates several things. Firstly that Western epistemic communities depended on local encounters with 'indigenous' epistemologies. Secondly that through these encounters western knowledge of tropical nature not only appropriated 'local' knowledge, but also erected hierarchical boundaries between supposedly superior scientific and 'primitive local' knowledge. Thirdly, western epistemologies were not homogenous but rather fragmented and internally disputed along the lines of competing approaches to 'tropical nature': scientific, philological, or missionary.

Wallacea. Constructing a Floristic Tropical Zone in the Philippines (ID 95)

Sonja Walch *(University of Vienna, Vienna, Austria)*

Between 1954 and 1960, the plant physiologist and "tropical botanist" Mona Lisa Steiner voyaged in the Philippine Islands, collecting plants and their local names. Her research in ethnobotany reflects the growing cultural and scientific investment of international scientific networks – mostly of the United States – in the Pacific region. Having fled Vienna to Manila to escape National Socialist persecution, it had taken years to adapt to (post-)colonial botany as well as scientific cultures. Starting off lecturing experimental botany and contributing to the intensely promoted agricultural sciences in the Philippine Islands, her access to the local flora remained situated in the office. Whereas her pre-formed imaginations on the tropicality of the local population gradually shifted towards a less racial understanding of culture, Steiner's landscaped adventures and field encounters with Philippine vegetation prompted her not to discount speculation on the origin and tropical 'otherness' of the Pacific flora. Rather than considering Dobzhansky's and Mayr's work on reproductive isolation when studying endemic species and speciation, she emphasized a concept of Elmer D. Merrill in evolutionary phytogeography that was considered outdated but corresponded to the early state of tropical botany's development in the 1920's, envisioned the Malay Archipelago as a transition zone of migrating plants, turning the region into an epistemic space where no intrinsic evolution had happened since pre-historical times. After two decades of local studies on the distribution of plants in the Philippine region, Merrill and a network of scientists had translated their data into a historical distribution and formulated the concept of a biozone named "Wallacea". This presentation examines the conceptualization of Wallacea in the Philippines up to the 1920's, as well its translation and integration in the 1950's state of research in tropical botany.

Keywords: Tropical botany, Philippines, Wallacea, Malay Archipelago, tropicality

Relocating and Provincializing European Botany: Melchior Treub, Buitenzorg and the Tropics as New Center of Plant Laboratory Science, 1880–1909 (ID 97)

Robert-Jan Wille *(Ludwig-Maximilians-Universität, München, Germany)*

In the first years after 1880, when Melchior Treub became director of the Buitenzorg Botanical Garden at Java, he felt isolated. Treub was a laboratory biologist who had worked on the new German plant embryology, especially on the developmental cycles of cryptogams such as ferns, mosses, lichens and fungi, and in the Dutch colony he felt far away from the new academic centers of biology that had developed in Germany in the nineteenth century; there were no laboratories and the colonial government was mainly interested in higher seed plants and cash crops such as sugar, coffee, tobacco, cinchona and tea.

However, when 29 years later Treub left the Dutch Indies, he did so as retiring director of the new department of colonial agriculture, supervising a whole complex of laboratories in botany, zoology and chemistry, with many international biologists as visitors, especially from the Netherlands, Germany, Austria-Hungary, Russia and the United States. Treub had succeeded in winning the colonial government for embryological big science by stressing first the unity of tropical botany under the flag of developmental biology. To combat crop diseases scientists had to study the development and co-evolution of higher and lower plants, and their ecological relationship to other organisms in their environment, such as insects, fungi and other plants. Secondly, he reorganized the tropics as a new central space for global botany, suggesting that European botany, with its cold autumn and winter season, was handicapped and that the tropical landscape with its abundance of warmth and sunlight was better equipped for completely mapping plant dynamics, from recolonization on volcanic islands by primitive pioneer plants to complex ecologies of plant-plant and plant-animal interaction, and from studying the mechanics of root formation to the chemistry of photosynthesis.

Symposium 105: Odd scientific objects in post-Great Depression Europe

Organizer: ***Alina-Sandra Cucu*** *(Max Planck for the History of Science, Berlin, Germany)*
Commentator: ***Maria Paula Diogo*** *(Universidade Nova de Lisboa, Lisbon, Portugal)*

Our session offers a fresh perspective on the biographies of scientific objects in fascist and state socialist regimes. It explores the co-constitutive relationship between technoscientific practices and political power as experience in several countries in what David Roberts called "post-liberal Europe", a historical configuration emerging in the aftermath of the 1929 crisis, characterized by a refusal of liberal individualism and parliamentary democracy, and by an embrace of mass mobilization doubled by violence and coercion. Our selection of scientific objects becomes an illuminating entry point into the ways in which ideals of rationality, possibilities of legibility and anticipation, or notions of "efficiency" and "secrecy" impacted the visions of the future and the politics of scale of these regimes.

Unlike previous scholarship on these matters, we make two conscious historiographic choices: one related to periodization, the other related to the scientific objects that constitute the focus of our inquiry. First, following recent trends in the economic and social history of 20th century Europe, we choose to treat fascism and communism together, as specific responses to a world in crisis in the aftermath of the Great Depression. Our approach goes beyond an investigation of these regimes in terms of continuities and ruptures by addressing the complex economic, social, and ideological ramifications of their post-liberal foundations through the Cold War. Connecting the dots between the two historical configurations allows us to transcend nominalist perspectives as well as their reductionist treatments as "totalitarian societies" or "dictatorships" as we try to understand what technosciences of fascism and state socialism can reveal about the very nature of power in these regimes and, simultaneously, about the non-liberal dimensions of Western capitalism itself. Thus, we move our attention from their supposed exceptionality to the moist social, political, and economic hummus from which they emerged and to the ways in which they confronted rival (but not necessarily fundamentally different) practices of modern capitalism in the technoscientific realm and beyond.

Second, all the contributions in this panel focus on what we might call "odd" scientific objects. We ask what planes in Germany and Italy, labour organization in Romania, scientified socialist governance and its technologies in Czechoslovakia, or underwater sounds in Gibraltar can reveal about the particular historical configurations emerging with the challenges of the 20th century. These objects are odd because historically they have been falling in and out of the boundaries of "science", challenged discourses related to livelihood, security, or the nation, and related contested pasts to utopian futures in unexpected ways. They all shared an intimate relationship with the two regimes and became synthetic expressions of what was thought to be possible and for whom in 20th century Europe. It was precisely the "oddity" of their historical trajectories that made them into flexible material instruments of statecraft, delineators of territories and populations, or cornerstones in processes of capital and class formation. Following these trajectories on the ground can illuminate an important page of European history from a new angle.

Keywords: scientific objects, state socialism, fascism, post-liberal Europe, Cold War

Underwater Sounds and Spain's Participation in the Golden Age of Capitalism (ID 183)

Lino Camprubí *(Max Planck for the History of Science, Berlin, Germany)*

Although its modulations received scientific attention since Ancient times, sound qualifies as an odd scientific object in all possible senses. As an object of enquiry, sound only got its own discipline (acoustics) in the 18th century. Sonic objects themselves have been elusive and relatively hard to isolate and analyze. The situation becomes even more slippery underwater. Until the invention of the hydrophone in the late 19th century, submarine sounds were such a rarity that the oceans were often referred to as a "silent worlds." But submarine surveillance in the Cold War, this paper argues, put underwater

sound at the center of nuclear warfare, and thus understanding and managing sound became a key piece in the deathly equilibrium between the capitalist and the communist empires.

What happens when a country is caught in the middle and how can underwater sound help us understand the fight over its political economy? In the 1930s, anti-liberal politics permeated the Spanish Second Republic, with important political groups both from the left and the right arguing for taming, transforming, or overthrowing capitalism. After a bloody Civil War, General Franco seized power in 1939 with the help of fascists-inspired groups and Catholic traditionalists, both of whom shared a mistrust of "materialism", be it capitalist or communist. When the Axis lost the world, politicians in the West decided to isolate the regime politically hoping that it would soon dissolve into a democracy. But with the start of the Cold War, Franco's fierce anti-communism made its rule attractive to many in the US. Spain's strategic position as the rearguard of Europe and at the Strait of Gibraltar, a chokepoint for Soviet submarines, made it particularly attractive to US Navy officials. In the early 1950s, Spain and the US signed a series of defense agreements that, simultaneously, put the Spanish coast at the service of US submarine sound surveillance and signified Franco's Spain reintegration into the capitalist world as part of the EuroAmerican Golden Age of capitalism.

Exploring underwater sound in connection to Spain's transition from economic autarky to international capitalism will reveal the geopolitical and non-liberal components of Western capitalism in the early Cold War.

Keywords: underwater sound, Cold War, Gibraltar, surveillance

Politics of Time: Labour Heroism and Scientific Vision in Early Socialist Romania (ID 111)

Alina-Sandra Cucu *(Max Planck for the History of Science, Berlin, Germany)*

How to make people work more, faster, and better has been the question that stood at the core of industrial modernity, both in its capitalist and its state socialist version. Variants of psychotechnics, scientific management, and sociological endeavours that connected the factory to broader contexts of social reproduction and leisure pushed workers' bodies and practices into laboratories, transformed the shopfloor itself into extensions of these laboratories, shaped subjectivities and ways of doing, and defined new fields of knowledge and expertise. Drawing on the chronically understudied case of the Romanian socialism, my contribution to this panel explores the on the ground encounter between different traditions of thinking that tried to answer this question and moulded labour into an object of inquiry that was at the same time scientific and fundamentally political in the 20th century.

By following the transformations in the fields of expertise and in the ways of producing knowledge about the production process in socialist Romania I reveal the complex and not straightforward relation that the science(s) of labour had with the Bolshevik Marxist tradition and with Western developments in labour management. I argue that the making and the unmaking of labour into a scientific object was a deeply contradictory process that reflected the dialectical relationship between the three conflicting temporal horizons of socialist construction: the time of modernization and historical catching-up, the linear time of workers' discipline and factory management, and the transcendent time of revolutionary outcome.

Keywords: labour, time, state socialism

Scientifically Organized Socialism: State Socialist Governance as A Scientific Object (ID 109)

Vítězslav Sommer *(Institute for Contemporary History of the Academy of Sciences of the Czech Republic, Prague, Czech Republic)*

The aim of this paper is to analyze how socialist governance was researched and discussed by social scientists and experts in Czechoslovakia since the 1950s until 1980s. The idea of scientisation of socialist governance became widespread since the late 1950s in the Eastern Bloc countries. As a consequence of this post-Stalinist politics of scientisation, socialist governance became an object of social scientific research and expertise. This kind of research was based on the conviction that far-reaching application of scientific knowledge in the sphere of governance was a basis for more sophisticated and efficient control and organization of crucial social and economic processes. This paper will discuss 1) how various state socialist governmental technologies were developed and analyzed by social scientists, 2) to what extent research on socialist governance was established as a specific field and 3) how the interconnection between social scientific scholarship and governance in state socialism was rationalized by scholars, experts as well as political elites.

Keywords: state socialism, governance, social sciences

Symposium 110: Scientists and the powerful from the Middle Age to the Classical period

Organizers: ***Valérie Debuiche*** *(Ceperc, Aix en Provence, France),* ***Pascal Taranto*** *(Ceperc, Aix en Provence, France)*

From the Middle Age to the 18th centuries, the science incredibly improved because of the development of both technical devices and theoretical doctrines. For instance, Galileo's telescope met natural theology, paving the way to geocentrism; Leeuwenhoek's observations with the microscope revived the debate between mechanism and vitalism; Pascal's invention of a calculating machine shed light on the issue of the combinatorial nature of reason.

Many skilled scientists also were great thinkers or philosophers, who deeply embodied the spirit of their era: Al-Khwarizmi, Averroes, Galileo, Descartes, Newton, Leibniz, etc. In a way or in another, they confronted or benefited the power of political rulers or religious censors. As a result, the first model for a political organization of science was held by Lord Chancelor and scientist Francis Bacon, e.g. the "Solomon's House" of the *New Atlantis,* a utopia which was soon to lead to the creation of The Royal Society. Besides, their works were not only promoted or constrained by the action of the powerful, but also influenced, even nourished by the interest of a Caliph, a Queen, a Prince, a religious dignitary, etc. For instance, Caliph Al-Ma'mum promoted the development of the most famous and greatest House of Wisdom: the *Bayt al-Hikma* in Bagdad where scientists worked on translations and comments of the most important of antic books. The very famous epistolary relation between Descartes and the Queen Christina of Sweden led the philosopher to elaborate on the moral theory of passions. In his project of writing the history of the House of Brunswick-Lüneburg, Leibniz travelled in Italia where he had the opportunity to improve his works on dynamics.

The aim of this symposium is to consider the nature of the relation between scientists or philosophers and the powerful from the Middle Age to the Classical period in any geographical area:

- Was that relation institutional, social, theoretical, political, relative to personal ambitions, etc.?
- How did it influence the work of scientists: their method, the choice of their topics, their general or philosophical doctrine of knowledge, etc.?
- What was the extent and the consequence of the power of scientists on the powerful: on their education, on their mentality, on their choices of government, etc.?

Keywords: Classic Period, Middle Age, Political influence, Power, Science, Philosophy

Algebra and proto-algebra: about formalism and foundations (ID 258)

Marouane Ben Miled *(University of Tunis El Manar, Tunis, Tunisia)*

When, between the seventh and the ninth centuries, the Arabic language came out of Arabia with Islam, it became the language of the law (Coran and Sunna) and of the administration; then studies of Arabic grammar became a necessity for the Greeks, the Persians, the Syrians etc.

More precisely, at the end of the 7th century, with the reform of the Caliph Abd al-Malik ibn Marwān, Arabic became the language of the administration, and consequently, of science. Between the 8th and the 9th centuries, two schools of grammar were active, one at Bassorah and the other at Kufa. At the same time, in Baghdad, the Caliphs al-Rashid, and then al-Ma'mun, founded and developed the House of Wisdom, as the most important scientific institution. Other private scientific institutions of the same type were also founded. A movement of translations of the scientific and philosophical Greek, Syriac and Persian texts was launched.

The formal works on Arabic language, together with those in Greek about geometry as well as the Greek and the Hindu-Persian arithmetic, gave rise to a new discipline: Algebra. It was also a demand of jurists to make the calculations that the Islamic laws of inheritance required.

The recent knowledge about al-Khawarizmi's, Abu Kamil's, al-Karaji's and al-Samaw'al's algebras leads us to question the classical periodization. First, with al-Khawarizmi, in the first half of the ninth century, equations are the result of a formal grammatical combinatorial approach on three words with a geometrical interpretation. In the tenth century, there are two kinds of Algebra: al-Khayyam's geometrical one, which will lead to the one by Sharaf al-Din al-Tusi, and later to Descartes' Geometry, and the formal one developed by al-Karaji and then al-Samaw'al, which is a kind of "generative grammar" to build polynomials.

Keywords: House of wisdom, Caliphate, Arabic Grammar, Algebra, variable, unknown, equation, algorithms, Diophantus, Khawarizmi, Karaji, foundation, Khayyam, Descartes

Leibniz and Sophie Charlotte of Brandenburg: from master to friend (ID 114)

Valérie Debuiche *(Ceperc, Aix en Provence, France)*

Leibniz (1646–1716) is a famous philosopher and scientist who was very close to the members of the House of Brunswick-Lüneburg in Germany. In particular he was the mentor and friend of the Electress Sophie (1630–1714), the mother of the future king George the first of Great Britain and of the future Queen of Prussia: Sophie Charlotte (1668–1705), Electress of Brandenburg. Besides she also was the sister of Elisabeth of Bohemia who shared an important and rich correspondence with Descartes.

Her daughter Sophie Charlotte married Friedrich the third, Elector of Brandenburg in 1688. She initiated the construction of an astronomical observatory in Berlin in 1697. Aware of this project, Leibniz wrote to Sophie Charlotte in order to suggest her the joined creation of a society of sciences (for the Germanic nations). The reception of his proposal gave her the opportunity to ask for Leibniz's learning and friendship. Indeed, like her mother, Sophie Charlotte was a brilliant mind, very interested in philosophy, with a deep knowledge of the science of her time. For a long time she has respected and admired the old friend of her mother.

In March 1700 the Elector of Brandenburg approved the creation of the astronomical observatory and of the Society of Sciences. On July 1700 he is promoted the President of the Society of Sciences of Berlin. In-between, in June, Leibniz wrote his first letter addressed to Sophie Charlotte (and to her mother, Sophie). Within this letter, he sent a summary of his doctrine of mind and body, worrying about the fact that the young Electress could be not able to understand the final mathematical metaphor, as he explained in a letter to her lady-in-waiting, Henriette Charlotte von Pöllnitz. This was the first letter of a regular and varied correspondence between Leibniz and Sophie Charlotte.

The last letter about philosophical issues that Leibniz wrote to Sophie Charlotte, before her death in February 1705, was sent in May 1704. This time, he did not summarize his doctrine for a young lady but shared with her his reading of Curdworth's book as he would have done with another philosopher. The main topic of my presentation is then to present the difference between these two letters, the one of 1700 and the other of 1704, and to show the relation between their content and form and the evolution of the relationship between a thinker and a queen.

Keywords: Leibniz, Sophie Charlotte, Philosophy, Science, Correspondence, Society of Sciences, Berlin

«Scientia potestas est»: Francis Bacon and the birth of technocracy (ID 113)

Pascal Taranto *(Ceperc, Aix en Provence, France)*

Francis Bacon is often credited with having raised the move towards what would later be termed a «technocracy», *i.e.* a strong alliance between science and political power through new institutions, producing new inventions, and leading to a scientist program of society control. The famous sentence *«Scientia potestas est»,* knowledge is power*,* is supposed to be the baconian *motto* for this new era, which was to prove effective with the growing power and dominion of England in the eighteenth century, as if the scientific program defined in the *Novum Organum*, the *New Atlantis*, and the *Advancement of learning*, and embodied in the Royal Society, was finally to find its best proponent with the liberal state born from the Glorious Revolution. But such a program of *scientia operativa* or «active science» is not clearly linked with such a political organization. On the contrary, the utopist model explained in the *New Atlantis* would find a better chance with an absolutist regime the kind of which was supported by former's Bacon's young secretary, Thomas Hobbes. His vision of organized science thus involves a strongly hierarchized structure, subservient to strictly political aims: power outside, order inside. Is it possible to revisit Bacon's utopia and give the sentence «knowledge is power» a more democratic turn? Tracing the roots of technocracy in Bacon's dreams would then be an anachronistic overstatement, and it would then be more justly labelled, following Hans Blumenberg, an «epistemocracy».

Keywords: Bacon, technocracy, Royal Society, England, eighteenth century

Symposium 115: The power of norms: standardisation and normalisation through International Scientific Organisations

Organizers: ***Danielle Fauque*** *(Université Paris Sud, Orsay, France),* ***Brigitte Van Tiggelen*** *(Chemical Heritage Foundation, Philadelphia, USA)*
Commentator: ***Brigitte Van Tiggelen*** *(Chemical Heritage Foundation, Philadelphia, USA)*

Most international scientific unions, such as IUPAC, IUPAP, IUPAB, IAU, IUGG, URSI, ... were creations of the 20th century, and aspired to be pure scientific bodies, above national government or cultural influences, making decisions or issuing recommendations on strictly rational grounds. One of their aims was to draw up norms and standards to facilitate the development and the propagation of science. In the frame of ICSU for instance, IUPAC and IUPAP founded joint special commissions to deal with specific matters: symbols, units, nomenclature, constants, atomic weights, physicochemical standards, analytical methods, etc.

Standards allow for a better diffusion and exchange of knowledge by creating and maintaining a common language. But standards, terminology and norms also are a mean of power. It comes thus as no surprise that before these standards were enacted and accepted locally, whenever they were, heated or extended debates took place inside commissions before reaching consensus. Afterwards, the task still remained for the international bodies to diffuse the new standard as a scientific recommendation to be followed by its users, especially in teaching and publishing.

Few historical studies have been devoted to this contingent part of scientific activity up to now, that appears as a purely administrative or technical part of scientific management, whereas this process of normalization eventually impacts and structures the science itself. The proposed session will focus on this under-investigated facet of the scientific work, to which nonetheless several scientists, often of great fame – F. and I. Joliot-Curie, E. Bauer, G. T. Seaborg, G. De Hevesy or J. Timmermans… –, have devoted a notable part of their time and activity.

The session gathers case-studies on the emergence and negotiation of specific norms, and historical trajectories of actors or groups of actors (commission) engaged in this process, ending with comment and roundtable discussion of the topic.

Keywords: International Scientific Organisations, Standardisation, Standards, Norms

The Joint Commission of Standards, Units and Constants of Radioactivity: Demonstrations of power in IUPAC and IUPAP (ID 194)

Danielle Fauque *(GHDSO-EST, University Paris Sud, Orsay, France)*

Standards usually require agreement; in the sciences the international unions created after World War I, were the places where these agreements were concluded. To deal with those standards that related to more than one discipline, joint commissions, attached to one or another of the unions concerned, were established. In this paper, I examine the procedures, issues, outcomes, and power relations in the joint commissions of the International Union of Chemistry (today IUPAC) and the International Union of physics (today IUPAP), and take as example the Commission of Standards, Units and Constants of Radioactivity.

Although not set up until 1947 in London, this Commission had roots going back, under various titles, to the beginning of the century. Effectively, at the Liège International Conference of Chemistry (1930), it was decided to work with the Radium Standards Committee (RSC) founded before the First World War, with Ernest Rutherford as president, to create a new international commission, the International Commission on Radioactive Constants, to serve as a liaison between the Union of Chemistry and RSC. In 1949, at Amsterdam International Conference of Chemistry, they produced their first joint report.

Among the new Commission's leading figures was a double Nobel Prize, Frédéric Joliot, representing IUPAC, who played a key-role, and Irène Joliot-Curie of IUPAP.

Keywords: radioactivity standards, IUPAC, IUPAP, Frédéric Joliot

Taking the CNIC Route: How Systematic Nomenclature Failed, Yet Won (ID 164)

Ann Robinson *(University of Massachusetts Amherst, Amherst, USA)*

In the late 1960s, the Commission on Nomenclature for Inorganic Chemistry (CNIC) of the International Union of Pure and Applied Chemistry (IUPAC) began to develop a systematic nomenclature for the elements with atomic number greater than 100. This was, in large part, a means of avoiding pressures from within and without the IUPAC to render judgment as to who had discovered new elements. The members of the CNIC felt they lacked the necessary knowledge to decide which group had discovered an element and furthermore that this was not a nomenclature issue. There was some debate within the CNIC about with which element the new systematic nomenclature should begin as there were controversies surrounding the discovery and naming of several of these heavy elements (101, 102, 103, etc.). There was also disagreement within the higher levels of the IUPAC about what the nomenclature should look like or even if it would be used. When it was published, there was a definite negative reaction from the nuclear chemistry and physics communities, and from the International Union of Pure and Applied Physics (IUPAP) as well. Although they disliked the systematic nomenclature, nuclear scientists could not completely avoid using it. Nor, to the dismay of the CNIC, did it completely solve the problems it had been created to fix.

Keywords: elements, chemistry, physics, discovery, IUPAC, nomenclature

Reporting NMR Spectra and Electing a Reference: Role of IUPAC (ID 182)

Pierre Laszlo *(Ecole polytechnique, Palaiseau, France)*

The Instrumental Revolution brought nuclear magnetic resonance (NMR) in the laboratories during the Sixties. The case study I shall submit concerns nuclear magnetic resonance, NMR spectra and the role of International Union of Pure and Applied Chemistry (IUPAC) in their standardization and referencing. This task was an essential requirement for chemical publications, primarily. There was a need for agreeing upon an internal reference, viz. a compound that could be added to the sample without interacting significantly with either solvent or solute. This internal reference would serve as the origin of the frequency scale, upon which the various resonances were displayed.

In this manner, a uniform and universal format would be not only recommended, it would be enforced also upon chemists worldwide. Relevant questions are: Was there a deplorable loss in the diversity of practices? How timely was the role of the International Union of Pure and Applied Chemistry (IUPAC) in enforcing uniformity? In what way was the imposition of uniformity a power play? Was it at all an abuse of power?

This presentation will address specifically the intervention of the International Union of Pure and Applied Chemistry (IUPAC) in its introduction and timing. Reception by the international chemical community and generalized use will be addressed specifically.

Keywords: NMR, IUPAC, Standardization

Instrumental Practice, Organizational Votes, and the Carbon-12 Scale of Atomic Weight (ID 177)

Keith Nier *(independent, Madison, NJ, USA)*

From the 1930s through the 1950s increasing instrumental precision created an issue of real, approximate, incommensurability for chemists and physicists. After isotopes of oxygen were discovered, chemists used a reference scale of atomic weights based on O, now understood as a mixture of one predominant and two more isotopes, having a defined relative weight of 16. Physicists used a scale based on the single isotope, O-16, having its mass defined as 16. The difference seemed inconsequential at first but became a growing practical problem primarily due to two developments. It was discovered that the ratios among oxygen isotopes varies; thus so does the relation between the mass scales. Meanwhile, the spread of improved mass spectrometers allowed scientific work to be done beyond the level of precision where the scales disagreed. Efforts at resolution were organized through the International Union for Pure and Applied Chemistry (IUPAC) and the International Union for Pure and Applied Physics (IUPAP). The resulting C-12 standard, the unified scale of atomic mass, settled by votes at the start of the 1960s, involved considerations of experimental and technological practice, the weight of custom, professional interests, and economics as much as considerations of logical consistency. Comparison with later problems in the determination of nuclear masses suggests that this episode points to general implications for understanding science.

Keywords: atomic weight, mass, precision, isotopes, reference scale, mass spectrometer, oxygen, incommensurability, votes

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Constructing Safety and Quality: The UN, the ICMSF and the postwar development of global food norms (ID 199)

Brigit Ramsingh *(University of Central Lancashire, Preston, UK)*

The period following the Second World War marked the emergence of several coordinated regional and international efforts all designed to ensure safe, nutritious and abundant food, whilst facilitating trade and development. Many of these initiatives were based out of Europe with headquarters in Rome, Geneva, Paris or Brussels. In 1955, the United Nations' Economic Commission for Europe (the ECE) established its *Protocol on the Standardization for Fruits and Vegetables*, a classification scheme that distinguished between "first" and "second-class" foods ranging from apples and pears to tomatoes, endives and table grapes. It established limits, tolerances and allowable dimensions for blemished, cracked, or unclean items in a given batch, particularly if the fruits or vegetables in question posed a threat to public health as they circulated in the Common Market. Groups with a more international focus emerged as well, such as in 1947 the International Organization for Standardization (ISO), and in 1962 the International Commission on Microbial Specifications for Foods (ICMSF). One of these projects, the *Codex Alimentarius* (or "Food Code") began as a joint initiative of the United Nations' Food and Agriculture Organization (FAO) and World Health Organization (WHO). Emerging in the early 1960s, the *Food Code* not only drew upon the ECE Protocol and the work of the ICMSF, but also went further to establish maximum tolerances for pesticides, microbes and food additives, as well as standard laboratory methods for analyzing food in order to protect consumer health and facilitate transport and trade. Drawing upon archival evidence and reports, in this paper I will illustrate how food safety

and quality standards represent multiple interests, and consider the intrinsic power dynamics at play in the process of the creation and adoption of scientific norms. In particular, I will highlight the emerging tensions in the postwar global food system between the aims of protecting health versus protecting trade; regional versus international goals, and the consequences of these standards for developed and developing nations.

Keywords: ICMSF, ISO, Food Norms, Codex alimentarius, Economic Commission for Europe

Chemical Definitions as Tools of Business Pressure: Negotiations Surrounding the Standard ISO 412 on Turpentine (ID 165)

Marçin Krasnodebski *(University of Bordeaux, Talence, France)*

Turpentine is a volatile product of resin distillation used in the paints and varnishes industry. As uncontroversial as it may seem, after the International Standardization Organization decided to unify national standards on resins, the question of turpentine provoked tensions between chemists from many prestigious research centers. French and international scientists clashed defending radically different definitions, all of them backed by science. The ISO committee TC/35 became the centre of heated debates on epistemology, boundaries of science, and the role economic conditions in shaping the definitions of chemical products. The goal of the presentation is to explain how scientific institutions involved in standardization may convey implicitly through most elementary chemical definitions, a whole variety of national economic and industrial interests.

Keywords: Turpentine, Resin, Standards, ISO, History of Chemistry

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An historical perspective on the definitions of detection limits given by IUPAC and regulatory authorities (ID 168)

Marco Taddia *(University of Bologna, Bologna, Italy)*

Nearly half a century has elapsed since the publication of Currie's paper (1968) revealing a plethora of mathematical expressions and literature's definitions of detection limits (LOD) in radioactivity measurement processes. Results given by commonly used alternative definitions were shown to be unsatisfactory for they encompassed three orders of magnitude. In order to prevent a scientific Babel not only in nuclear chemistry but also in the whole field of applied analytical chemistry, stricter rules were

proved to be indispensable and urgent. Therefore it was very important to reach an international agreement on this topic, especially for comparing results obtained by various analysts in different laboratories and countries. Economic, social and also political consequences of LOD definition are still evident in many fields. All methods employed in food, environmental, clinical and forensic analysis are concerned. It's obvious, for example, that whenever a legislator needs to establish the limit of a pollutant in drinking water he must take the LOD of available methods into consideration. The modern definition of LOD can furthermore not disregard statistics. Kaiser's studies in this field (1947–1966) soon became a classic.

A IUPAC recommendation document on data interpretation in spectrochemical analysis (Nomenclature, Symbols, Units), that reinforced the Kaiser theory of detection limits based on a statistical approach, was adopted in 1975. Such document was disseminated through Pure & App. Chem. (1976) and Spectrochim. Acta (1978). Nowadays it's also clear that a measurement process of minimum detectable quantities may require the introduction of three specific definitions: (i) decision limit, (ii) detection limit and (iii) determination limit. This is another interesting controversial research topic to be discussed in the present communication.

Keywords: Analytical Chemistry, Detection in Analytical Chemistry, Analytical controls, Detection limit, Decision limit, Determination limit

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Symposium 116: From Lysenkoism to Evolutionary Biology

Organizers: ***Tomáš Hermann*** *(Charles University in Prague, Faculty of Science, Prague, Czech Republic),* ***Marco Stella*** *(Charles University in Prague, Faculty of Humanities, Prague, Czech Republic),* ***Mikhail Konashev*** *(Russian Academy of Sciences, Saint-Petersburg Branch, Saint-Petersburg, Russian Federation)*
Chair: ***Eduard Kolchinsky*** *(Russian Academy of Sciences, Saint-Petersburg Branch, Saint-Petersburg, Russian Federation)*

The symposium will be devoted to various aspects of a long and complex process of contacts, struggles, transitions and conceptual overlaps of lysenkoism and neodarwinian evolutionary biology and its' unorthodox extensions, such as theories of epigenetic inheritance. These contacts and transitions took place in almost all countries of the Eastern Bloc, including Soviet Union, Czechoslovakia and other countries. A surprisingly high number of evolutionary biologists were able and willing to work on the margins of two political and epistemological regimes, both in the form of critique. Even if "lysenkoism" is mostly considered as an illustrative example of pseudoscience, by many from East and West it was taken seriously. For some (not necessarily from West), it was an opponent worth to struggle with. For others (not necessary from East) a theoretical and epistemic background that was (unlike neodarwinian evolutionary biology) able to offer new explanations of biological phenomena or predictions of future evolution. At the same time *being supported* and *supporting* Marxist, or Marxist-leninist philosophy ideas. Figures such as Vladimír Jan Ámos Novák in Czechoslovakia, the author of the theory of sociogenesis, Vladimir Sukachev in the USSR and Th. Dobzhansky in the US are, among others, good examples. For instance, Novák is a good example of how the theories of heredity and evolution were changing throughout the post-War development in Czechoslovakia from lysenkoism to concepts that have only recently had a strong impact on the shaping of mainstream evolutionary biology. He started his career as an insect endocrinologistwho tried to apply some lysenkoist methods on butterfly larvae. Later on, he developed his own evolutionary theory of sociogenesis (an Eastern counterpart of Wilson's sociobiology) and a multilevel theory of heredity, both strongly infuenced by epigenetic theory of inheritance. Vladimir Sukachev was an outstanding Soviet botanist and one of the key figures in the struggle against lysenkoism in the USSR. Th. Dobzhansky was a world/famous evolutionary geneticist and the nost important Western critics of lysenkoism. The symposium will focus on the development of different attempts to communicate, highlight or transgress differences of ideas on evolutionary principles over the Iron curtain, compare biographies of protagonists and look closely on possible aftereffects.

Keywords: history of biology, lysenkoism, evolutionary biology, USSR, Czechoslovakia, Eastern Bloc, Th. Dobzhansky, V, Sukachev, VJA Novák

NeoLysenkovshichina XXI century and its causes (ID 130)

Eduard Kolchinsky *(St. Petersburg Branch Institute for the History of Science and Technology, St. Petersburg, Russian Federation)*

The phenomenon typically referred to as "Lysenkoism" has long been a feature of Soviet scientific historiography. Less examined is the problem of *Lysenkovshchina*, which is far more important in that it is the strategy by which the former is being revived today. I define Lysenkoism as a set of concepts and theories proposed by a scientist named Lysenko, as opposed to *Lysenkovschina*, which was a social practice consisting of scientists competing for influence in the power and society (Kolchinsky, 2014). This distinction is essential to understanding the contemporary treatment of Lysenko's work in Russia, and attempts to restore his academic credibility. Dozens of publications produced by established scholars also glorify Lysenko's "achievements" in applied biology and blame Vavilov for his alleged failure to focus on "real" problems of agriculture. Too frequently Vavilov is accused of wasting state funding on useless expeditions and international exchanges. His critics also emphasize Vavilov's

supposed lack of patriotism. Sometimes these accusations go so far as to suggest that geneticists were "lucky" to become victims of Stalinist repressions. Their victimhood allegedly earned them fame, while Lysenko – as the argument goes – suffered for his patriotism. His struggle against eugenics, achievements in plant selection and animal breeding, and alleged opposition to Khruchshev's risky experiments with agriculture, are all presented as unacknowledged virtues. Such attempts were called NeoLysenkovshchina (Korochkin, 2003). I'll try to examine the main arguments advanced by Lysenko's apologists, and illuminate the social, political and intellectual contexts of their efforts. Nationalist sentiments shared by the ruling elite, as well as a portion of Russian society, are particularly important in facilitating the revival of Lysenkoism in post-Communist Russia. However the principal reason for the NeoLysenkoist revival lays in contemporary public attitudes toward science in Russia, especially the rise of anti-scientific sentiments in society and among the ruling elites, combined with the growing influence of religious fundamentalism. To some extent, the revival of Lysenkoism can also be explained by the academic traditions of Russian biologists, many of whom learned biology from textbooks produced by the advocates of Lysenko. Many of the most active and capable geneticists emigrated. A deeply entrenched confrontation between those Russian biologists who work at the institutions of the Academy of Sciences, and those who specialize in agricultural research – a field still dominated by Lysenko's advocates – is also a factor contributing to the revival of Lysenkoism

Keywords: Lysenkoism, Lysenkovshchina, NeoLysenkovshchina, Vavilov, society, power

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Soviet evolutionary biology and Th. Dobzhansky's critics of lysenkoism (ID 156)

Mikhail Konashev *(St. Petersburg Branch of the S. I. Vavilov Institute for the History of Science and Technology, Russian Academy of Sciences, St. Petersburg, Russian Federation)*

Dobzhansky played an especially important role in the criticism of lysenkoism and in the restoration of genetics in the USSR. By the end of 1940s he had already become a world-famous geneticist and evolutionist, and it was well known that he was from the Soviet Union. the specifics of Dobzhansky's criticism of lysenkoism had internal and external features. As many other critics, he at first criticized only Lysenko's research and wrote nothing on lysenkoism as a social and political phenomenon, or its cultural and historical roots. In several articles he showed the theoretical and experimental inconsistency of all Lysenko's claims, and also convincingly demonstrated that they were indeed a return to ideas and hypotheses of a science of the past. But after news of Nikolai I. Vavilov's death in prison and especially after the meeting of the Lenin All-Union Academy of Agricultural Sciences in August 1948, he changed sharply his criticism. He now analysed lysenkoism as special social and political phenomenon, and tried to explain how and why it was possible. Dobzhansky insisted that the Soviet State had given science tremendous support from the very beginning, but that this support also had its opposite side. Such criticism of lysenkoism by Dobzhansky could not pleased the Soviet authorities, who saw it as "ingratitude." Likely, it was one of the main reasons why he was not allowed to visit the USSR in the 1960s when invited by his Soviet friends and colleagues. At the same time Dobzhansky was one of the four principal founders of the "synthetic theory of evolution" and he influenced greatly

the development of the evolutionary biology in the USSR in 1960–1980. Owing Dobzhansky soviet biologists considered the theory of biological evolution of 1960s –1980s as a more modernized version of the "synthetic theory of evolution". The USSR, being for some time the stepfather or the stepmother of "the synthetic theory of evolution", had again become one of the centers of evolutionary research greatly respecting Ch. Darwin and Darwinism, and its new modern version. But because of lysencoism the Soviet scientists would find it difficult to return to their former outstanding positions in genetics or in evolutionary researches.

Keywords: Th. Dobzhansky, evolutionary biology, lysenkoism

Histories of Lysenkoism Continued: A. E. Stepushin and why is there no English translation for 'Lysenkovschina?' (ID 246)

William de Jong-Lambert *(City University of New York, New York, USA)*

In this paper I will cover one of the relatively understudied periods of Lysenko's career—his work breeding cattle on his model farm in the Lenin Hills outside Moscow. It was during this period that Lysenko moved his attention from flora to fauna, while continuing to lose influence within the world of Soviet biology, as well as in neighboring Communist Bloc countries such as Poland and Hungary. To do so I will follow the account of his chief veterinarian, A. E. Stepushin, as chronicled in his book *Eyewitness to Lysenkoivschina*. Stepushin's account covers his views on the 1948 VASKhNIL session, the fate of Vavilov, and his personal experience working with Lysenko on his farm. This "eyewitness" account reveals a previously unexamined, at least as far as the literature in English is unconcerned, perspective on Lysenko's career and the reasons for his downfall. I will also discuss possible reasons why there is—unlike the related term "Lysenkoism"—no English translation for "Lysenkovschina." Whereas the former term refers specifically to Lysenko's theories, the latter describes the politicization of science under Lysenko. Parsing out why this distinction is made in Russian, but not English, is useful towards understanding the significance of the Lysenko controversy in context with the broader history of "pseudoscience."

Keywords: Lysenkoism, USSR, Lysenko, Lysenkovschina, VASKhNIL, pseudoscience

Bad guys turned to good guys: Milan Hašek, VJA Novák and others on the way from Lysenkoism to mainstream science in Czechoslovakia, 1950–1980s. (ID 180)

Tomáš Hermann *(Faculty of Science, Charles University in Prague, Prague, Czech Republic),* ***Marco Stella*** *(Faculty of Humanities, Charles University in Prague, Prague, Czech Republic)*

The aim of this paper is to improve our understanding of Lysenkoism as a specific parts of totalitarian ideology during late 1940s to 1980s.Due to specific local conditions, remnants of Lysenkoism survived in Czechoslovakia longer than in neighbouring countries. Even after the unmasking of Stalinist science, a 'soft' version of Michurinian biology lingered in official biology (I. Málek, M. Hašek) until at least mid-1960s. Another factor which aided the prolonged presence of Michurinian biology in Czechoslovakia was the influence of the Czechoslovak Academy of Sciences (CSAS). It was established during the Stalinist era (1952) based on a Soviet model and within the institution, biology was organised according to the principles of Michurinian biology. Even so, CSAS did promote research, helped in overcoming the grossest deformations, and some of the work done there was valuable. The fact that ideologically interpreted research achieved some original results valid even from the perspective of Western science then somewhat paradoxically helped Michurinian biology survive longer than in some surrounding countries. During the period of hard-line Lysenkoism, four scientific schools were created which eventually had later an impact on both Eastern and Western science. It was 1. Milan Hašek's school of immunology; 2. Ivan Málek's school of microbiology; 3. Ferdinand Hečík's school of radiobiology; 4.

Vladimír J. A. Novák's evolution theory and theory of sociogenesis. In more detail only on the first of the above: Hašek's discovery of immunological tolerance was interpreted in zoology in terms of vegetative hybridisation (P. Medawar received a Nobel Prize for the same discovery and he recognised Hašek's contribution). Czechoslovak immunological school gained international recognition and students of Hašek (an erstwhile radical Lysenkoist) who emigrated after the Soviet occupation in 1968, still work in laboratories all over the American and European continent. Somewhat similar stories could be told about other schools and their founders mentioned above. This shows that in some fields, Czechoslovakia functioned as a unique bridge between the Western and Soviet science, a fact that may have had a more general impact.

Keywords: Czechoslovakia, Michurinian biology, Lysenkoism, immunology, microbiology, evolutionary theory

Symposium 121: Scientific Persona as a way to scientific Power: how scientists deal with categories of social difference (SPaSP)

Organizers: ***Mineke Bosch*** *(University Groningen, Groningen, the Netherlands),* ***Kaat Wils*** *(University of Leuven, Leuven, Belgium)*
Chair: ***Kirsti Niskanen*** *(Stockholm University, Stockholm, Sweden)*

The success of scientific or scholarly knowledge is not solely based on internal, objective standards of truth, but also on institutional context and the authority and the reliability of the scientist or scholar as it is presented by the scientist and perceived by other members of the scientific community. This means that social context, as well as the presentation of a scientific or scholarly self are important aspects of epistemology, as Shapin already concluded in relation to his study of Robert Boyle in 1994. That is why scientific biography with a focus on scientific identity has become important in the historical study of science and the humanities. Sometime later in a theme issue of *Science in Context* the concept of the 'scientific persona' (persona is Latin for mask) was coined in order to emphasize the deeper and more permanent aspects of developing a scientific identity as an intermediate between the individual scientist and the public institution of science. Whereas in this issue a chronology of the scientific persona is presented, we argue that scientific identities are always the result of a bricolage of existing older and newer scientific roles and repertoires, depending on specific person and context.

Well-known repertoires are the otherworldly hermit-like scientist that is indebted to the culture of the monastery, the gentleman scientist that was based on elite aristocratic learnedness, the sick scientist that can be seen as a secular translation of the learned monk, the scientific genius that is indebted to the romantic cult of the genial artist, the scientist as entrepreneur who came to be a reliable spokesman for science even as a moneymaker in the age of capitalist science. The examples suggest that there is a connection between social and scientific authority and power, and that scientific personae are based on a combination of social and scientific identities. This means that categories of social difference such as gender and race will have an impact, and that for black and white women and black men, or for white men of 'humble origins', it may have been and may be still more difficult to create a convincing scientific persona than for white men of bourgeois backgrounds. The different ways in which repertoires can be mixed and performed, however, also offers opportunities for 'outsiders' to present themselves as reliable spokespersons for science.

In the proposed panel, we will approach the history of scientific persona while focusing on the impact of the wider social and cultural context of gender, race and class. The main questions will be the following:

How were black male and female scholars able to reconcile black stereotypes with repertoires of white male scientific personae? What were the advantages and what the pitfalls for black and white women to appropriate 'masculine repertoires', what roles were successfully performed by black and white women and how? Are there examples of black and white women or female and male blacks who did not succeed in forging a reliable and convincing persona?

In answering these questions we will pay attention to the kind of sources that are appropriate for the study of scientific persona.

Keywords: scientific persona, gender, race, class, scientific travel, scientific identity, black and white women scientists, female and male black scientists

Marianne van Herwerden's metamorphosis: from secluded laboratory scientist to American style researcher (ID 159)

Mineke Bosch *(University Groningen, Groningen, the Netherlands)*

In 1920 the Utrecht University based biomedical researcher Marianne van Herwerden (1872–1834) received a grant from the F. C. Donders fund for a three-months trip to several research institutions in the US. During her trip she wrote a series of 'Travel letters to the US' that she published in the Dutch Medical Journal. In order to study Van Herwerden's scientific identity or 'persona' I decided to read these travel letters against several other sources: her publications of 'general cultural interest' in cultural magazines and weeklies, a few autobiographical pieces addressed to a female public, and last but not least, Marianne van Herwerden's semi autobiography, i.e. the biography of Marianne van Herwerden by her sister and life companion Charlotte van Herwerden (published in 1947). In this biography Van Herwerden's American adventures figure prominently with 80 out of 229 pages. Actually the report of her American journey consists of a collage of selections from the published letters as well as the private letters to her sister, some essays that Van Herwerden published in other journals and even abstracts from a travel diary. For the analysis I mingled a rhetorical analysis and/or a historical (discourse)analysis, asking questions about the text and the context such as: for whom did she write, why did she do it, how did she do it? What does she see in the American laboratories and how did she report her observations? How did her public letters differ from the private reports? I will then try to answer the question of what this can tell us about her self-fashioning and persona formation before and after her trip. In what way give the letters testimony of the American based scientists' scientific personae? What repertoires of the scientist can be recognized? And how did these encounters change her way of being a scientist?

Keywords: scientific persona, woman scientist, research trip, travel letters, autobiography, discourse analysis

'… we did not think his appearance was negroid enough to be any handicap.' Rudolf van Lier becoming a scientist. (ID 122)

Margriet Fokken *(University of Groningen, Groningen, the Netherlands)*

In this paper I analyse how the sociologist, historian and poet Rudolf van Lier (1914–1987) appropriated and negotiated his Jewishness, Creoleness, and Surinameseness in the early stages of his scientific career. Van Lier was born in Suriname, at the time a Dutch colony, into a Jewish family. He left Suriname at a young age to continue his education in the Netherlands, later also studying in Paris and Chicago. At the end of his life Van Lier reflected that he had not often encountered discrimination, being a light colored Creole from a well-to-do family. However, he also stated his Dutch teachers had held all sorts of stereotypical views of persons from Suriname and that he had to prove these preconceived ideas wrong. When he applied for a fellowship of the Rockefeller Foundation (RF) in 1947, which would enable him to study with some acclaimed sociologists and anthropologists in the United States of America, the officials at the RF discussed whether him being 'one-quarter Negro' would be a 'handicap'. Van Lier's race, religion and cultural background raised questions in the different academic settings that he frequented in the early stages of his career. I show how this led Van Lier to self-consciously construct the 'mysterious paradoxical personality' that his former students ascribed to him at the end of his career.

Keywords: Scientific persona, race, religion, Suriname, identity, discrimination, Dutch, sociology, history

Scholars as servants of the nation on the home front and in the field: Elsa Enäjärvi-Haavio and Martti Haavio (ID 134)

Lisa Svanfeldt-Winter *(Stockholm university, Stockholm, Sweden)*

During the Second World War, Finland stood twice in war against the Soviet Union. While the first war was easy to justify for the people as a defence, the second, in which also previously non-Finnish areas were occupied, required more justifications. Science and scholarship were actively used to convince that the occupied areas naturally and historically belonged to Finland. This paper uses the concept *scientific persona* to examine how taking part in the war as experts affected Finnish folklorists' possibilities to both use and gain academic authority and legitimacy.

The spouses and folklorists Elsa Enäjärvi-Haavio and Martti Haavio are used as case studies. Elsa Enäjärvi-Haavio held during the war patriotic radio speeches and wrote articles, mainly addressed to women. She talked about the past of the Finnish people, explaining how the occupied areas in Carelia were part of a cradle of Finnish culture. Martti Haavio was summoned to the military forces, where he took part in the military actions, but also had responsibility to act as educator of the soldiers. He also participated in a government lead scientific expedition to the occupied areas, where he conducted folkloristic research. The paper argues that the scholars' statuses as experts were used in order to make an effort for the country, but that the participation also formed their scientific personae towards more respected and influential scholars. Moreover, it argues that gender had an important impact on how the expertise was used and the persona shaped as a result.

The study leans on correspondence and diaries of the couple, Enäjärvi-Haavio's notes for her speeches in radio and her published articles, and documents sent to the military head quarters to state reasons why Haavio was a trustworthy scholar, who the state would gain from sending to the occupied areas.

Keywords: Scientific persona, Gender, Nationalism, Second World War, Authority, Folklore, Finland, Couples

Eileen Power and scientific persona: the role of the Albert Kahn Around-The-World Fellowship (ID 196)

Rozemarijn van de Wal *(University of Groningen, Groningen, the Netherlands)*

The focus of this paper is the importance of scientific travel in the formation of scientific personae, specifically for the case of the British medieval historian Eileen Power. In 1921, Eileen Power became the first and only woman to ever hold the British version of the prestigious Albert Kahn Around-The-World Fellowship. The aim of the fellowship, was to enable young university teachers still at the beginning of their career to gain travel experience otherwise unobtainable, while at the same time furthering internationalism and open-mindedness. Eileen Power spent her fellowship traveling through Asia, submerging herself into different cultures and customs. Even though this was not a standard scientific travel experience aimed at research, her year as a Kahn Fellow influenced her scientific career and the way in which she 'fashioned herself' as a scientist, in some sense even quite literally, as Eileen Power after her return started to dress up in beautiful elaborate Asian gowns which were commemorated and commented upon in nearly all her obituaries.

By analyzing the wealth of material available for Power's travels, insight can be gained into how her journey through Asia influenced her scientific persona and in turn her scientific career. In what way was Power's scientific persona influenced by her year as a Kahn Fellow? Did it help her overcome certain boundaries of gender and enhance her scientific credibility, and how? In other words, how did the Albert Kahn Around-The-World Fellowship help Eileen Power gain recognition as a successful historical scholar?

Keywords: Eileen Power, Albert Kahn Fellowship, Scientific Personae, Scientific Travel

Symposium 123: Astral Sciences and Power in Europe and China

Organizers: ***Matthieu Husson*** *(CNRS, SYRTE-Observatoire de Paris, Paris, France),* ***Liang Li*** *(Chinese Academy of Sciences, Beijing, China)*

Soon after the beginning of the second millennium of the Common Era but on opposite sides of the Eurasian continent, a similar astronomy based on Islamic *zijes* was practiced in Europe and in China. Certainly the *Huihui li* astronomy that derived from the eastern traditions of Islamic *zijes* can be contrasted in many respects to the 'Toledan' and then 'Alfonsine' astronomy that flourished in Europe as adapted from western traditions of Islamic *zijes*. Both traditions are rich and diverse, but they have retained common points from their Islamic origin. They share some basic Ptolemaic cosmological assumptions, the same use of large sets of numerical tables associated with complex procedures, and, to some extent, their metrologies and use of sexagesimal numbers. The astral sciences in Europe and China are, because of the influence of *zijes*, like sisters separated at birth to be reunited only in the 16th century. It is therefore possible to carry very precise and fruitful comparison between astral sciences practiced in Europe and China in the second millennium.

In contrast with the situation of the astral sciences, the political, religious, economical and sociological power structures in Europe and China are obviously very different. This is certainly also true for the respective scholarly worlds. In China the astral sciences were for the most part an official imperial prerogative, the methods to compute the official calendars were cultivated and kept secret in dedicated administrations often close to the centres of imperial power. From the 16th century onward, the Jesuits soon understood the situation and tried with mixed success to reach these centres of imperial power through a diplomatic use of the astral sciences. In Europe, Islamic astronomy was first practiced in cathedral schools and universities. At least some royal courts were also deeply interested in astral sciences (Alfonso X in the end of 13th century is surely a most famous instance) and they later established observatories and scientific societies in which the astral sciences were developed.

This symposium proposes to take advantage of this singular situation to shed light on the complex relations of astral sciences and power. Relying of the diversity of each domain by analysing different episodes in Europe and China before and after the 16th century, we want to see how two astronomies sharing the same fundamental bases, and a common origin, could relate to two distinct system of powers. What types of constraints, resources and opportunities did these systems of powers impose on the astral sciences? What where the mechanisms of their influences on the astral sciences? What were the consequences for the astral sciences as such? Reversely, how did different powers use the astral sciences to various political, diplomatic and ideological ends? What, lastly, made the astral sciences relevant for these purposes?

Keywords: Astral Sciences, China, Europe

Doors Open and Shut: The Bureaucratic Insulation of the Astral Sciences in Imperial China and the First Waves of Foreign Influence (ID 124)

Daniel P. Morgan *(CNRS, SPHERE-Paris 7, ERC Project, Paris, France)*

It was its closed, official nature that stood out about the practise of astronomy in China to early Western observers from Matteo Ricci to Joseph Needham—government control so strict, for example, as to have effectively segregated Chinese and Islamic traditions behind closed office doors for the better part of a millennium. Such was not always the case. In this paper, I will discuss how the culture of bureaucratic isolation emerged over the first millennium CE through public bans, institutional restructuring, and reforms in office education, testing and recruitment. What legendarily began as a hereditary office in pre-imperial times had become, by the second century BCE, a nexus of outside talent and public debate. From 104 BCE to 420 CE, for example, only 31 percent of office-holders named as contributing to state astronomical policy actually held a post in the Clerk's Office, and those

who did were usually the first in their family to do so; the history of the eighth-century office, by contrast, is one of family clans. For a time, the clans that ran this office were of foreign ancestry—the Indian Kāsyapa, Kumāra and Gautama, replaced by the Nestorian Li—but Indian and Persian technical knowledge ended up having little manifest influence on their Chinese colleagues' practices. This paper will use the case of this first wave of foreign talent and transmission to examine how much the scientific and office culture of these centuries had changed since the Han, and how it adumbrated the conditions of later dynasties.

Astronomy and religion in late medieval England (ID 125)

Seb Falk *(Cambridge University, Cambridge, UK)*

The Catholic Church played an important role in fostering and governing astronomy in medieval Europe. Astronomy was overwhelmingly taught, practised and developed in religious settings such as universities, monasteries and religious schools. Astronomers were often monks, clerks and friars, and their motivations for studying the stars were avowedly religious. This is well known. But how did these religious contexts affect the content of late medieval astronomy?

This paper will present the initial findings of a new research project into English monastic sciences. Although the universities – particularly Oxford – were the home of England's most notable astronomers, such as William Batecombe and John Killingworth, the monasteries were also home to important astronomical developments, most obviously the complex astronomical clock designed for the abbey of St Albans by Richard of Wallingford. Papal edicts ensured that monks received astronomical training and access to new texts, tables and instruments. The monastic context influenced the astronomy practised there in subtle ways: the vow of "stability" taken by monks may have been a cause of the differences between the products of their astronomy and that of friars such as John Somer and Nicholas of Lynn. It will be shown that the diverse influences of religious belief and authority resulted in varied astronomies across the range of late medieval settings.

The struggle of western astronomy in China: conflict of planetary motion between 1634 and 1635 under the Chongzhen reign (ID 126)

Liang Li *(Chinese Academy of Sciences, Beijing, China)*

The calendrical system had always been of utmost political and symbolical importance in ancient China. The reasons for calendrical reform were various. Some were "scientific", while others were more purely political and social. Reform provoked debate on issues as wide-ranging as the reasons for reform itself. "Accuracy" was a key factor, but it was by no means the only one at play.

At the beginning of the Ming dynasty (1368–1644), the court took up their predecessors' astronomical system, and by the end of the sixteen century the need for calendrical reform was felt acutely amongst officials; several proposals were put forward. Xu Guangqi (1562–1633) who had long emphasized the European science, resorted to western astronomical system, and he was commissioned to set up and supervise the new Calentrical department (*Liju* 曆局, or Western Calentrical department) in 1629. In order to carry out the calendrical reform, several Jesuits such as Johann Schreck (1576–1630) and Adam Schall von Bell (1592–1666) were employed by the Western Calentrical department. During the following years, the Western Calentrical department produced a number of works on mathematical astronomy that were presented to the emperor. Even though the Western Calentrical department claimed the superiority of western astronomy to the Chinese traditional one and attempted to proof this assertion, the emperor Chongzhen (r. 1627–1644) was reluctant to implement the new system.

After the Jesuits failed to predict the eclipse of large magnitude on March 29th in the year 1634, another newly formed department, the Eastern Calendrical department (*Dongju* 東局), was set up. The Eastern Calendrical department was led by Wei Wenkui, who had modified the model of the Chinese traditional *Datong* calendrical system. He was particularly hostile to western astronomy, and also challenged the legitimacy and efficacy of the Western Calendrical department. After Xu Guangqi's death in 1633, it seems that the Jesuits' other protectors amongst high officials were not in a position to carry through the reform according to his initial proposal.

In order to defend the credibility of Western astronomy, the Western Calentrical department planned to resort to a new competition on the calculation of the planetary motion, which was thought to be the weakness of Chinese traditional system. In the November and December of 1633, the Jupiter was repeatedly observed and the displacement between Jupiter and Praesepe (M44, Galactic cluster) was resorted to examine the accuracy of the predictions, and in the following two years, the motion of Jupiter was successively pursued. On the other hand, the motion of Venus, Mars and Saturn was crucially tested by the conjunction of different planets. Behind these activities, the serious conflict between Eastern Calentrical department and Western Calentrical department occurred continuously, and the fighting happed in many aspects including the rationale of calculation, measuring units, astronomical instruments and so on.

John of Murs and John of Lignières pragmatic uses of their social and institutional environment (Paris, 14th century) (ID 127)

Matthieu Husson *(CNRS, SYRTE-Observatoire de Paris, Paris, France)*

John of Murs and John of Lignières are two major figures of the Parisian astronomical milieu that, between 1320 and 1330, shaped what is now denominated the Parisian Alfonsine Tables. Their works soon circulated in England, Italy and Central Europe and were the basis of tabular astronomy for about two centuries. Although both of them were related to the faculty of arts in Paris many of their works are also inscribed in other institutional settings: secular and religious courts, monasteries and religious orders. These variety of contexts offered different constrains, opportunity and audiences with which John of Murs and John of Lignières negociated through their career. However the interactions between the two astronomers and this diversity of institutions was not limited to the search of patrons, protections and resources. Relying on a variety of texts -including John of Murs' *Expositio*, Eclipses notes in the Escorial O II 10, *Tabule permanentes*, *Epistola super reformatione antiqui kalendariii* and John of Lignières' *Tabule magne* and second *equatorium*- this paper will show how the two astronomers developed a pragmatic use of the opportunities offered by the various institutional settings in which they worked in order to propose important innovations in the way numbers were manipulated, tables and computations shaped and observations reported.

The conflicting cognitions on fixed stars in the calendar reform in late-Ming China 1629–1644 (ID 128)

Ding Ming *(University of Science and Technology of China, Hefei, China)*

Astronomy played an important role in the Jesuit missions in China from the sixteenth century. The urgent need for calendar reform provided opportunities for the Jesuits to enter the court of China. In 1629, the new proposal for calendar reform was accepted by the Emperor Chongzhen (r. 1627–1644). Committed with the calendar reform under supervision of Xu Guangqi 徐光啟 (1562–1633), the Jesuits resorted to the Tychonic world system to modify Chinese traditional calendric system. The result of this work was the publication of a set of books named *Chongzhen lishu* 崇禎曆書 (Books on calendrical astronomy of the Chongzhen Reign), which introduces the western astronomy systematically. At the

same time, the rise of western astronomy in the calendar reform also aroused strong opposition against it. The acute conflicts between promoters and opponents of the western astronomy reflected both power struggles and cultural tensions.

This article focuses on the contents concerning fixed stars in *Chongzhen lishu* and tries to tell the differences of the understanding of fixed stars between promoters and opponents of the reform. The conflicts between both sides can be revealed in the literature *Zhili yuanqi* 治曆緣起 (the collected memorials concerning the reform of the calendar), one part of *Chongzhen Lishu*. The western theories and methods of the observation and mapping of fixed stars were introduced in *Hengxing lizhi* 恒星曆指 (Gist of the Calendar of the fixed stars, a part of *Chongzhen lishu*) in details. *Chongzhen Lishu* also contains several star charts, including *Chidao nanbei liang zongxing tu* 赤道南北兩總星圖 (General Star Map of the Southern and Northern Hemispheres Divided by the Equator), *Jianjie zongxing tu* 見 界總星圖 (General Map of the Visible Stars), etc. Some of the star charts were based on Western star-atlases, while others integrated Chinese traditional star-atlases and European methods of star-mapping. Together with reference to some other materials, this article tries to clarify the various cognitions on fixed stars in late-Ming China.

Controlling the Calendar in Early Modern Europe: Astronomical Knowledge, Printers and Civic Authorities (ID 129)

Richard L. Kremer *(Darmouth College, Darmouth, USA)*

From the very beginning of European typographic printing in the 1450s, annual almanacs and prognostications poured from the early print shops. Printing historians estimate that 28,000 separate editions were printed before 1501; among those are more than 1000 editions of annual calendars. This genre quickly standardized in both format and content. The almanacs, usually broadsides, present calendrical information on the moveable Christian feasts, the dates and times of eclipses and syzygies, and medical rules for bloodletting based on the Moon's motion and medieval medical theories. The prognostications, usually a single quire of 8 to 12 leaves, provide astrological interpretations for the significant astronomical phenomena of the coming year, plus more general predictions for weather, war and peace, fertility and various social groups (kings, clerics, miners, farmers, merchants, etc.). In both types, the calendar makers invariably took their astronomical predictions from the Parisian Alfonsine Tables that had emerged in the 1320s and had soon circulated widely across Europe.

Although printers generally organized the production of these calendars, university faculties, medical guilds, city councils and even the French court quickly moved to regulate and control the printing of this material. By such regulations, these authorities sought to unify medical practices, protect local printers against 'foreign' competition, and (in some cases) to support their friends and punish their enemies. Drawing on examples from the 1430s (even before printing) through the 1530s, this paper will show how printers sometimes followed, sometimes negotiated with, and sometimes evaded the civic authorities who wanted to control local calendar making. And it will argue that the astronomers produced their predictions by consistently deploying the Parisian Alfonsine Tables. The "power" of the Alfonsine Tables in producing astronomical knowledge, it would appear, exceeded the "power" of the local authorities seeking to control that knowledge.

Astrological or Political: The Interpretation of Comets in the Time of the Crisis of Empire of Qing China (ID 137)

Ting Chen *(University of Science and Technology of China, Hefei, China)*

In the late 19th century, Qing China's Astronomical Bureau continued the astronomical calculation of the 17th–18th centuries, and in fact making astrological interpretations remained the main function of this institution. However, astrological information was not as restricted as it had been earlier, because, after the introduction of western astronomy it was easy to obtain information about celestial phenomena through other channels. The reactions that the proponents of traditional astrology on one side and the supporters of Western learning on the other side had when faced with certain astronomical observations will be discussed through two sightings of comets.

The first sighting is the Great Comet in 1881 (C/1881 K1) and the Great September Comet（C/1882 R1). When the two comets were visible in China, some Chinese official agencies, such as the astronomical bureau *Qintian Jian* and the government school *Tongwen Guan*, and some amateur astronomers observed and recorded them. Astrological interpretations of the comets were important.

The second case concerns comets visible just before the Chinese Revolution of 1911. Then, the atmosphere of imperialist aggression contributed to the transformation of the elites that gradually divided into two groups, the Revolutionaries and the Constitutionalists. In 1907 Comet C/1907 L2 (Daniel) appeared and caused wide public concern. In order to urge the Qing Government to focus on constitutional reform, the constitutionalists spared no effort in criticizing the absurdity of astrology. To the contrary, the revolutionaries seized the chance to hint at a relationship between apocalyptic cometary predictions and violent actions. In 1910, mass attention was paid to the return of Halley's Comet, which gave the revolutionaries another chance to predict that the Qing Empire would be destroyed with the arrival of the comet. The constitutionalists tried to prevent these rumours from spreading, but they failed to do so. Consequently, the character of apocalyptic prognostication shifted from mere prediction to concrete advice on how to act and, ultimately, pursue revolutionary agitation.

The two cases discussed above reveal that, in times of crisis of empire, astronomical knowledge was still interpreted in the traditional astrological way, even after Western scientific learning had long been known among the literate elite. It could even still act as an instrument for the political factions to attack each other.

Keywords: comet, Halley's Comet, crisis of empire, Chinese astrology, 1911 revolution

Symposium 142: Science, Medicine and the State: The Revolution of Chinese Medicine in Modern China

Organizers: ***Xi Gao*** *(Fudan University, Shanghai, China),* ***Yuan Yuan*** *(Donghua University, Shanghai, China)*

Chinese Medicine has changed a lot since the introduction of Western medicine by Christian medical missionaries in the early Nineteenth Century. Ever since then, Western medicine has flourished in China; meanwhile, Traditional Chinese Medicine (TCM) has faced great challenge and tried to blend itself with science and modernization till this day. The process of this revolution of Chinese Medicine is very important in the history of Chinese Medicine. There have already been many important researches on this topic, such as Bridie Andrews' The making of Modern Chinese Medicine,1850～1960 (University of Hawai'I Press,2014), etc.

Based on these former researches, our symposium mainly concerns on three powers that exercise great influences on the revolution process of Chinese Medicine in modern China: Science, medicine itself, and the state. The relationship among these three powers and which power is the main force in the course of the reform will be fully discussed.

For details, this symposium will offer talks from different kinds of Medical practices and powers in Modern China:

1, The State Medicine. The Nationalist Government's Ministry of Health issued an Administration Plan entitled "State Medicine System Regulations" that announced its public health policy on April 1930. This talk will concern on the Government's attempt in the construction process of Public Health System in Modern China.

2, The first Attempt in Standardizing TCM Disease Terms in the 1930s. The first attempt to standardize TCM disease terms was undertaken by the National Institute of Chinese Medicine in the Republic period. This talk will try to analyze the progress and the result of this attempt, finding out that this attempt failed at last. the power of the science, tradition, and the state are equally important factors in the progress of the TCM revolution.

3, Medicine is an important strategy frequently used both by Catholic Missionaries and Protestant missionaries in China. This talk will try to give a complete comparison between Catholic Missionaries (especially the Jesuits) during 16th–18th centuries and Protestant missionaries in China in 19th century, and analyze the reasons of the difference and similarities.

4, Missionary hospitals and TCM. Missionary hospitals greatly influenced traditional Chinese Medicine in modern China. This talk will research on the medical practices and medical education activities in the missionary hospitals in Shanghai, discuss their influence on the TCM.

5, Acupuncture is one of the most important essential component of TCM. This talk will discuss several changes of Acupuncture in 1950's China. In comprehensive survey of these transformations, we can see that the power of government is the most important factors in the diversions of Acupuncture in that period.

6, Uyghur Medicine in Xinjiang (1949–2011). After the establishment of the People's Republic of China in 1949, Xinjiang has been the most important academic centers of Uyghur Medicine, and the "state-led" model has been gradually established. This talk will discuss the "State-Led" model in the development of Uyghur Medicine.

Keywords: Traditional Chinese Medicine, Western Medicine, The State Medicine, National Institute of Chinese Medicine, Medical missionary, Missionary hospital, Acupuncture, Uyghur Medicine, Modern China

The State Medicine: an idea and practice movement in Modern China (ID 143)

Xi Gao *(Fudan University, Shanghai, China)*

The Nationalist Government's Ministry of Health issued an Administration Plan entitled "State Medicine System Regulations" that announced its public health policy on April 1930. From then on, "State Medicine", as a disputable public health policy had influenced the Ministry of Health in the construction process of its Public Health System for nearly 20 years until 1949. Regards to research on Chinese health system construction and development of public health have made remarkable achievements both in Chinese and foreign academic. But there are rare papers concerning to "State Medicine" in Chinese, although it never hasn't been ignored by foreign scholars. As one part of Western medicine introduced to China, the initial aim of "State Medicine" issued in China was different from the Western which was the result of industrialization and urbanization. Chinese Health administrator thought "it is very important to promote rural public health services since more than 85% of the population lives in rural areas. State Medicine is the only policy to push rural public health services and medical care to the utmost." Namely, the Government attempted to take responsibility for rural public health services, which was the first time announced by the government in the Chinese History.

However, as some researcher has pointed out that "State medicine" was a strategy of Chinese government tried to build medical modernization instead of Traditional Chinese Medicine. In fact, the rural people couldn't become the main target of Republic China government and "State Medicine" was bound to fail since they paid more attention to solve the conflict between the State and the private, especial the private practitioners (both of Western doctors and Traditional Chinese doctors) and private medical enterprise after the year of 1937. State medicine for creating models and how to advance its development, the health officer and the medical elite has a different plan based on their different belief and objective for building Chinese new medical and health system.

Keywords: The State Medicine, the Nationalist Government's Ministry of Health, Public Health System, Modern China

Science, Tradition, and State: The first Attempt in Standardizing TCM Disease Terms in the 1930's (ID 144)

Yuan Yuan *(Donghua University, Shanghai, China)*

The history of standardizing scientific terms has always been concerned in the history of science for scientific terminology is an essential ingredient of the modern scientific institutionalization in China. The situation is the same in the field of history of medicine. Many scholars have discussed the progress of standardizing western medical terms in China by far. The work of standardizing western medical terms in China has already started in the early Nineteenth Century when the Chinese Medical Missionary Association appointed a committee to work up the subject of medical nomenclature. In contrast, the work of standardizing Traditional Chinese Medicine (TCM) terms hasn't been valued and supported until the 21st Century. The first attempt to standardize TCM disease terms was undertaken by the National Institute of Chinese Medicine in the Republic period. This paper tried to study the progress and the result of this attempt. The resulted showed that this attempt failed at last. It triggered a nationwide controversial debate from the beginning and wasn't accepted by the Traditional Chinese doctors. On the other hand, the work of standardizing western medical terms was very successful in the same period. The result implied that the power of the science, tradition, and the state are equally important factors in the progress of the TCM revolution.

Keywords: Disease Terms, Traditional Chinese Medicine, National Institute of Chinese Medicine

The Diversion of Acupuncture Impacted by Policy Factors in 1950's China: Zhu-Lian and New-acupuncture (ID 146)

Shu-jian Zhang *(Nanjing University of Chinese Medicine, Nanjing, China)*

Ms. Zhu Lian, a famous acupuncture scholar and high government official in 1950s China, constructed the "New acupuncture" theoretical system. Based on western medical theories (e.g., neurology), the "New acupuncture" system was very different from traditional Chinese acupuncture that essentially "dressed up" ancient Chinese philosophy. During the first half of the 1950s, the Chinese government had been heavily promoting the political movement of "Scientification of Chinese Medicine", so Zhu Lian's "New acupuncture" theory became highly respected due to governmental support. Zhu Lian's monograph entitled *New acupuncture* was recommended to Chinese medical schools for use as a textbook, while traditional acupuncture books were considered old, backward, and were quickly being abandoned by schools. Things began to change in 1954. The government started to veer away from its previous policy towards Chinese medicine that year. The movement of "Scientification of Chinese Medicine" was gradually replaced by another political movement, "Western Doctors Learning from Chinese Doctors". The ideas of Zhu Lian and her "New acupuncture" system was probably in great contrast to, and disharmonious with the new atmosphere of fanatical advocation of traditional medicine, and it was criticized by the authorities. Meanwhile, traditional acupuncture books were reintroduced into Chinese medicine institutes and universities. Had there not been government intervention, the so-called "New acupuncture" system could have led Chinese acupuncture theory onto a more innovative way in the middle of last century. As a result of the failure of "New acupuncture," Chinese acupuncture theory reverted to the old traditions.

Keywords: Ms. Zhu Lian, "New acupuncture" theory, Acupuncture Academic History

Frontier Experiences in Modern National Construction of China: From the Perspective of Medical Images (1950–1977) in Xinjiang (ID 120)

Junchen Wei *(Sun Yat-sen university, Guangzhou, China)*

This paper analyzes the relationship between medical images and national construction in Xinjiang region in 1950s, 60s,70s, focusing on pictures such as news photographs, illustrated magazine, and propaganda posters. The formation of modern China has been seeking a balance between the historically inherited diversity and homogeneity of modernity. In the perspective of "state", under the context of frontier in the early days after the Communist Party of China declared the founding of New China, one of important aspects of "nation-building" is constructing its own legitimacy through medicine. Its internal logic is similar to the "medical imperialism" in the 19th century, but more importantly, it contains dimension, which seems quite human, of identity, sense and values. Medical treatment, as a substantial technology, plays a role of mediating individuals and the country, especially in national region, where hospitals were established and promoted firstly by the army, then mainly managed by the country, and therefore are closely related to state power. Meanwhile, medicine is also a kind of tangible channel for infiltrating national ideology and consequently producing direct emotional and conceptual results among the mass. Therefore, using medical images the country delivers such powerful messages: the development of frontier region, the acceptance of science (western medicine), the identity of the state, and so on. The organizational forms of modern hospitals and modern state are in some way isomorphic, that is, the core of the organization is standardization and homogenization. This paper is seeking to read the metaphor of medical images from the perspective of class, gender, state and common people, and thus shows that medical technology surpasses the meaning of "object" itself and embraces some transcendent meaning of the state and society. On the other hand, this paper hopes to contribute the understanding of national identity in modern China through revealing the fact--the country promotes regime construction by medical technology and medical images reflect such process.

Keywords: medical images, national identity, modern national construction, science and technology, state power

A New Medical Order in China: Dissection, Research and Power (ID 459)

Núria Pérez-Pérez *(CEHIC (Universitat Autònoma de Barcelona), Bellaterra, Spain)*

In the eighteenth century the development of modern surgery was determined for an increasing demand of well medical trained personnel able to attend the several fronts opened in Europe as well as for the overseas expeditions. For instance, in Spain, the Royal Colleges of Surgery supposed the most important enlightened medical institution created by Spanish Bourbon monarchy and that was the subject of my doctoral dissertation. The use of dissections as an essential tool in order to know the nature of disease processes reappears when western doctors and surgeons favoured and contributed to the spread and transmission of the European enlightened science heritage through East Asia, mainly China and Japan. In this sense, the study of the establishment of modern medicine in East Asia (19th–20th centuries) is the subject I am developing as a work in progress.

This communication aims to highlight how surgery and medicine served the transmission of western science in East Asia as an instrumental knowledge. In the case of China, the Rockefeller Foundation projects were in large measure an effort to build a base for technical expertise in order to lay rational foundation for social reform. In 1914 in New York, the Commissioners published their first report about this country and in this communication I would like to emphasise its fifth chapter which is focused in the question of dissection and autopsies. The report justifies the use of dissections as an essential tool to teach the nature of disease processes and fundamental for many types of research.

Keywords: surgery, Rockefeller Foundation, China, dissection, medicine, social control, XXth century

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Symposium 149: Power and Authority in 20th Century Childbirth

Organizers: ***Paula Michaels*** *(Monash University, Melbourne, Australia),* ***Ema Hrešanová*** *(University of West Bohemia, Plzeň, Czech Republic)*
Chair: ***Ema Hrešanová*** *(University of West Bohemia, Plzeň, Czech Republic)*

In keeping with the theme of the EHSH Conference, this symposium seeks to illuminate the varied ways that science defines the twentieth-century experience of childbirth. With papers on caesarean section and consent in the United States (Jacqueline Wolf); medicalization of American home birth (Wendy Kline); efforts to humanise maternity care in socialist Czechoslovakia (Ema Hrešanová); and the trauma of birth as understood in North American and European psychological theory (Paula Michaels), this panel explores the medico-scientific engagement with birth practices from the perspectives of the social history of medicine, intellectual history, the history of psychology, and women's history. The participants draw on published sources, archival documents and oral histories to conceptualise questions of power and authority in the clinical encounter, as well as the social construction of the body and mind.

This topic coheres with a number of sub-thematic topics, but most closely speaks to (D) Science, Technology and Power in Specific Circumstances. At once both a universal human experience and an extraordinary life-cycle event, childbirth offers a rich case study in the negotiation of science and power. Whether a midwife or a physician, the maternity caregiver brings to bear on the experience of childbirth an authority that stems from learning and observation and is enacted through the specialised and technical language of medicine. The birthing woman lacks the caregiver's bona fides, but possesses senses that generate somatic knowledge about the unfolding birth process. In the context of a hospital-based, technocratic birth she finds her body's information discounted, trumped by the weight of evidence offered by expert opinion and technology. These four papers explore how a scientific understanding of childbirth works to enact relations of power and the ways that women themselves at times express agency through the active support of obstetric power and at other times seek to resist that power.

Keywords: childbirth, psychology, caesarean section, home birth, Leboyer, Freud, Rank, consent, risk

Using Risk to Exert Power: Obstetricians, Cesareans, and Consent (ID 151)

Jacqueline Wolf *(Ohio University, Athens, USA)*

In the 19th century, the maternal death rate after a cesarean exceeded 50% in the United States and Europe. Consequently, physicians avoided the surgery. On the rare occasion that a doctor believed a cesarean offered a slim chance of saving a woman who otherwise would die, he sought consensus from all present before proceeding, including the patient. Obtaining consent allowed physicians to share the risk of a surgery likely to end in the patient's death.

By the last decades of the 20th century, asepsis, innovative surgical techniques, antibiotics, and the ability to store and transfuse blood had rendered cesarean surgery largely safe. The onus of risk shifted—to vaginal birth. Between 1965 and 1987, the cesarean section rate in the United States soared 455%—from 4.5 to 25% of births. Edward Hon, the obstetrician who introduced the electronic fetal heart monitor in 1969, articulated one reason for the precipitous rise. He noted with dismay, "They're dropping the knife with each drop in the fetal heart rate." Interpreting the monitor's readings as an emergency in the making, obstetricians now elicited consent from the patient by invoking the specter of risk associated with vaginal birth. Women often expressed gratitude for the subsequent surgery, reporting that without a cesarean they or their child would surely have died.

This paper, using data culled from magazines, obstetric texts, obstetricians' personal papers, and oral history interviews with mothers and obstetricians, argues that while early 20th-century physicians elicited a patient's consent for a cesarean birth as a means of sharing risk, late 20th century obstetricians

employed risk as a threat to obtain consent. While the patient was in the throes of labor and especially vulnerable to professional influence, doctors exercised their power to imply that the patient herself would shoulder all risk if she refused cesarean surgery.

Keywords: childbirth, risk, consent, cesarean

The Politics of Place: Joseph DeLee, home birth, and the rise of modern obstetrics (ID 152)

Wendy Kline *(Purdue University, West Lafayette, USA)*

Recent media coverage of the increasing popularity of out-of-hospital births in the U.S. and Europe has generated a widespread debate about the politics and place of birth. Is it safer to give birth at home or in the hospital? Does modern technology and medical intervention utilized in hospitals improve or worsen birth outcomes? While there remains much disagreement, the 2014 British Birthplace study, which reviewed 64,000 low-risk births in different settings, suggested that the risks of over-intervention in the hospital may outweigh the risks of under-intervention at a birth center or home for healthy women. Yet most women today choose to give birth in the hospital. How and why did out-of-hospital birth come to be viewed as dangerous and undesirable? Many historians of science and medicine have tackled these questions and offered important evidence of the medicalization of childbirth and the growing influence of obstetrics in the 20th century.

Yet more work needs to be done. This conference paper will address the increasing bifurcation of birth practices in the mid twentieth century (home vs. hospital) by looking at the influential role of Dr. Joseph DeLee and his Chicago Maternity Center in promoting obstetrics. DeLee is one of the most influential figures in 20th century American obstetrics, and was determined to wrest control of childbirth from midwives to obstetricians. Yet he was also keenly aware of the value of exposing medical students to the natural process of birth that occurred outside of the hospital. His creation of the Chicago Maternity Center in the 1930s played a pivotal role in promoting the study of obstetrics – *at home*. Despite his desire to see childbirth move into a medical setting, he viewed home birth as a safe, cost effective, practical procedure in working-class Chicago. His desire to promote the home birth setting as an effective learning environment for medical students inadvertently provided justification for sustaining home birth practices in urban areas later in the twentieth century. The data and arguments created by DeLee ultimately provided key evidence that later home birth activists would use to denounce the very shift to hospital birth promoted by DeLee.

Keywords: DeLee, childbirth, home birth, Chicago, maternity

The Island of alternatives: Power and gentle birthing in socialist Czechoslovakia (ID 153)

Ema Hrešanová *(University of West Bohemia, Plzeň, Czech Republic)*

Maternity hospitals were not particularly homey and friendly places in socialist Czechoslovakia. Birthcare was highly depersonalised. Providers primarily focused on technical aspects of care and failed to give birthing women any emotional support; they treated them in a way that resembled a factory assembly line. Even though criticism of these practices periodically surfaced on pages of a major obstetrical journal as early as the 1950s, not much changed in practise throughout the whole communist era. However, in the early 1980s a few maternity hospitals introduced radically different regimes of care that constituted "islands of the alternative" within the system. In this paper I inquire into a history of a maternity hospital in *Ostrov nad Ohří,* which may serve as a paradigmatic case. *Ostrov* means an "island" in Czech and this maternity hospital truly became an island of alternative within the Czechoslovak maternity care in the last decade of the Communist rule.

Dr Hana Marková was a key instigator. Inspired by ideas of Frederick Leboyer, she gathered a team of medical experts who were dissatisfied with the depersonalised hospital care and helped her implement an alternative model of "gentle" birthcare. Leboyer was a French obstetrician severely criticizing modern maternity hospitals for ignoring emotional needs of newborns and their mothers. Focusing particularly on a baby's transition from a womb to the outer world, he proposed a set of particular procedures and arrangement changes easing this process. To put them into practice was, however, not an easy task, complicated even more by a fact that Marková was seen as politically objectionable for her public protests against the Warsaw Pact invasion in 1968. I shall explore political and social factors and power dynamics at individual as well as institutional levels, which enabled this peripheral hospital to become a headline of socialist birth care.

Keywords: Czechoslovakia, maternity, Leboyer, childbirth, Marková

The Twinned Histories of Birth Trauma (ID 150)

Paula Michaels *(Monash University, Melbourne, Australia)*

The history of trauma has been written entirely as a straight line from the emergence of the shell shock diagnosis in World War I to the entrance of Post-Traumatic Stress Disorder (PTSD) into the Diagnositic and Statistical Manual (DSM) in 1980. The single thread of the soldier's experience of psychological trauma defines our understanding of how trauma evolved as a diagnostic category, rendering invisible the many and varied ways that trauma was used and understood prior to 1980.

This paper examines one arena in which psychologists frequently invoked the concept of trauma: childbirth. Birth trauma has been used historically in two ways. Following the work of Freud's onetime disciple and, later, his antagonistic Otto Rank, psychoanalysts have posited that the act of being born is itself a traumatic experience and the source of neurosis. As exemplified by the concepts of postpartum depression and postpartum psychosis, giving birth can also inflict or reactivate psychological trauma.

Based primarily on debates carried out primarily in American medical journals, but with reference tool to debates in British, French, and Soviet venues, this paper seeks to reconstruct the evolving 20th century understanding of the twinned meanings of birth trauma and in doing so the recast our understanding of the evolution of trauma as a psychological concept.

Keywords: Freud, trauma, childbirth, psychology, Otto Rank

Symposium 157: Mendel and the Uses & Abuses of the Scientific Past

Organizers: ***Gregory Radick*** *(University of Leeds, Leeds, UK),* ***Ondrej Dostal*** *(Masaryk University, Brno, Czech Republic)*
Chair: ***Ondrej Dostal*** *(Masaryk University, Brno, Czech Republic)*

In 2016, the world will mark the 150th anniversary of the publication of a scientific paper widely regarded as one of the most significant of all time: Gregor Mendel's 1866 "Experiments on Plant Hybrids." Reporting and analysing crosses of pea varieties in the garden of St. Thomas' monastery in Brünn, Mendel's paper introduced methods and concepts that, in the hands of growing numbers of "Mendelians" in the early twentieth century, went on to define the new science of genetics. Even today, in the age of genomics and epigenetics, with biologists placing ever more emphasis on the complexity of gene-environment interactions, students at every level begin their instruction in the biology of genes by learning about Mendel and his peas. Outside the classroom, meanwhile, public discussion is not of interaction and complexity but of genes, especially genes "for" this or that bodily or mental trait.

What people think Mendel discovered remains highly potent, most notably in connection with the view that an individual's makeup, culture, character and future are all "written in the genes." Such genetic determinism has long been repudiated by biologists. Yet it remains a deeply problematic and persistent doctrine. It is a social problem, because outdated ideas of genes as all-powerful determinants can lead people to make poor decisions about their health and the health of others. It is a cultural problem, in that the alternative perspectives that might facilitate a more critically minded reception of the latest "gene for" reports are culturally invisible. And it is a political problem, as it underpins the racist politics that have so badly scarred Europe in the past and that are once again resurgent.

Exploring the prospects for an interdisciplinary approach that blends the history of science with science pedagogy and material culture studies, this session brings together researchers concerned with how ways of understanding and representing genetic science's past have affected, and continue to affect, beliefs and attitudes about genes and their power. The collective aim is to open up a new angle of approach to the problem of genetic determinism and its persistence, by uniting research work in three hitherto separate areas:

- representations of Mendel's legacy and related legacies from the scientific past
- beliefs and attitudes about genes in particular and inherited "nature" in general, including essentialist notions of race
- social, cultural and political problems linked with genetic determinism, narrowly and broadly construed

Keywords: Mendel, genetics, genetic determinism, science pedagogy, material culture, race studies, China, empire

What Mendel Did for (and to) Us (ID 235)

Gregory Radick *(University of Leeds, Leeds, UK)*

In the decades following its publication in 1866, Mendel's paper on his pea-crossing experiments acquired a modest reputation among those concerned with plant hybridization. At his death in 1884, he was better known for his practical work with bees and fruit trees. All of that changed in 1900. Suddenly Mendel was being hailed as having established the foundation for a new, true, powerful science of inheritance. Within a few years there were growing numbers of "Mendelians", who rebranded this new Mendelian science "genetics", and the underlying hereditary factors they studied "genes".

Now, talk of genes is everywhere, in and out of science. So, wherever genetics is taught, is Mendel. From primary school to university, students get their introduction to the science of inheritance via the simple patterns Mendel described and, with updated vocabulary, the simple processes by which he

explained those patterns. And they learn to admire Mendel's purifying methods as having provided a royal road to scientific understanding. What did Mendel do for us? He showed, it's said, how to be scientific about inheritance -- and in doing so discovered the hereditary entity par excellence, the gene.

In this talk I want to look at the possibility that this understanding of Mendel's legacy may have a significant downside. The re-examination is inspired in part by recent historical work looking at the criticisms levelled at Mendelism back in the early twentieth century by the Oxford biometrical biologist W. F. R. Weldon (1860–1906). A major concern of Weldon's was that a Mendelian perspective misleadingly downplays interaction between heredity and environments, inner and outer. Given changes in both biology and society over the last century, this concern may be even greater now than it was then. The talk will also report on some work at the University of Leeds trialling a promising alternative way of organizing knowledge of inheritance – a "Weldonian" curriculum in introductory genetics.

Keywords: Mendel, genetics, Weldon, counterfactual history, pedagogy, genetic determinism

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'Mendel's peas', elsewhere: Mendelism, race, and the histories of human biological collections (ID 301)

Ricardo Roque *(University of Lisbon, Institute of Social Sciences, Lisbon, Portugal)*

Mendel famously drew on plant interbreeding experiments and on his collections of peas to develop novel ideas about heredity. 'Mendel's peas' thus occupy an important place in current narratives about the origins of Mendelism and genetics. Peas, in a way, are a common historical character in stories about the past of Mendelian genetics – but what about other materials, other collections? How to retell the past and present of Mendelism, if one shifts analytical focus from plants to humans, from peas to human bones, blood and tissues, for example? In the first half of the twentieth-century Mendel's ideas on inheritance travelled into the sciences of the human, impacting strongly on the development of eugenics and racial sciences in Europe. A range of human bodily materials – hair, blood, bones, or tissues -- was collected and investigated in museums and laboratories, partly with a view to address the challenges posed by the new hypotheses on heredity to ongoing debates about human racial diversity and hybridity. Either used and discussed, or simply ignored over the years, some of these collections remain a significant presence in contemporary museums and laboratories across Europe. Thus building on preliminary research in the history of race and human biological collections, this paper calls attention to the place of materiality in narrating the past and present of Mendelism and genetics – and proposes to shift focus from plants to humans.

Keywords: Race, Biological collections, Museums, Physical anthropology

Between Imperialism and Democratic Science: Reconsidering Mendel in Twentieth-Century China (ID 162)

Lijing Jiang *(Nanyang Technological University, Singapore, Singapore)*

Since the introduction of Mendelian genetics in the early twentieth century, the "official" understanding of Mendelism in China had turned from viewing it as a scientific exemplar to an example of scientific imperialism. Eventually, the restoration of a dominant Mendelian understanding of heredity in the 1980s was depicted as representing a triumph of scientific democracy in China. These turns of interpreting Mendel usually corresponded well-recognized political signposts, especially with the domination

of Lysenkoism soon after the Chinese Communist Revolution (1949) and the Chinese Economic Reform (1976). Despite the damage to science incurred by political movements in the early Communist state that suppressed Mendelian genetics, debates about Mendel's experimental practice and the political environment that cemented the impact of his idea have invoked serious reflections among Chinese biologists about the veracity of Mendelian hereditary claims and their social implications. One consequence from these reflections was that the importance of Weismann-Mendelian view had been intensely debated with a neo-Lamarckian view in China since 1956, along with experimental research on both camps, until the late 1980s. The paralleling "two schools of genetics" in China offered a case in which repositioning Mendel during the Cold War happened with a different temporality or intensity from what took place in the West or the Soviet Union.

This paper examines how leading Chinese geneticists, especially Tan Jiazhen (C. C. Tan, 1909–2008), an influential fly and primate geneticist known as the "Chinese Morgan," have appropriated the history of Mendelian genetics and their own research experience since the 1920s in reinterpreting Mendel in official debates and ceremonies. Especially, I compare how Mendelism was depicted at the 1955 Michurin Centennial, 1956 Qingdao Genetics Symposium (intended for an open conversation between the "two schools of genetics"), and the 1984 Centennial of Mendel's Death. With this analysis, I challenge the conventional view that Maoist era was a "dark age" of Chinese genetics and argue instead that it was a time in which Mendelism was critically debated in China through which its multifarious ideological implications and practical problems became understood and highlighted. At the end of the paper, I discuss potential lessons that these interpretations about Mendelism voiced by Chinese biologists could offer to our understanding of Mendel and Mendel's legacies today.

Keywords: China, 1956 Qingdao Symposium on Genetics, Mendelian Genetics, Michurin Biology

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Biology Textbooks Between Science and the State: The Case of Mendelism in Sweden (ID 253)

Niklas Gericke *(Karlstad University, Karlstad, Sweden)*

School curricula are means for the state to express current established ideas in society. In this paper a study will be proposed on how the concepts of *Mendelian genetics*, *genetic determinism* and *race* have been enlisted into pedagogy over time in Sweden. In order to investigate this historical process, an analysis of the evolution of school biology textbooks as well as all curricula from 1900 to present, i.e. from the rediscovery of Mendel until today, using the *Anthropological Theory of Didactics* (ATD) (Bosch & Gascón, 2014) as a general overall framework will be proposed. According to ATD the pedagogical objectives and activities of education cannot be identical to those in the academy of science; the students can never act or learn as "real" scientists.

In a first step of inquiry we will use the *Didactic Delay Theory* as a methodological framework, which analyze the time lag between the recognition of a concept within the academy of science and how long it takes before it is recognized and used within school curricula and textbooks (Quessada & Clément, 2006). If the time span is long this will indicate resistance against this concept within the societal discourse related to specific values, attitudes or social practices. We will examine when the different concepts of Mendelian genetics appear within curricula and textbooks and compare to when they were recognized within the scientific community. The same will also be accomplished with the concept of race and genetic determinism that in the first half of the 20th century were recognized as scientific ideas.

In a second step we will use another framework called *Didactic Transposition*. The transition from knowledge as a tool to be put to use, to knowledge as something to be taught and learnt is what the educational researcher Chevallard (1989) has termed the didactic transposition of knowledge. This process acts on the changes that a body of knowledge and its uses has to undergo at the different levels of the didactical organization. It introduces distinctions between: (1) scholarly scientific knowledge as it is produced by scientists; (2) knowledge to be taught officially, as prescribed by the curriculum; and (3) knowledge as it is actually taught by teachers in the classroom, represented by textbooks. By doing comparisons between these different levels of the didactic transposition it is possible to see what aspects of the Mendelian genetics that is emphasized and what is left out when it is transformed in the educational system, and how this relates to the concepts of genetic determinism and race.

Keywords: Anthropological Theory of Didactics, curricula research, genetic determinism, Mendelian genetics, race, textbook research

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Symposium 170: Counteracting erroneous interpretations of bibliometrics: Tensions between science and politics

Organizers & Chairs: ***Michal Kokowski*** *(Polish Academy of Sciences, Krakow-Warsaw, Poland),* ***Efthymios Nicolaidis*** *(National Hellenic Research Foundation, Athens, Greece)*

Currently, bibliometrics is very often mistakenly identified with scientometrics by science administrators around the world. This identification has been criticized severely by many scholars, e.g. Cook et al. (2009), the San Francisco Declaration on Research Assessment (DORA) (2012), Hicks et al. (2015), and Werner (2015).

Taking into account the achievements of the science of science and science studies and the standards of research applied in these branches of knowledge, it is reasonable to support and expand this criticism. The keynote of the symposium is the shared view of 74 editors representing 56 leading journals in the history of science, technology and medicine:

Great research may be published anywhere and in any language. Truly groundbreaking work may be more likely to appear from marginal, dissident or unexpected sources, rather than from a well-established and entrenched mainstream (Cook et al. 2009, p. 2).

Therefore, the symposium is open to reliable analyses of bibliometric laws and methods in the light of the science of science and science studies, *and their respective histories*. The history of all sciences and humanities — from the past to the present — can be a rich source of interesting examples worthy of deeper analysis.

The papers submitted to the symposium will be published in the peer-reviewed, open-access journal *Proceedings of the PAU Commission on the History of Science | Studia Historiae Scientiarum* (provided they are positively rated; see Peer Review procedure).

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Keywords: scientometrics, bibliometrics, abuses of bibliometric indicators, science of science, history of science

On the unscientific foundations of bibliometrics (ID 171)

Michal Kokowski *(Polish Academy of Sciences, Krakow-Warsaw, Poland)*

This paper discusses the history of bibliometrics. However, since many serious researchers and institutions have sharply criticized the bibliometric approach all over the world, it appears that this history amounts to a multifaceted problem involving a variety of serious limitations of citation databases, e.g. domain bias, language bias or geographical bias of indexation databases; as well as numerous problems with abuses of citations, e.g. the Mendel syndrome, the classic publications syndrome, the palimpsestic syndrome, the effect of the disappearance of citations, the so-called Matthew effect, citation theft, the so-called secondary and tertiary citations, negative citations, "fashionable nonsenses", forced citations, and pathologies of the so-called citation cartels or cooperative citations, guest authorship and honorable authorship.

In spite of such problems and criticism, bibliometrics is still used in many countries as a main tool to evaluate research performance not only in all sciences, but also in all of the humanities. How is this possible?

What can help us to untie this Gordian knot is reference to the science of science[1], its history and methodology, the history of the historiography of science, e.g. the 'internal' and 'external' histories of science, and the social history of science. What we suggest is to undertake research into the history of bibliometrics with the use of an integrated approach linking the elements mentioned above, since it seems to be capable of providing the best results.

First of all, through these analyses, we can see that bibliometrics originated during the Cold War. It is therefore not surprising that, being a product of the era, it inherited well-known ambitions and limitations of its times. In other words, it was designed to control and plan the development of science, which was, incidentally, linked with the rivalry of hostile powers. Their evaluations were perfect, since — according to the advocates of bibliometry — its theoretical and empirical bases (such as Bradford's Law of Scattering, Garfield's Law of Concentration) were allegedly solid and we could thus precisely measure and predict the profundity of human creativity using simple indicators, etc.

However, many serious studies show quite the contrary, i.e. that it minimized these 'unpredicted differences and derogations' by means of propaganda, such as "only the best journals are included in our databases", "there is no problem with negative citations, retractions of articles, *Matthew effect*" etc.

Moreover, it was actually the science of science that served as context for the development of bibliometrics in its early stages. This was also the real merit of bibliometrics, as it served as protection against many contemporary simplifications in this area of knowledge. Ironically, this fundamental relationship is now almost completely forgotten.

In the light of the approach mentioned, we can see that these bibliometric simplifications are caused by the tensions between rationality and various interest groups, between science, business and politics.

Finally, on this ground, we stand against the 'tyranny of bibliometrics' and for the promotion of the 'impact of publication' instead of the 'importance of publication' or 'significance of publication'.

[1] It is composed of the history and philosophy of science, the sociology of scientific knowledge, science policy, scholarly communication, bibliometrics, etc.

Keywords: bibliometrics, scientometrics, informetrics, science of science, the two cultures of sarton-snow, the third culture of sarton-snow, scholarly communiaction, social history of science, politics

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The history of the European Reference Index in the Humanities (ERIH) (ID 175)

Robert Halleux *(University of Liege, Liège, Belgium),* ***Efthymios Nicolaidis*** *(National Hellenic Research Foundation, Athens, Greece)*

The aim of this paper is to present the history of the first efforts to apply to the humanities the evaluation methods used in "hard" sciences.

As early as the 1970s, the question of evaluation methods for the Human sciences based on quantified factors has been arisen. During the 1980s, UNESCO, CIPSH (Conseil International de Philosophie et Sciences Humaines) and later ESF (European Science Foundation) have created various Commissions in order to develop an evaluation system for the humanities. These commissions were asked to find "objective" methods to measure the results of the research in human sciences. Various proposals have been elaborated and discussed by these Commissions and some of these proposals were presented to the international community of scholars. A key issue of the evaluation methods was the creation of an index of references of books and articles of the Humanities.

Based on the Archives of the ESF and the CIPSH about the creation of a European Reference Index in the Humanities (ERIH) conserved in the Centre d'Histoire des Sciences et des Techniques at Liège, the paper will present the development of this evaluation system, the various methods proposed by the involved parties as well as the limits of such an enterprise to evaluate the sciences of humanities.

Keywords: Humanities, Evaluation, Reference index

Philosophy in bibliometrics. A look at the supply-side of academic information (ID 172)

Steven Laporte *(Vrije Universiteit Brussel, Brussel, Belgium)*

Is research shaping bibliometrics or are bibliometrics shaped by research? Or are they both shaped by external causes? These are question that arise almost automatically when comparing the bibliometric representations of different academic fields and considering the resulting national policies.

One of the most apparent evolutions in academic policy during recent decades, has been a shift away from the social sciences and the humanities (SSH) in favor of science, technology engineering and mathematics (STEM). Research evaluation has proven to be instrumental in vindicating cutbacks in the funding of SSH research programs and even the closing of departments. The interpretation of bibliometric indicators plays a pivotal role in most current evaluation systems, but the rationale behind the weight that is allotted to bibliometric arguments has been the subject for intense debate. Subsequently a considerable body of research has accumulated, discussing the difficulties of comparing different academic fields through bibliometric analysis. Questions were raised about the (in)ability of bibliometrics to reveal the intrinsic qualities of research, the artificial nature of impact measurement and arbitrarity of research value assessment.

But what information do the practitioners of SSH disciplines feed into the academic datapool? Do they do it in the most effective way? Taking the case of the field of philosophy, this paper aims to explore how the body of data that is the object of bibliometric analysis is formed by looking at the supply-side of research information. Do practices of disseminating research in philosophy differ from those used in STEM? How do standards of constructing and handling metadata influence bibliometric scores? Do differences in the permeation of digital technologies between the practitioners of different fields affect their bibliographic footprint? To answer these questions we examine the presence of works of philosophy in digital environments and assess its agency in academic.

Keywords: bibliometrics, academic policies, social sciences, humanities, science, technology engineering, mathematics, philosophy, digital technologies

Symposium 197: Hungarian schools and students in various fields of power

Organizers: ***Attila Szilárd Tar*** *(Krúdy Gyula Academic Grammar School, Győr, Hungary),* ***László Szögi*** *(Eötvös Loránd University, Budapest, Hungary)*

Our symposium is going to present some aspects of the relationship between political power and students, or schools of the higher education. The presentations in our symposium are going to deal with the following sub-thematic clusters of the general presentation of the theme of the conference: A) Science and technology and the management of power (Attila Szilárd Tar); C) "Sources of funding and other forms of support (Réka Bozzay, Ibolya Réka Juhász and Attila Szilárd Tar); D) Science, Technology and power in specific circumstances (Alex Durovics and Ibolya Réka Juhász); and F) Scholars as actors in the structure of power (Borbála Kelényi, Andor Mészáros and Attila Szilárd Tar).

Each member of the symposium is active in research concerning the history of higher education in Hungary and abroad. Mr. Durovics, Ms. Juhász and Ms. Kelényi are members of the MTA-ELTE university research group in Budapest (led by Mr. László Szögi). Mr. Andor Mészáros is professor at the ELTE University in Budapest. Mrs. Bozzay is working at the Science University of Debrecen, while Mr. Tar is working at an academic grammar school, however he has been dealing with the German studies of Hungarians in the 18th and 19th century periods.

Réka Bozzay is going to deal with the Hungarian peregrination academica to Dutch universities in the early modern age. Mrs Bozzay will focus on the activity of the authorities which controlled the peregrination. She will explain the process and the background of the administrative obstacles in connection with the studies. Although she analyses the connection between the government authorities and the students who depended on their good will, her presentation belongs to the sub-thematic cluster C), concerning forms of support.

Alex Durovics and **Ibolya Réka Juhász** chose two sub-topics from the period of the Hungarian enlightened absolutism, by which they can demonstrate the relationship between science and power in extreme circumstances (sub-thematic cluster D). On one hand there was a need of modernisation, while on the other hand the power wanted to keep the empire unchanged and safe from rebellious ideas. Alex Durovics examined the relationship of power and Protestant Higher Education during the period of "Cabinet Absolutism" in Hungary in the second half of the 18th century

Ibolya Réka Juhász is going to show the factors, which indicated the issuing of the great reforms in education by Maria Theresa and her successors. She explains its effects on the University of Nagyszombat (Trnava) and the Jesuit educational institutions. Furthermore she will highlight the role of the central regulations in the life of the royal academies. This topic can be seen as relating to sub-thematic cluster D), but in the second part of her presentation Ms. Juhász is going to present the necessary funds of these institutions including the royal academies. This part is connected to cluster C).

Borbála Kelényi examined the attendance of the Hungarian students at foreign universities in the Middle Ages. She could utilise a database of 12 500 records for this purpose. First of all, Vienna, Krakow, Paris and the Italian universities were among the destinations of Hungarian students. A significant part of these scholars later became prelates or men of the royal court, so they were involved in arenas of power. In relation to sub-thematic cluster F) we will get a summary of the investigations on this topic.

Andor Mészáros presents the role of the Central European universities and university scholars in the political life of Hungary between 1867 and 1918. He wants to describe the role of academics taking part in political life, mainly in state organization, and minority issues. A new aspect could be the relationship between the studies of the political elite of the nationality groups and their influence in Hungary after the Compromise in 1867. We relate his presentation to the sub-thematic cluster F).

Attila Szilárd Tar makes an attempt to present which studies led or helped to get into the spheres of political power. Several people used the studies in Germany for social mobility, esp. in the 18th century.

Later the situation changed, since for a higher political status university studies abroad were required, especially in the faculty of the law or in technology/natural sciences. This relates to sub-thematic cluster F) of the conference. If one stresses the type of knowledge which leads to a political office, the investigations are connected with sub-thematic cluster A), while the sources of funding may point to topic C).

Keywords: peregrination, university, Calvinist, Lutheran, Ratio Educationis, royal academies, curriculum, funds, political careers, German universities

The Influence of Hungarian Authorities on the Education of Hungarian Students at Dutch Universities (ID 312)

Réka Bozzay *(Science University of Debrecen, Debrecen, Hungary)*

The Hungarian peregrination academica to Dutch universities was a new phenomenon of the early modern age. It was caused by the lack of a (Protestant) university in Hungary. Hungarian students were forced to leave Hungary to receive higher education.

The Protestant peregrination academica to Dutch universities was a necessity but it was controlled by Hungarian and, in the 18th century by Austrian authorities. In my presentation I will focus on the connection between authorities and the students who depended on their good will.

The study abroad of Protestant students was stimulated by the need for higher educated clergymen. The Hungarian Calvinist Church wanted to make sure that its scholars would keep their orthodox Calvinist faith, and would spend money on things which were allowed by the church and the territorial synod. In my presentation I will highlight what kinds of measures were taken for that.

The Austro-Hungarian authorities controlled the study of Protestant students, too. Passports were required from the Royal Council of the Governor. Dutch universities were asked to make lists of their Hungarian students and inform the Vienna Court about it. In my presentation I will explain the process and the whole background of it.

Transylvania was ruled apart from Hungary, so Transylvanian students were controlled by the Main Consistory of the Transylvanian Reformed Church and the Reformed Colleges of Transylvania. How these students received their passports and their certificate will be told in my presentation.

Keywords: Dutch universities, Protestant, Calvinist Church, Transylvania, Royal Council of Governor

The Enlightened Rulers' Influences on the Hungarian Higher Education (ID 313)

Réka Ibolya Juhász *(Eötvös Loránd University, Budapest, Hungary)*

The purpose of my presentation is to introduce the grand change that had been progressing in the second half of the 18th century in the Hungarian politics of higher education. The reforms were carried out by two rulers, Maria Theresa (1740–1780) and Joseph II (1780–1790), who were the representatives of the enlightened monarchs in the Habsburg empire. One of the main themes of my presentation is the Ratio Educationis, which was urged by Maria Theresa and underwent several reforms in the reign of Joseph II. These rulers with their reforms were trying to form a well-educated social class, who were absolutely loyal to the Habsburgs.

At the beginning of my presentation I would like to feature those factors, which brought about the need of the Ratio Educationis. I also plan to shortly clarify which institutions were affected by the reform, mainly the University of Nagyszombat and the Jesuit educational institutions. I would like to

summarize in a few sentences the development of the reforms, and furthermore the creation of the necessary fund which was essential to renew the Hungarian education system.

The questions that I would like to examine in my presentation are, firstly, what kind of reforms could fulfil the wish of Maria Theresa and Joseph II to build a strong monarchy? And of course in this plan which kind of role did the institutions of higher education play?

I also would like to mention the provisions that refer to the University of Nagyszombat specifically. First I would like to highlight the development of the University, the foundation of the Medical Faculty and the foundation of new professorships. Secondly, I would like to speak about the rigorous regularisation of the new curriculum, which reduced the opportunities of the teachers to spread their own ideas in order to transmit new theories.

I would like to review in a few words the organization of the new institutions, namely the Royal Academies. At this point, I think, it is important to highlight the fact that the duty of the academies was to prepare the students, who wanted to continue their studies at the University of Pest. The academies also played a main role to increase the educational effectiveness in their region. To fulfil this task, they had a more stable financial background than the Protestant institutions, and the centrally made curriculum. Furthermore, the reforms were regularising the acceptance of the application of the teacher. I am going to submit the organizational structure of the academies and the hierarchy of the institutions.

At the end of my presentation I plan to speak about the influence of the reforms. I would like to show a few diagrams about the increasing numbers of the students in these institutions. In my view, the question of the students' social, ethnic, confessional stratification are important considerations, because they demonstrate who had been in important positions within the academies organisational structure over many periods. For these data, I am going to use the database that is owned by MTA-ELTE History of University Research group.

Keywords: Ratio Educationis, Jesuit, University of Nagyszombat, royal academy, curriculum, medical faculty

The Relationship between Power and Protestant Higher Education during the Period of "Cabinet Absolutism" in the Kingdom of Hungary (ID 310)

Alex Durovics *(Eötvös Loránd University, Budapest, Hungary)*

In the period of enlightened absolutism, in spite of the fact that some similarities in conceptions about the necessary educational reform existed between the royal court of Vienna and the Protestant churches, the latter ones protected their early achieved license on this matter.

After the short reign of Leopold II, the new king's accession to the throne was the beginning of a new era. As part of the Habsburg Empire the Protestant churches of the Kingdom of Hungary faced new challenges. The court of the new ruler inherited and accepted the viewpoints of the departed enlightened ruler Joseph II about the unity of the realm, and tried to govern according to them. Despite this basic idea the King's cabinet applied new methods and ways in order to keep the empire both in an unchanged state and safe from the rebellious ideas. Accordingly, important problems were left unresolved (such as the correction of citizenry's and serfdom's situation, the recognition of the necessity of modernisation) and the fruits of the enlightenment were seen as dangerous matters. Against these challenges many obsolete but formal measures were applied.

In my presentation I would like to summarize what kind of changes took place under the period of cabinet absolutism and which ones had an effect on Protestant higher educational institutions (i.e. book censorship, declaring self-development courses dangerous, forbidding the existence of lending libraries). Another important question I wish to address is how these measures influenced their traditionally good connections with foreign universities. Naturally I may not leave out of consideration those provisions which aimed to hinder the spreading of new ideas (such as making the purchase of foreign periodicals, journals and books harder) nor those measures that aimed to keep the Protestant students inside the monarchy and lead them into the direction of the imperial capital's educational institutions.

The Road to Power – Hungarian Politicians with University Studies in Germany (ID 307)

Attila Szilárd Tar *(Krúdy Gyula Academic Grammar School, Győr, Hungary)*

There were always Hungarian students at universities of the Holy Roman Empire and later Germany. The total number of Hungarian registrations at German universities (excluding Austria and Bohemia) tallied 3944 between 1694 and 1789, while 14 548 between 1789 and 1919. During the 18th century the main destinations of the Hungarian students were Wittenberg, Jena and Halle, and later Göttingen. The popular studies were Theology (68% of the known data), Medicine and the Law.

In my presentation I want to show which studies were useful for a later political career. In other words: How was it possible for scholars to be involved in arenas of power later in life? This would be a reference to sub-thematic cluster F) of the conference. An alternative description would be: which knowledge could help one for a political office? The investigations on this question relate to sub-thematic cluster A) while the sources of funding fall under topic C) in connection with: "Sources of funding and other forms of support".

The fact is, that approx. 2% of the wandering students (known careers) became members of the political elite, while 2.5% took a country or county political office. It would be an interesting question to know the answer to the following question; what and where had they studied before in Germany?

The situation may have changed in the long 19th century, because the whole world experienced a great development due to the Industrial Revolution. The number of Hungarian students at German universities increased and the favourite destinations changed, too. Besides Jena and Halle, the University of Berlin and the Technical University of Munich attracted hundreds of Hungarians to Germany. Theology remained the most popular subject, however technology and natural sciences appeared from nowhere and took the second place. The Law disciplines were still popular, nevertheless Philosophy joined this group.

According to our research several Hungarian politicians, i.e. 18 ministers or PMs from the governments between 1867 and 1919 studied at German universities. The chosen subjects and the favourite faculties may have changed amongst the politicians. The changes concerning the preferences will be highlighted in my presentation.

Keywords: Germany, university, Halle, Göttingen, Berlin, politicians, faculty of law, natural sciences

The Profit of Learning. Students from the Medieval Hungarian Kingdom and Their Later Career (ID 314)

Borbála Kelényi *(Eötvös Loránd University, Budapest, Hungary)*

The aim of this essay is to demonstrate the attendance of students from the Hungarian Kingdom at foreign universities during the Middle Ages, their studies at the university and their later careers.

According to the present state of our research, there were almost 12500 records of Hungarian students attending foreign universities in the middle ages from the end of the 12th century till 1525 (the year 1526 means the end of the Middle Ages in the Hungarian history, because of the battle of Mohács). After identifying the Hungarian students at foreign universities, the second task is to research the faculties at which the particular persons studied. It is not striking that most students attended the *artes facultas*, since it was the first step of university studies, and the attendees of Vienna and Krakow universities also preferred this faculty.

The third aspect of the research concerns their later careers. According to the present phase of our research, prosopographical data and later career are known for about 10 % of the Hungarian students. Since for the main part the attendees were prelates, it is not striking that many of them gained ecclesiastical office later. The role of the educated people in the royal court and administration needs further

research. However Péter Haraszti Szabó has made some investigations with reference to the Prague students.

Lastly, the effects of the university attendance on the later career can be investigated as well. Personal relationships are demonstrated in the cases of the chapters of Buda, Pozsony (Bratislava, SK), Székesfehérvár, Győr, Pécs, Esztergom and Nagyvárad (Oradea, RO) by József Köblös, Tamás Fedeles, Norbert C. Tóth and Ilona Kristóf. These interlacements between the dignitaries of the chapters can often be traced back to the academic fellowship.

The Role of the University Education in the Formation of the Political Elite in Hungary in the Age of Dualism (ID 334)

Andor Mészáros *(Eötvös Loránd University, Budapest, Hungary)*

The role of the Central European universities and university scholars in the political life of Hungary between 1867 and 1918, that is at the time when the modern constitutional state was formed, became more and more important for multiple reasons. This was due, on the one hand, to the influence of the modern and open-minded legal and state education of the leading German speaking universities and on the other hand to the establishment of smaller, "national" universities in the region. It was also due to important developments such as the bifurcation of the universities in the Czech Lands to a German and a Czech speaking parts, mainly the partition of the Prague university in 1882, but also the establishment of the Zagreb university in 1874 and the formation of the Slovene speaking university sections at the Cracow, Brno and Prague universities.

In my paper I would like to describe the scientific and historical background of the formation of the modern German legal and state university educational system, the main training places of the Hungarian political elite after the Austro-Hungarian Compromise, and the role of academics who took part in the political life, mainly in the state organization and minority, nationality and language use issues. An important part of this topic is the question of the formation and influence of the political elite of nationality groups in Hungary after the Compromise, mainly in the first decades of the 20th Century. In the formation and education of this new political layer of the Monarchy, an important role had been played by Prague, Zagreb, Lemberg, and other universities. The university education, their influential, prestigious university professors or university fellows, the evolving national university student circles and their publications, including newspapers, had a significant impact on the emergence of the political elite of the nationalities of the Austro-Hungarian Monarchy.

Keywords: political life, Central Europe, scholars, politicians, political elite, nationalities, Prague, Zagreb, Lemberg

Symposium 200: Comparative study on the interplay between knowledge practices and powers in Chinese history

Organizer: ***Yiwen Zhu*** *(Sun Yat-sen University, Guangzhou, China)*

Chinese sources abound in documents evidencing various forms of interplay between science and power. Such sources have already been used in research related to this issue, mainly within the context of a single discipline. For example, the relationships between astral sciences and power, and between mathematics and power, have been the subject of many publications. This symposium aims to further shed light on this issue, by considering what could be derived from discussing the interplay between different kinds of knowledge practices and powers. Moreover, cases from different time periods will be brought together, and special attentions will be paid to the connection of exchange between the two. Generally, our goal is to consider the following questions: What, in the different cases, is the *structure* of the interplay between the two? That is, how do different knowledge practices and powers *relate to* each other? And how is this type of structure related to the social context in which the interplay takes place? To address these questions, various factors, such as scholars, classics or textbooks, specific materials, institutions, and social psychology, will be identified and carefully analysed.

Specifically, our symposium is going to deal with the above questions from three main research directions. Firstly, how was a kind of knowledge practices institutionalized in the past? Zhu Yiwen will discuss this issue using the case that mathematics became a subject of the imperial examination in the seventh century China; Zhou Xiaohan will deal with the issue using the sources of the prefaces of mathematical books in the fifteenth century China when mathematics was not in the imperial examination; Jia Lu will analyse how the logic failed to be included in the imperial examination in the sixteenth century China; Pan Dawei will study the role of Mao Zedong in the establishment of "Integration of Chinese and Western Medicine" in modern China. Secondly, how was a kind of knowledge practices transmitted and taught in the past? Wang Xiaohu will address this issue with abundant sources related to the almanacs in Chinese history; Han Jie will focus on the Chinese history of academy, mainly in later imperial China; Yan Chenguang will bring us the case study of two representative mathematical journals active in Japan and China during the Second World War. Thirdly, a comparative study between China and other areas is considered. Tao Peipei will study on Della Porta against the background of Jesuits in the sixteenth century Italy; Jiang Lu will also touch this issue using the case of Ferdinand Verbiest in the seventeenth century China; Yan Chenguang's work will also contribute to this research direction.

Keywords: Chinese history, mathematics, medicine, logic, almanac, journal, legitimacy, institutionalization, transmission, academic community

Mathematics and Power in Seventh Century China (ID 201)

Yiwen Zhu *(Sun Yat-sen University, Guangzhou, China)*

My recent research has revealed that in seventh century China, in the commentaries on Confucian canonical texts (e.g. *Rites of Zhou [Dynasty]*, *Zhouli* 周 禮), there existed a mathematical practice that was different from the one previously described by historians of mathematics on the basis of purely mathematical writings (e.g. *Nine Chapters on Mathematical Procedures*, *Jiuzhang Suanshu* 九 章筭術). The differences between these two practices can be grasped through several features: a) different mathematical procedures were used to solve the same problems; b) different mathematical bodies of knowledge were taught in different schools of the Imperial University (*Guo Zi Jian* 國 子監), that is, the mathematical practice specific to Confucian canonical texts was taught in the School for the Sons of the State (*Guozi Xue* 國子學), the Supreme School (*Tai Xue* 太學), and the School for the Four Gates (*Simen Xue* 四門學), while the one represented by the mathematical writings was taught in the School of Mathematics (*Suan Xue*筭學); and, c) different subjects in the Imperial Examination (*Ke Ju* 科 舉)

were set up for these two mathematical practices. On the basis of this preliminary research, my talk intends to address the relationship between mathematics and power that this phenomenon reveals. My presentation will shed light on this issue from the perspective of the ways in which mathematics and power related to each other. Firstly, the differences between the ways of writing mathematical knowledge, as evidenced by Confucian canonical commentaries and mathematical texts in the context of early Tang 唐 scholarship, will be analysed. Secondly, I will examine why, from the Tang dynasty onwards, the school of mathematics was established and abandoned several times. Thirdly, I intend to discuss how mathematics became a subject for the Imperial Examination. Finally, the mathematical practices in Confucian canonical texts will be used in a comparison with those described in the second and third parts, to depict a complex historical image of mathematics and power in the seventh century Tang China.

Keywords: mathematics, Confucian canons, imperial examination, school of mathematics, seventh century China

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The anxieties of legitimating mathematical knowledge represented by prefaces to mathematical works in the Ming Dynasty (1368–1644) (ID 216)

Célestin Xiaohan Zhou *(Université Paris 7, Paris, France)*

Ming Dynasty mathematical works contain prefaces that devote much space to what we can interpret as establishing the legitimacy of mathematical learning. For example, they quote the same ancient texts like the "Six Arts" in the *Rites of Zhou*, and use identical sentences by Confucian philosopher Mencius (372–289 BC) about getting to know the height of the sky and the distance to celestial bodies. Contrasting contemporary with ancient times, their authors express their disappointment about the fact that mathematical classics go missing, and their dissatisfaction about the widespread ignorance of mathematics in their time. Instead of simply accepting these narratives as expressing the authors' actual motivation for devoting themselves to this study, I suggest to interpret what they say and how they say it in the prefaces as indicating that the authors feel the need to justify the fact that they embraced mathematical learning.

Why should a certain knowledge be acquired? This question is more vital if the knowledge lies at the margins of orthodox knowledge. General speaking, it is usually the bodies of knowledge perceived as orthodox that can interact with the power at various levels. For example, these bodies of knowledge are related to the power in an explicit way, by means of the government's determination of subjects of imperial examination, or, implicitly, through forming the intellectual elite's tacit knowledge and skills– both being necessary for their social intercourse as well as for establishing the practitioners' cultural identity and the "distinction" (Bourdieu, 1979) between them. To a large extent, managing the orthodoxy of knowledge means possessing the alchemy of transformation between one's cultural capital and symbolic power. On the contrary, a marginalized knowledge usually faces a "legitimation crisis", requiring that one addresses its origins and its necessity, whereas practitioners of this knowledge face a dilemma.

In this paper, I rely on authorial and allographic prefaces to Ming Dynasty mathematical works by Wu Jing (fl.1450), Wang Wensu (c.1465–c.1524), Gu Yingxiang (1483–1565), and Cheng Dawei (1533–1606), and use the method of discourse analysis to inquire into the following concrete questions. In these prefaces, to which attitudes did the authors testify towards mathematical knowledge and practice? What psychological motivation do they mention as leading them to devote themselves to this

subject, or to support the author who wrote the book? Did prefaces evoke a tension between other forms of knowledge perceived as more "orthodox" and the knowledge embodied by the book? In case they did, did the prefaces express a sense of alienation from mainstream intellectual elites? Furthermore, do the prefaces contain traces displaying that practitioners accepted the domination of the ideology of what they perceive as mainstream knowledge, and that they admitted the knowledge dealt with in the book was of a subordinate type? In case they did not, or not absolutely, what kind of resources did the prefaces use to legitimate the knowledge displayed in the book?

Keywords: mathematical practitioners, legitimacy of knowledge, history of mentalities, preface, Wu Jing, the Ming Dynasty, sociology, the orthodoxy, the marginalized knowledge, discourse analysis

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Gu Yingxiang (1483–1565), *The Classified Explanation of Procedure to Sea Mirror of Circle Measurements* (1550)

Cheng Dawei (1533–1606), *Systematic Treatise on Algorithms* (1592)

Establishing Logic as a Subject of the Imperial Examination – Ferdinand Verbiest's Ambitious Plan (ID 209)

Lu Jiang *(Sun Yat-sen University, Guangzhou, China)*

Ferdinand Verbiest (1623–1688), administrator of calendar-making at the Court of Emperor Kangxi, succeeded in gaining the Emperor's confidence and taught him Euclid's *Geometria* which had already been translated into Chinese by Matteo Ricci and Xu Guangqi. It was even printed upon Kangxi's order and with his permission by the Imperial printing press. However, the opus magnum compiled by Verbiest known by the name "Qiongli Xue" suffered a quite different fate: in this work, Verbiest aimed to establish a foundation for the Christian teaching in the form of a Chinese version of the Aristotelian logic and philosophy, as his letter to Pope Innocent XI reveals. *Qiongli Xue* therefore contains Furtado's and Li Zhizao's already published translation of the Coimbra Commentary on *Isagoge* and Aristotle's *Categories* and the unpublished translation completed by Li Zizhao's son Li Cibin of the Coimbra Commentary on Aristotle's syllogism. Verbiest coined a most ambitious plan which envisioned logic as a standard subject of the Imperial examination (regarded by Max Weber as the bureaucratization of knowledge). *Qiongli Xue* was therefore meant by its author to be an official textbook for the examination and presented to Kangxi in this intention. Before making his decision, Kangxi sent the manuscript of *Qiongli Xue* to his ministers at the Ministry of Rites and the Imperial Academy, both institutions being in charge of education and examination. There this work was met with vehement opposition and condemnation. As a result, *Qiongli Xue* remained unpublished, not to mention becoming a standard textbook for the imperial examination. My talk intends to examine in how far the Aristotelian philosophy was compatible with the Confucian knowledge system and the Institution of Imperial examination in early Qing society, and further, upon this basis, to judge, whether Verbiest made a misjudgment regarding the power structure of China under the reign of Kangxi.

Keywords: Aristotelian Logic, Imperial Examination, Ferdinand Verbiest, Qiongli Xue

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Science Facing Different Authorities: Comparison between Matteo Ricci and della Porta (ID 236)

Peipei Tao *(Donghua University, Shanghai, China)*

At the turn of the 16th century, modern science was just at its beginning in the west and its future was not clear. At the same time, in the Far East, western science started its eastward dissemination during the Ming Dynasty. This paper focuses on two important contemporaries, Matteo Ricci (1552–1610) and Giovanni Battista Della Porta (1535–1615), who were both from Italy, yet facing two different strong authorities with science. Matteo Ricci, as an Italian Jesuit, brought western science into China along with Jesuit China missions. Della Porta, as a famous natural magician, spent the majority of his life on categories of science. Matteo Ricci successfully made use of scientific knowledge and instruments brought from the west to gain the favor of the imperial power of China. On the contrary, della Porta was charged with "having written about the marvels and secrets of nature" by the authorities of the Church, though he cautiously avoided the conflict with the Church, and by 1585 he had become a lay brother of the Jesuits. This paper compares the differences of scientific practice between Matteo Ricci and della Porta. Matteo Ricci catered to the authorities of China by only passing on selected scientific knowledge, while della Porta's action of "having written about the marvels and secrets of nature" threatened the Church. This paper then discusses the formation of the two approaches of scientific practice when facing two different authorities, based on historical materials such as "China in the Sixteenth Century: The Journals of Mathew Ricci: 1583–1610", Mathew Ricci's letters from China and his Chinese translation of western science work.

Keywords: Della Porta, natural magic, Jesuit, Inquisition, the Church

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The power of Geometry to Introduce Algebraic Language as Liu Hui and al-Khwârizmî did (ID 496)

Iolanda Guevara-Casanova *(Universitat Autònoma de Barcelona, Bellaterra, Spain),* ***Carme Burgués-Flamarich*** *(Universitat de Barcelona, Barcelona, Spain)*

The use of algebraic language is difficult for most students because of the degree of abstraction involved. The proposal for improvement is to connect the symbolic language of algebra to geometry. We introduce historical geometric diagrams in tasks for students (grade 9) to solve problems related to right triangles and quadratic equations, and we discuss their learning outcomes. The question for this research is to what extent the introduction of historical geometrical diagrams, related to the secondary curriculum, encourages students to resolve certain problems.

The problems proposed to the students correspond to situations where right triangles or solving 2nd degree equations are involved. In all cases, the proposal is that students transfer the reasoning expressed linguistically (2nd degree algebraic expressions) to reasoning with visual diagrams (figures with squares and rectangles) that are the geometric interpretation of the 2nd degree algebraic expressions.

The problems proposed to students correspond to chapter 9 of the *Nine Chapters*, problems 1–13 and 24 in the version of Chemla & Shuchun (2005). What we want to emphasize is the justification of the calculation procedure of the classic text (s. I) with geometric figures that Lui Hui made in the year 263. Likewise, the material for the unit of solving quadratic equations is based on the justification of a geometric equation with squares and rectangles.

Given the results contained in the analysis of the activities of students and conclusions generated, it can be said that the teaching of algebra in the first year should go hand in hand with visual arguments and the use of diagrams: that is, the introduction of algebra, besides being a generalization of arithmetic, a model where the rules of numbers becomes rules with letters should also have a visual component which gives the geometrical interpretation of algebra formulas. All operations and rules to operate with letters have their interpretation in the geometric model. In this way, the properties of operations are not justified solely on grammar rules or symbols they have an equivalent in the geometric model.

Going from arithmetic to algebra by skipping geometry can be considered as a pedagogical and historical error. This is an explanation in the context of the seventeenth century when the force of the new symbolic language had replaced the visual geometric reasoning but not in the XXI century. (Katz & Barton, 2007). For many centuries humanity, in the absence of formal algebra and with only the four basic arithmetic operations, has been able to solve some problems that we solve now with equations. There is a significant portion of students who do not solve problems because they have not thoroughly understood the rules of this language and they are illiterate, from the point of view of mathematics. Perhaps, at the beginning of learning of algebra, it is necessary to return to the reasoning of ancient mathematicians. The ancient mathematicians calculated on the basis of geometric models to justify the validity of their operations.

The session will present research performed, with special mention of the activities proposed and analyzed, as well as learning outcomes produced in the students. It combines time so the audience attains four objectives: The first one, get activities to solve problems with right triangles and solving 2nd degree equations with visual reasoning. The second one, from the productions of students sees learning outcomes of a group of students solving these activities. The third, evaluate the advantages of the use of diagrams in solving problems and introducing algebraic language. The fourth, get historical context in which the reasoning algebraic reasoning is connected through visual geometric interpretation of the situation or problem.

Keywords: visual reasoning, Historical diagrams, Geometry, Algebraic language, Secondary Education, Right triangles, Quadratic equations

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Symposium 202: Domesticating the air: The politics, technics, and material culture of breathing safely

Organizers: ***Elena Serrano*** *(Max Planck Institut, Berlin, Germany),* ***Marie Thébaud-Sorger*** *(Centre National de la Recherche Scientifique, Paris, France)*

Our panel looks at inventions, architectural devices, domestic recipes, and pneumatic instruments aimed to clean, disinfect, and purify the air. It will analyze artifacts and practices as a way to explore how beliefs, ideologies, and attitudes became embedded in societies and vice-versa, how ways of interpreting nature, society, and politics became embedded in material devices.

Breathing stands at the interface between the self and the environment. It intimately connects the interior body with the exterior medium and the private with the public. It stands crucially between life and death and between health and sickness. Inevitable and necessary, breathing may also be hazardous. Arguably the most intimate of actions, it also provokes the subtlest contact with the other. It is thus that the artefacts that mediate between ourselves and our breathing attain epistemological, social, and political significance.

This panel examines historical artefacts attempted to try to make breathing safer and healthier. It will analyze these objects with reference to understanding the intimate, subtle connections between practices and beliefs, the private and the political; and between fashion, consumerism, and technology. Such artefacts posed questions of gender and expertise, of ideologies and civil rights, of constructing identities and exerting political and scientific power. They helped to construct images of the self. They allow us to question the frontiers between users and inventors, patients and doctors. Who is entitled to examine and to change the properties of the air? How did breathing connect with uses of public physical spaces? What did domesticating the air mean for different actors in different historical periods? How did these artefacts serve political aims?

The panel chronology ranges from the fifteenth to the nineteenth-century. Papers will use a wealth of sources – recipe notebooks, maps and architectural models, representation of objects in commercial leaflets, newspaper advertisements, records and proceedings of societies, and the artefacts themselves. They are set in different socio-political contexts— Ancien regime and revolutionary France, Georgian Britain, Absolutist Spain, the Victorian suffragists movement, the heterogeneous circles of English Protestant Dissenters. From medieval domestic recipes which aimed to balance the exterior air with the interior humours through the porous body, to eighteenth century machines that used acid gas fumigation to destroy aerial miasmas and measured the breathability of atmospheric air, to a seventeenth-century natural philosopher and architect who attempted to refresh indoor air, to an eighteenth-century *oeconomic* ventilator conceived for the public welfare, to a nineteenth-century respirator that become a metaphor of the protesting woman, the panel will trace our changing relationship with air, pure and impure.

Keywords: air, artefacts, consumption culture, environmental medicine, domestic spaces, gender, pneumatic chemistry, public sphere, societies, scientific institutions

The Material Handling of the Air: Household and University Expertise in the Medieval West (ID 204)

Montserrat Cabré *(Universidad de Cantabria, Santander, Spain)*

The humoral epistemology that sustained the understanding of health and disease in Europe from Antiquity through the late Renaissance conceptualized human bodies as porous entities living in an ongoing relationship with the environment. A central concern of learned medicine was the control of the first of the six non-naturals –the air that, together with clothes, was conceived as being in intimate contact with the body surfaces and as a powerful medium both to maintain health and to cause illness. University physicians advised their patients to maintain their health and to combat particular illnesses

by changing the condition of the air they lived in with a diverse array of therapeutic strategies particular to each of the disease categories they were identifying and investigating.

My aim in this paper is to contrast physicians' concerns with the everyday practices of lay people – women and men- to care for the air, both in times of sickness and in times of health. Medieval recipe collections for household use contain a wide variety of practical knowledge to look after the material conditions of healthy living, and procedures to intervene in the quality of the air figure prominently in these archives of domestic knowledges. Household recipe collections are full of instructions to prepare waters, oils, scent bottles, smokes or herbal concotions to influence the air with the power of smell. I intend to study these technological devices as they appear in medieval Iberian collections of recipes for household use. My goal is to question whether they reflect the power of learned medicine over lay practitioners or, on the contrary, can be interpreted as instances of a shared knowledge that, more often than not, is tacitly ascribed exclusively to university expertise.

Keywords: disease, scientific institution, expertise, households, practical knowledge

Joseph Priestley and the Politics of Nitrous Air Eudiometry (ID 256)

John R.R. Christie *(University of Oxford, Oxford, UK)*

Nitrous air eudiometry, an instrumentalized method of measuring the 'goodness' (breathability) of airs, was initiated by Joseph Priestley in the mid-1770's, its instrumental basis improved by Henry Cavendish in England, and its potential uses for public health pursued elsewhere in Europe, notably in Italy. According to Priestley, 'nitrous air test' was a misnomer for the procedure. This paper thus pays attention firstly to the chemical specificity of the test procedure as Priestley understood it, and then to the precise language with which he characterized the counter-intuitive chemical phenomenon upon which the test was based. This language, it turns out, bears close comparison to the account of the origin of the Leyden Phial which he provided in his *History of Electricity* (1767), suggesting that Priestley perceived a strong analogy between the two devices, and also between the discoveries of their phenomenal bases. Pursuit of the significance of this analogy for Priestley will then take us into unexpected territory, namely Priestley's writings on religion, politics and their histories (writings whose quantity far surpasses the amount of natural science he published). Focusing relevant elements of his politico-religious thought on the explication of key passages of the 'Introduction' to his reputation-making *Experiments and Observations on Different Kinds of Air* (1774) will then demonstrate their precise relevance to understanding Priestley's conception of nitrous air eudiometry; the additional material reveals a fundamental aspect of the meanings which Priestley attributed to these new electrical and chemico-pneumatic instruments. These meanings, I will argue, are of a specifically political nature, and broadly intelligible within the context of the emergently revolutionary politics of the crisis of the European Ancien Régime. To my mind, however, they are not easily assimilated to any standard secular, progressivist-radical account of Enlightenment. Instead, they are characteristic of the radical politico-religious sensibilities of the heterodox communities of English Protestant Dissent, for whom Priestley acted as a public voice and political advocate.

Keywords: eudiometry, Priestley, politics, religion, Enlightenment, Dissent

Spreading the Revolution: Guyton's Fumigating Machine in Spain During the Napoleonic Era (ID 250)

Elena Serrano *(Max Planck Institute for the History of Science, Berlin, Germany)*

Around 1801 Louis-Bernard Guyton de Morveau (1737–1816), in collaboration with the prestigious instrument-maker Dumotiez, designed his famous fumigating machine. It spread a controlled emission of a specific gas ––described as an oxygenated muriatic acid— that was supposed to destroy the contagious miasmas in the air, objects, and bodies.

During the 1804 outburst of the yellow fevers, the Spanish Absolutism Government ordered that the original design of the Guyton's fumigating machine be adapted to the Spanish market for it to be used extensively in the households. This was done against some criticism, as the nature of the contagion was avowedly unknown and the acid fumigation technology polemic. Nonetheless, the machine was pictured as crucial for the health of individuals and the society as a whole.

The essay explores the fumigating machine as a way to explore how scientific and political beliefs and practices pervaded societies and vice-versa, how ways of interpreting nature and society became embedded in artefacts. It will show, first, how the machine served to spread the new French chemistry among Spaniards; second, how it embodied a new relationship between the citizens and the state, and third, how was that this artefact was imported by the Spanish absolutist state, appropriated, and used for its own propaganda. Focusing on a chemical artefact, it shows the complex interweave between theory, material culture, and politics.

Keywords: gas, artefact, Guyton de Morveau, Lavoisier, oxygen, political propaganda, fumigating machine, enviromental medicine, yellow fevers, biopower

Aerial Commodification: Technological Construction of Domestic and Public Space in 18th Britain and France (ID 203)

Marie Thébaud-Sorger *(Centre National de la Recherche Scientifique, Paris, France)*

"Stove without fumes", "portable ventilator", "steam bath", "cooking-apparatus", "lamp with double air current": in the second half of the 18th century, a blooming consumption culture encouraged the invention of small devices that relied on the use and management of various properties of airs (hot air, noxious air, vital air…). From a body of printed ephemera appearing on both sides of the Channel – leaflets, press cutting, advertisements, subscriptions, trade cards — this presentation firstly attempts to outline a "taxonomy" of these multi-functional and adaptable commodities. They embedded a power to act upon the everyday environment by turning the 'airs' into efficient agents; and they potentially constituted the public as knowledgeable consumers, while fostering inventive practices.

I will then focus particularly on William White's 'air machine', in order to highlight how concerns about technology and public welfare came together in the design of artefacts. White developed, patented and manufactured a hand ventilator in the 1790's, which he aimed to disseminate for households as well as for public buildings, ships and mines, targeting also colonial markets. He sought an appraisal from the philanthropic *Humane Society*, which dealt directly with resuscitation of drowned people and also discussed properties of gases and practical issues concerning rescue. He also sought appraisal and support from the London *Society for the encouragement of arts, manufacture and commerce*, which established a special committee on "a hand ventilator", and a premium reward for suitable invention in 1791–1792. They promoted especially technological improvements for the management of social reforms. This promotion of a new understanding of airs addressed respiration in diverse ways, in both the individual body and the collective, social body, and so facilitated the conjunction between investigations into nature and social reform, and between the intimate scale of household and individual and the public sphere.

Keywords: air, artefacts, consumption culture, environmental medicine, domestic spaces, pneumatic chemistry, public sphere, societies

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Vapours' calling. The role of the site called 'grotta del cane' in the chemical studies about gases (XVII–XIX centuries) (ID 516)

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Near Naples there is a cave known as the Dog's grotto where a mysterious vapour hovered low to the ground can kill. For many centuries scholars from all over the world (mainly Europe, of course) came there attracted by the famous phenomenon, which allowed people to see with their own eyes the slight passage from life to death just by means of breathing. This action so familiar and innocent became in such place clearly hazardous, but the physical reason of that was simply invisible: as it was a transparent fluid, which was able to reveal its dangerous properties by entering the bodies, in an unknown manner.

Anyway, the death of "the dog" was not the rule, the point is that many times different kind of scientific experiments were performed by local scholars for foreign visitors, so the grotto was quickly and widely considered a site for chemical studies.

The paper goal is to describe by means of travel journals, chemical writings, books about volcanic stuff, reports about experiments *en plein air* and pictures the history of the *Grotta del cane* as a site of scientific enquiry about gases from the late XVII century to the early XIX. Then, going through the scholars and personalities interested in this site and the different historical periods involved, I will try to highlight the effects of all these different interests on the social, cultural and political value of this place of the Kingdom of Naples.

Keywords: Naples, Vesuvius, Chemical revolution, mephitic exhalations, in situ analyses

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Symposium 205: Natural knowledge, power and politics in the long eighteenth century

Organizers: ***Sebestian Kroupa*** *(University of Cambridge, Cambridge, UK),* ***Dorit Brixius*** *(European University Institute, Florence, Italy)*

Natural history was by no means a purely intellectual or philosophical affair but must certainly be considered as a marriage between intellectual attempts and political-economic goals. Particularly from the late seventeenth century onwards, knowledge about the natural world became increasingly associated with public discourse, as both public and political authorities realised the potential that such knowledge offered in terms of propaganda and manipulation and, consequently, they strove to shape it into diverse instruments of different ideologies. This session therefore intends to explore the exploitation of natural history within the realms of politics and power in the long eighteenth century in both a European and a world context. It is designed to bring together material, social, local, and global approaches to the history of natural knowledge and seeks to unveil the role that natural history played in various political processes and empowerments. Encompassing the epistemic, political and economic relevance of fields as diverse as pharmacy, taxonomy, museology and botany, each paper discusses a particular meaning that natural history assumed with respect to power within a specific geographic milieu. The first two speakers set natural knowledge in the context of intellectual circles: while Emma Spary explores the power of poisons in pre-revolutionary Paris, addressing the ways in which the making of and thinking about poisons challenged scientific and medical claimants to public expertise, Sebestian Kroupa's contribution examines how the Linnaean system of classification was used as an instrument of political ideology in Ignaz von Born's pamphlets amid the Josephine reforms of the Habsburg Empire. Papers three and four are dedicated to practical aspects of natural knowledge on display and as subject of consensus formation, respectively, as they seek to shed light on how local powers built and shaped various approaches to how nature was viewed and exploited. In her paper, Déborah Dubald aims to illuminate the evolution of the capacity of mayorship in provincial France at the turn of the nineteenth century and, in particular, its complementary influences on the operation with and exhibition of nature in museums, as well as on the more general discourse on nature. Finally, moving beyond the European borders, in paper four Dorit Brixius endeavours to look at the local negotiation practices of indigenous people in the French colonial enterprise by unveiling the power that the local islanders had over French colonial agents.

Keywords: natural history, botany, eighteenth century, local power, public discourse on science, local encounters and negotiation, science and satire, classification

Poisons and Providence in Old Regime Paris (ID 210)

Emma Spary *(University of Cambridge, Cambridge, UK)*

This paper addresses the way in which making, controlling and writing about poisons in Paris between 1670 and 1789 created both opportunities and crises for scientific and medical claimants to public expertise. The capacity of poisons to evade detection, to work invisibly in undermining the health of the individual or public body, and to subvert existing power relations made them unreliable proxies for groups and individuals seeking to constitute themselves as knowledge experts. Those who did lay claim to knowledge about poisons risked public censure; the subtleties of the apothecaries', distillers' and cooks' arts, their claims to expertise over the distinction between poisons, medicaments and foods, and their skills in manipulating and re-producing these categories, made them prime targets for charges of poisoning in the late Old Regime. Physicians and botanists, by contrast, 'neutralised' poison by presenting it as a problem of wrong conduct and ignorance among consumers, one which public enlightenment in matters of health and natural history would resolve. Poisons, both literal and figurative, particularly preoccupied those critics of French courtly politics who, like Jean-Jacques Rousseau, were deeply invested in constructing Nature as the sole authentic foundation and guarantrix of moral,

social and political order. For such reformers, the existence of naturally venomous plants such as fungi posed a particular problem, especially in the face of theologically heterodox works which used them as evidence of divine malevolence.

Keywords: poisons, pharmacy, plants, Old Regime Paris, public discourse on science, public health, enlightenment, state of nature

Ignaz von Born's Monachologia (1783): Carl Linnaeus in the Emperor's service (ID 207)

Sebastian Kroupa *(University of Cambridge, Cambridge, UK)*

In 1783, in the midst of Joseph II's progressive reforms of the Habsburg Empire, there appeared a short anti-Catholic pamphlet called *Specimen Monachologiae Methodo Linnaeana*. Published under the alias Joannes Physiophilus, the work is widely ascribed to Ignaz von Born (1742–1791), a prominent naturalist and a leading figure of Central-European enlightened thought. In this satirical attack on the Catholic Church, monks were dehumanised – depicted as the 'missing link' between humans and apes – and selected religious orders were described and classified according to the Linnaean system: all that in support of Joseph's radical decision to dissolve hundreds of monasteries of predominantly mendicant and contemplative orders, which he considered of little public utility.

This paper explores Born's motivations, approach, and success in shaping the Linnaean system into an instrument of political ideology. Seeking inspiration in contemporary developments in natural history, particularly in the Linnaean programme which drew attention to the anatomical resemblance of humans to apes, Born masterfully turned a scientific debate into a tool of propaganda as to manipulate public opinion. Key to his success was the newly literate mass readership of the Enlightenment, which enabled scientific propaganda to attain new importance and become an essential part of modern sociopolitical discourse. Curiously, although monkeys had appeared in satire long prior to *Monachologia*'s birth, systematic dehumanisation reflecting scientific debate and based on the proximity of apes to humans *sensu Borniano* was innovative at the time, and *Monachologia* can be thus regarded as a pioneer of this now established practice.

Keywords: natural history, Ignaz von Born, Carl Linnaeus, science and satire, taxonomic classification, Josephine reforms

Putting knowledge on display: mayors, museums and public discourse in the French provincial city (1800–1860) (ID 211)

Déborah Dubald *(European University Institute, Florence, Italy)*

In the wake of the nineteenth century, French administrative and territorial maps had been deeply reshuffled. A new figure emerged, that of the mayor. From 1800 to ca. 1860, his status showed relative constancy: nominated by the executive power, his function remained rather equivocal as he represented the state as well as the interests of his local community – which also included the management of museums newly born from the Revolution. No matter how spontaneous or unfinished these expanding institutions may have seemed, they shared a common root in the museological science developed within eighteenth-century natural history cabinets. During the first half of the nineteenth century, museums were established as well-founded, visible elements of the urban scientific space. Yet, even if they were inspired by naturalist classification, the share of museums dedicated to natural history was variable and dependent on the decisions of individuals. As the key holder of authority but also as an individual whose social practices were embedded in a local community of notables and savants, it was the mayor who was at the heart of the decision-making process related to museums. In doing so,

he also partook in the elaboration of discourse on nature: altogether a discourse on material dimensions of how nature should be displayed, a discourse of justification on how nature served the public good, and a discourse on local nature as an instrument of appropriation of the regional space.

This paper aims at illuminating the evolution of the practice of mayorship and more specifically the complementary influences on the practice of natural science and the exercise of local power.

Keywords: local power, mayorship, museums, science and the public good, post-Revolution provincial France, public discourse on science, taxonomic classification, display and order

Empowering Spices: Indigenous power during the French Spice Quests in South East Asia (1768–1772) (ID 212)

Dorit Brixius *(European University Institute, Florence, Italy)*

Between 1768 and 1772, the intendant of the Isle de France (present-day Mauritius) Pierre Poivre initiated a series of spice quests in the Indo-Pacific region. These spices, namely nutmeg and clove, were acclimatised on the Isle de France in order to break the Dutch spice monopoly. The French were only able to conduct such an enterprise by relying on local informants, traders, and spies from both the Philippines and the Moluccas. Throwing a twist into this story, this paper suggests the Indo-Pacific indigenous people's power over the French: Had it not been for the islanders' collaboration, the spice project would have failed. The French would have been chased off by the Dutch, and by all means, not been able to collect nutmeg and clove on the Dutch-possessed Spice Islands, which the vessels of other Europeans were not allowed to access. Hence, by employing indigenous people as spies and by paying pirates to bring young plants and seedlings to specific transit spots outside the Dutch territory, French actors relied heavily on local collaborators. Using new and lively archival records, this paper suggests that this dependence on local allies empowered indigenous cultures, with the French being well aware of the potential danger that losing their indigenous collaborators represented for their own cause.

Keywords: Mauritius, Moluccas, French empire, indigenous power, local encounters and negotiation, go-betweens, colonial botany, spices

Symposium 206: Challenges for the history of engineering: Education, professions, circulation, sustainability, power

Organizers: ***Antoni Roca-Rosell*** *(Universitat Politècnica de Catalunya, Barcelona, Spain),* ***Ana Cardoso de Matos*** *(Universidade de Évora, Evora, Portugal)*

At present, historiography of engineering is attracting more and more interest for several reasons. First, engineering constitutes an outstanding professional group with basic links with the military and the process of industrialization; second, from the Renaissance, the profession became a scientific profession, incorporating in the XVIII century the so-called "school culture"; third, engineering is a global activity, the engineers being professionals with a high mobility; fourth, engineering has always local roots, in relation with local developments; fifth, the power use to take engineering as the base not only of its military actions but also as a way of economic, technologic and cultural domination; sixth, engineering was confronted to sustainability in several experiences, despite the fact of early experiences with solar energy, such as the solar plant of Las Salinas, Atacama (1872).

These aspects have been studied in many aspects, but we need to go in depth in several fields. In this session we present a number of approaches to the subject related to the Iberian Peninsula and Latin America. Four papers are centred in military affairs (training for gunners, theoretical preparation of army officers, the 1730 plan of Verboom and an episode of espionage by the Betancourt brothers), six deal with several aspects of technical education and the set of elites (on the task of J. Wellingen, the design of a steam engine in Barcelona, the continuity of mechanical engineering training in Barcelona, the rise of the engineering elite in XIX century Spain, the involvement of engineers in the government in Portugal, and the origin of the engineering profession in Colombia), and one paper analyses the accidental way of solar energy in XX century Chile.

The context of the analyses should be the evolution from mixed mathematics to engineering as scientific profession. The study of sociology of elites should also be taken into account. In the Iberian world, including Latin America, engineering constituted a relevant part of the elites formed from the XIX century. Finally, sustainability, being a present conception, has relevant roots in the history of engineering. Nevertheless, the idea was usually controversial.

Keywords: Artillery in 16th century, Military engineering in XVIII century Spain, Mathematics, Mechanical engineering, Technical espionage, The Jesuits and mathematics education, Steam engine technology in early XVIII century, Engineering and the new elites, Engineering and sustainability

Mathematics involved in the training for gunners in 16th century (ID 234)

Fàtima Romero Vallhonesta *(Centre de Recerca per a la Història de la Tècnica, Mataró, Spain)*

The works of military art acquired great importance during the 16th century in Europe, which was the scenario of intense warlike campaigns that started in the 15th century and still continued in the 17th century. From the mid-century, there arose a proliferation of works related to various aspects of military life. These include some treatises on the teaching of artillery and the mathematical theories about artillery shooting. Artillery, which was a skill to be learned from the lessons of an artillery master, eventually became a profession that today we would associate with engineering.

In this paper we analyze the 4th and 5th books of *El perfecto capitan instruido en la disciplina militar* (1590) by Diego de Álava Viamont, a lawyer who had studied mathematics under the teaching of Jerónimo Muñoz. The 4th book of his work deals with the measurements that a gunner has to take, and other mathematical procedures that he has to learn and describes in detail how to perform the measurements. To aid in this, mathematical instruments such as the gunner's quadrant, the gunner's level and the planisphere were also described. The 5th book is about ballistics or the "new science of artillery" and is clearly influenced by the work *Nova Scientia* (1537) by Niccolò Tartaglia.

Keywords: 16th century, artillery, mathematics, Diego de Álava Viamont

References: *El perfecto capitan instruido en la disciplina militar* (1590) by Diego de Álava Viamont

The theoretical preparation of army officers in Spain in the middle of the 18th century (ID 254)

Juan Navarro Loidi *(Cátedra Miguel Sánchez Mazas UPV-EHU, Donostia-San Sebastián, Spain)*

During the reign of Fernando VI (1746–1759) several institutions were created for a theoretical preparation of the officers of the army in Spain. In particular, in 1752 the artillery opened academies in Barcelona and Cadiz to train its officers. On the other hand, since 1720 or even earlier, there was an Academy of Mathematics in Barcelona, managed by military engineers, but offering its teachings to officers from all the branches of the army. Military engineers disagreed with the opening of academies for artillerymen, because they considered that their Academy was enough to cover all the needs of theoretical preparation of gunmen.

Comparing the programmes of the academies opened for the gunners with the syllabus followed in Barcelona, few differences can be observed. The manual prepared for the classes in Barcelona by the engineer Lucuce had better qualities than the notes prepared by the teachers of the academies for artillerymen. For the admission and inner organization there were some differences, but they were not important. Therefore, it doesn't seem that engineers' criticism was unfounded.

King Carlos III (1759–1788) closed most of the military academies opened during the previous reign, leaving in 1760 only two centres, one in Barcelona and one in Cadiz. The attempts to have similar structures and programmes in both academies failed. So, since 1760, an Academy of Military Mathematics in Barcelona, ran as before by engineers, coexisted with an Academy at Cádiz manged by artillerymen, with problems to run correctly.

The subsequent developments did not lead to the union of these two academies. In 1764 the Academy of Cadiz was closed and a College of Cadets of Artillery was created in Segovia by the new head of the artillery, the Italian count Gazzola. This establishment did not follow the previous Spanish tradition, but was inspired by the military Academy of Mathematics in Naples, and was supported by the teaching of the Jesuit Eximeno.

Infantry and cavalry branches also tried to have their own training establishments and they got their own academies opened in the second half of the 18th century. It has to be noted that when civil engineers were not institutionalized in Spain and architects were beginning to leave a guild organization, the military men had academies, more or less organized, for each branch of the army.

Keywords: Spain, 18th century, Military academies

The 1730 proposal for the education of the men of war by Jorge Próspero Verboom (ID 215)

Antoni Roca-Rosell *(Universitat Politècnica de Catalunya, Barcelona, Spain)*

Jorge Próspero Verboom was the engineer in chief of the Spanish Army. In 1711, during the War of Spanish Succession, he was involved in the foundation of the Corps of Military Engineers. After the war, he proposed the establishment of academies in many cities of Spain to train mathematics to the officers. In 1720, the King created one main academy in Barcelona where Verboom was supervising the construction of the Citadel. After 10 years of running of the Academy, Verboom wrote a long report on the orientation of military education after which the Academy of Barcelona changed its conception. In this paper, we would like to analyse the contents of the report, conserved in the Royal Archives in Simancas. The text of Verboom shows the main lines of engineering education at its time, and we would try to demonstrate its influence in the Barcelona Military Academy of Mathematics. In 1730, Verboom was arguing with the director of the Academy, Mateo Calabro. Verboom insisted in a three-year syllabus, incorporating the last versions of Euclid Elements and the proposals of Bélidor, teacher of the Artillery academy of La Fère. Verboom appreciated the ideas of Bélidor, but he disagreed the short syllabus of French military schools.

Keywords: Military education, Mixed Mathematics, Euclid Elements, Bélidor, Military Academy of Barcelona

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The Engineers on the Service of Big Policy, or How Two Spanish Experts Spoiled the Secrets of British Navy in France (1788) (ID 217)

Irina Gouzevitch *(Centre Maurice Halbwachs, Paris, France),* ***Dmitri Gouzevitch*** *(Centre d'Etudes des Mondes russe, caucasien et est-européen, Paris, France)*

In spring 1788, two young Spanish engineers, José Betancourt y Castro, and Augustin Betancourt y Molina, who were staying in France as fellow trainees, made a very particular three weeks travel across Normandy and Bretagne, visiting an impressive set of relevant military harbours of the French Atlantic coast. The fact in itself is not unknown. The Spanish historians (to begin with Rumeu de Armas) regularly mention it, referring themselves to the public and private archives. But the most often, they simply connect this travel with José's interest for the new system of pulleys « which made the revolution in the military shipbuilding », without giving any detail on its circumstances, aims, nature and results.

In this paper, we would like to present the study that fills this gap and restores the whole story using as key-sources some fragments of a manuscript diary and drawings conserved in family archives. However, to make these documents explicit, we had to apply a cross-reading analysis of many other public and private sources and to examine them in a wider historical context which involves the British achievements in the field of military shipbuilding, the "prouesses" of French military intelligence and the efficiency of Spanish technical commissioners at the late 18th century. Indeed, as we could notice, the travel was an emanation of the international competition in the field of naval performances between three European powers – France, England and Spain. To better articulate the different challenges of this complicate affaire we also had to identify the position of José and Augustin Betancourt in the wide network of national experts involved in this transnational competition at the same time as inventors, entrepreneurs, investors and hardened kidnappers of technical military secrets of their neighbours who did not disdain, if necessary, to collaborate each with the other.

This mission which involves the interests of the individuals and of the big administrations, of the localities and of the States, is a small but significant episode of the history of professional motilities and of circulation of knowledge which explain how, in the history, the engineers put their nets and competences on the service of the big policy.

Keywords: British Navy, French military intelligence, Spanish fellow trainees in France, late 18th century, circulation of knowledge, international competition, Augustin Betancourt, José Betancourt, engineering travel, prodfessional mobility

Wendlingen: a scientist in the Eighteenth Century Spanish Court (ID 228)

Joaquim Berenguer *(Universitat Politècnica de Barcelona, Barcelona, Spain)*

In the mid-eighteenth century, the Spanish Court was aware that the country had to meet the demands for economic, social and military development which needed that technology be reinforced by the new scientific knowledges. The Bourbon Monarchy wanted to link science with the task of renovation of the institutions that aimed at the well-being and the progress of the country, that is to say, to put it at the service of the political power which was driving this task of reformation. The still powerful Society of Jesus was one of the sectors at the service of the Crown in the process of "modernization", where science and technology were identified with material progress of the society. Around 1750, the Society of Jesus sent Wendlingen, who was a Jesuit mathematician and teacher in Prague, to the Imperial College in Madrid. Wendlingen became professor of mathematics in this college, a tutor of the princes, and Cosmographer of the Indies. He particularly received an order to launch an astronomical observatory in the Imperial College that would have connections with the network of Europeans observatories. Furthermore, this Czech teacher published a complete treatise on mathematics in Madrid as a textbook for teaching either in the Imperial College or in the Seminary of Nobles. In 1761 Wendlingen left his post, even though he continued to teach at the Imperial College until 1767, the year in which the Jesuits were expelled from Spain.

The aim of our paper is, on the one hand, to show Wendlingen as clear exponent of the complicity established between the political power and religious powers, and the scientific community, as part of the process of promoting science as the best tool for improving the power of the Crown. Wendlingen, thus, was an active agent of applying mathematics to the technological development of the country, that is, as a technician supporting economic and military interests of the Spanish Crown.

In this paper, with some examples of Wendlingen's practise and texts he wrote, we aim to analyze his role in the process by which science became more visible in the Court of Madrid, as a tool for progress and, in which the authority of the actors involved was eventually consolidated. On the other hand, we have selected the manuscripts on differential calculus as the mathematical texts written by Wendlingen, the analysis of which may help to understand Wendlingen's role in the introduction of differential and integral calculus into the eighteenth century Spain, as a part of mathematics in its broadest sense, where technology, experimental physics and astronomy and cartography had a special relevance.

Keywords: Wendlingen, Differential and Integral Calculus, Eighteenth Century Spanish, Astronomical Observatory, Jesuit, Teaching Mathematics, Colegio Imperial

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Francesc Santponç and the construction of a double-acting steam engine in Barcelona (1804–1806) (ID 218)

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Francesc Santponç i Roca (1756–1821), a medical doctor, and an expert in Mechanics, designed and directed the construction of a steam engine for a textile factory of Barcelona. In 1804–1806 he wrote a report about the process in which he described the parts of the machine, with accurate drawings, and explained how it worked. The report was prepared to be printed at the Royal Press, but the war interrupted the process and the report was lost. In the private archives of Santponç's family, there are several drafts of the report from which J. Agustí Cullell prepared a printed version in 1983.

Recently, the original report that was lost, has been identified in a library in Barcelona. One of the remarkable features of the engine designed by Santponç is that it was a double acting machine, according to the design of the Spanish engineer Agustin de Betancourt, but Santponç introduced several improvements.

In this paper we analyse some of the technical contributions of Santponç, in the framework of the process of adaptation and appropriation of the steam-engine technologies in Spain, thereby providing evidence of the contributions made in the South of Europe to industrialisation. The engine of Santponç would to be printed by the Crown in order to diffuse the steam technology in Spain. The loss of the original eventually signified a delay in the introduction of this technology in Spain.

Keywords: Francesc Santponç i Roca, Steam Technology, XIX century, Double-Acting steam engine

The difficult search for the first Barcelona's professor of machinery (1821–1831) (ID 262)

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After the death of Francesc Santponç, professor at the School of Mechanics of Barcelona, the Junta de Comercio (Board of Commerce) tried to keep the theoretical and practical teaching of that discipline without having a specific school for this. Later, in 1828, when Gaietà Faralt, the director of the Machines cabinet, died, the Junta looked to find a suitable candidate to take charge of a new chair of machinery. This was not an easy task and this could not get until 1831 when the Junta appointed Hilarión Bordeje who, at that time, lived in Paris. Throughout this decade (1821–1831), the Junta de Comercio had more than ten requests between suitors to replace Santponç classes and candidates to teach machinery. They all had very different skills and knowledge. The former included Cristòfor Montiu, Carles Ernest Cook and Salvador Magrinyà and among the latter we have Pere Màrtir Armet, Josep Ricart, Francesc Corominas, Francesc Puig i Soler, Josep Antoni Carerac, Antoni Sadó, Francesc Arau and Francisco Grimaud de Velaunde. Furthermore, in 1826 the Junta sponsored the project of the brothers José and Luis Hubert to create an Establishment of theoretical and practical machinery, watches and other arts. This paper aims to analyze the criteria of the Junta de Comercio of Barcelona in its search for a suitable candidate for the chair of machinery.

Keywords: School of Mechanics of Barcelona, Chair of machinery, Hilarión Bordeje, 19th Century

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Meritocratic Fiction: The Rise of Spanish Engineers as a Social Elite (1836–1912) (ID 213)

Darina Martykánová *(Universidad Autónoma de Madrid, Madrid, Spain)*

Currently, engineers are held in high esteem in Spain. Degrees in engineering are considered to be among the most difficult ones, attainable only by hardworking and intelligent people. The image of excellence enjoyed by engineers contributes to actually push them away from engineering, towards top management. In my paper, I argue that this current image has roots in the construction of the profession in the nineteenth century, and has a transnational dimension. I will show how certain type of knowledge and meritocratic procedures in engineering education came to legitimise the engineers' aspirations to high social status in a society where liberal discourse achieved a hegemonic position, while work continued to be a practice that could be socially compromising. I would then examine how these patterns reproduced and transformed in a changing political context.

Keywords: engineers, Spain, meritocracy, elites

The engineers and the construction of a political elite and a liberal state. Portugal 1852–1926 (ID 237)

Ana Cardoso de Matos *(University of Évora -CIDEHUS, Évora, Portugal)*

In the second half of the nineteenth century, knowledge and territorial organization as well as modernization of public administration, which were essential conditions for the functioning of the liberal state, have highlighted the importance of technical skills and contributed to the political and social statement of the engineers.

The construction of transport networks, the modernization of urban infrastructures as well as industrial development, that were activities that demanded the technical expertise of engineers, also contributed to the growing importance of this professional group at a political and social level.

Thus, the participation of engineers in the political and administrative life of the country increased, either as ministers or officials of various ministries, as parliamentarians and as members of the local power structures. In Portugal, the Ministry of Public Works, Trade and Industry, was regularly directed by engineers, who were also present in other ministries such as the Ministry of War and the Navy and Overseas.

In this communication we aim to analyse the following aspects: a survey of engineers who occupied important positions in the central administration, with particular attention to those who held the post of ministers; a study of the education and the professional trajectory of the engineers who were ministers of the Portuguese government. The period under study would be from 1852, when a liberal regime that promoted the policy of "material improvements" was settled, to 1926, when the so called "28 May Revolution" changed the political regime of the country.

Keywords: Engineers, Political elite, Central administration, Ministers, Government, Portugal

20th Century Engineering Professors in Colombia: The Case of the Universidad Pontificia Bolivariana since its foundation in 1936, to the end of the 1990s (ID 272)

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This article is the result of a study intended to examine 20th Century Colombian Engineering teaching practices and professors; it specifically displays the case of the School of Engineering at Universidad Pontificia Bolivariana, located in one of the main cities, on the central mountainous region of the Country. The exploration was focused on the period from 1936 – date of foundation – to the 1990s; it also depicts a comparison to the actual situation.

The main aspects considered in this paper are professors' motivation, academic qualifications, attitude towards teaching in the Engineering field, as well as the actual social status of the profession. The exploration was carried out through the analysis of particular experiences that evidenced how time and change of mentalities have affected both the teaching practices and the professors during the 20th century in Colombia.

The paper provides answers to the following questions:

Why and how did a person become an engineering teacher, particularly in Antioquia, Colombia, during the 20th Century?

How has society perceived this decision through the 20th Century?

How have society, scientific and technical development affected the engineering professors' work?

As required by contemporary history, this study thoroughly reviews live memories from both students and professors, besides documentation from the Department of Documentary Management from the University, the historical archive from Universidad de Antioquia, and the National General Archive.

Keywords: Engineering Teaching, History of Engineering, Engineering in Colombia

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Solar energy discarded in XXth century (ID 221)

Nelson Arellano-Escudero *(Universidad Andres Bello-Chile, Valparaiso, Chile)*

Solar energy played a very important role in the mining industry in the 19th century in the Atacama Desert. Nevertheless, the solar techniques used mainly for desalination of water were discarded in the early 20th century and eventually completely forgotten. In the 1950s they were recovered in the USA, and solar technology has been used again in the Atacama Desert on an industrial scale. At the present time, a world-wide scientific and engineering network has been built up: science and technology as power.

The conception of the evolution of technology has been discussed by George Basalla in terms of the confrontation between continuity and novelty through selection processes that are affected by economic, social and environmental factors, techniques and policies. Gille and Hughes stated that the

management of artefacts generates socio-technical systems; Unruh argued that a technological momentum tends to lock-in of technical alternatives. Finally, the 7th thesis of David Edgerton states that in the history of technology the preferred option is not always the most economical alternative.

This communication aims to understand some aspects of the social values and cultural factors involved in the early history of the solar energy industry in the Atacama Desert. The work is based on Chilean, USA and European archives. The research encourages, in Basalla's words, the development of a narrative on viable alternatives to winning technologies.

Project HAR2013-44643-R, Spanish Ministry of Economy, Spain. Proyecto Fondecyt Postdoctoral 3160197, Universidad Arturo Prat – Chile.

Keywords: Solar energy, Artifactual discard, Intermittent duration, Nitrate industry, Chile, History of technology, Environmental History, Sustaintability

The educational project of the Faculty of Industrial Chemistry of Universidad Pontificia Bolivariana in the business development of Antioquia, Colombia (1938–1960) (ID 277)

José Álvarez *(Universidad Pontificia Bolivariana, Medellín, Colombia),* ***Marisol Osorio*** *(Universidad Pontificia Bolivariana, Medellin, Colombia),* ***Beatriz Garcés*** *(Universidad Pontificia Bolivariana, Medellín, Colombia)*

This work presents the most important findings of the research "Strategies for obtaining a historiography of the School of Engineering of the Universidad Pontificia Bolivariana (UPB)". Here, we consider the place of Chemical Engineering of UPB in global, national and regional industrial development; we expose the academic and social nature of the training project of the Faculty of Industrial Chemistry of the UPB at Medellín (Antioquia – Colombia) in the period of study and, as a result, we show a tour of some of the most relevant contributions to the industrial development of Antioquia.

Historical research has been supported by various local and national sources of information as Departamento de Gestión Documental (Department of Document Management) of Universidad Pontificia Bolivariana, Archivo Histórico (Historic Archive) of Universidad de Antioquia and Archivo General de la Nación (General Archive of the Nation), to locate the presence of graduates of the academic program of interest in companies the region, as well as their capacity for taking risks and performing innovation for the formation of new businesses in Antioquia; region in Colombia that has been recognized for its leadership in the development of such organizations. The background question is: How to explain the relationship education in chemical engineering and business development?

Keywords: History of engineering, History of industry, Industry and academia

Teaching Engineers in the Seventeenth Century: The Aula de Fortificação in Lisbon (Portugal) (ID 332)

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In the seventeenth century, technical developments in the military field (construction, fortification, pyro-ballistics, strategy) and in scientific instruments increasingly made the mathematical disciplines a universal tool. These disciplines, classified by the authors into pure and "mixed" mathematics, provided the basis for the training of engineers. This training gave rise to a series of textbooks named *Cursus Mathematicus* which set out the scope of mathematical developments. Theoretical and practical education was necessary for military engineers, especially the training in practical geometry for designing and building all kinds of fortifications in accordance with the historical circumstances prevailing in

Portugal at time. The fortification of borders became particularly important after the definitive separation from Spain in 1640.

Thus, the aim of this paper is to analyze this training at the Aula de Fortificação, founded in 1647 in Lisbon (Portugal) by the Chief-cosmographer and Chief-engineer Luis Serrão Pimentel (1613–1679). In his work, *Methodo Lusitanico,* written in Portuguese (1680), Serrão Pimentel was trying to pioneer a particularly Portuguese way of practicing engineering. It is our intention to conduct an in-depth analysis of some aspects of the syllabus at the Aula in which it is possible to determine the main advances of mathematics in the late seventeenth century.

Keywords: Mathematics, Pure Mathematics, Mixed Mathematics, Fortification, Engineering, Seventeenth century, Portugal, Luis Serrão Pimentel, Aula de Fortificação

American technocracy and the rhetoric of the technological fix (ID 8)

Sean Johnston *(University of Glasgow, Glasgow, UK)*

The notion of the 'technological fix' had a remarkable rise in popularity and application through the twentieth century. Its claim is that an engineering or technological approach is suitable not merely for tackling technological problems but also as a basis for efficiently diagnosing and resolving social, cultural and political issues. This confidence, or hubris, concerning the relevance of technological solutions to human concerns has ranged from the design of inherently safe streetcars to proposals for remediating climate change.

The rise of technocratic movements between the two world wars encouraged analysis of how scientific methods and technological change contributed to the nature of modern societies. In North America, Technocracy Inc promoted the management of society by 'technocrats', or engineer-scientists attuned to technological solution-finding.[1] From them came ideas that directly challenged conventional political and social authority.

This paper analyzes the discourse about technological fixes originated by American technocrats, identifying precursor ideas and exemplars and characterizing the rhetoric that co-evolved with it. It traces the evolution of these ideas from the Great Depression to postwar reformulations. Later enthusiasts, notably chemist and urban planner Richard L. Meier[2] and nuclear engineer-physicist Alvin Weinberg[3], reframed the notion as a tool to augment, rather than to directly challenge, conventional politics and economics. They argued for the rapid societal progress achievable through technological problem-solving. Expressed as a discussion-point rather than polemic, the concept has been widely disseminated since the mid-1960s.

Its engineering and technocratic supporters, on the one hand, and humanist and social-science critics, have informed wider cultural reflection on the short-term benefits and unintended side-effects of technological solutions, particularly in relation to health and environmental issues. By examining the historical trajectory of faith in the technological fix, this work reopens the central claims to fresh audiences.

Keywords: technological fix, technocracy, interwar, Alvin M. Weinberg, Richard L. Meier, technological confidence, expertise, scientism, authority

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2. e.g. Meier, Richard L., *Science and Economic Development: New Patterns of Living* (New York: Wiley, 1956).

3. e.g. Weinberg, Alvin M., *The First Nuclear Era: The Life and Times of a Technological Fixer* (New York: American Institute of Physics Press, 1994).

The role of French polytechnic engineers in Algeria's modernization process (19th–20th centuries) (ID 609)

Yamina Bettahar *(Université de Lorraine, Nancy, France)*

We know that the great French schools have contributed to the scientific and technical training of foreign students. But we don't know the role played by these institutions in the Maghreb countries and particularly in Algeria during the colonial period. Whether by sending French engineers in this country by hosting children of European people established in Algeria, in fact, a direct current between these schools and Algeria is discoverable.

If we specifically consider the example of the Polytechnic School of Paris, through the case of "corpsards", we see that this historical great school has contributed in different forms in the process of modernizing Algeria during the colonial period and after the country gained its independence.

We distinguish two major socio-historical periods: the late nineteenth and early twentieth centuries, with the arrival of the first engineers in Algeria related to mining exploration and the emergence of the first milestones of higher education in Algeria; and secondly, one that followed World War II, with the installation of French firms related to oil and gas exploration.

Independence was proclaimed in 1962, opens a new page in the history of Algeria, and French-Algerian relations, marked by the time of the scientific and technical cooperation between the two countries.

Keywords: Algeria/French colonial empire, colonization, industrialization, engineering training, Polytechnic, mining schools

Symposium 226: Science and Education in the Context of Modernization

Organizer: ***Dazhi Yao*** *(Chinese Academy of Sciences, Beijing, China)*
Chair: ***Baichun Zhang*** *(Chinese Academy of Sciences, Beijing, China)*

In general, science and technology are seen as an important driving force for modernizing human societies. Scientific education has also been understood an integral element for the modernization of countries. However, there are some tensions between modern science and traditional knowledge, between scientific value and engineering culture, between modern educational institutions and traditional bureaucratic systems in European and Chinese societies. What are these tensions? How does a modern intellectual recognize them in a transnational context? Is there any difference between French and Chinese conditions?

The priority of decision-makers in France and China is usually to improve their countries' economic competition or to support a strong national defense. However, some practical concerns, such as national defense, civil and military engineering, promoted the development of scientific and technological education. Although it is likely that projects of national defense and military engineering were more of a technological nature than a scientific one, sometimes funding and attentions were directed towards educational reforms with regard to pure science as known and practiced by scientists and mathematicians. The establishment and early history of the French *École polytechnique* is a typical case in a sense.

Some Chinese intellectuals and decision-makers understood science and technology, which are key factors of the development of advanced western countries, as effective instruments for the modernization of a catching-up country. They did not only promote the values of science in China, but also constructed new educational institutions applicable to this country. Some Chinese intellectuals compared modern scientific education to traditional cultivation, when discussing the significance of science and its institutional environment. Chinese Foochow Arsenal, founded in the context of traditional Chinese bureaucratic system, was obviously different from its European precursors, such as French *grandes écoles*. To some extent, those Chinese intellectuals' thoughts and China's institutions cannot simply be considered a copy of the western achievements.

Keywords: Science, Technology, Education, Modernization, China, France

The Nature of Science and Purposes of Education : Three Lectures delivered by Chinese intellectuals in the 20th century (ID 233)

Yufen Han *(Huzhou Technological College, Huzhou, China)*

Prof. Yang Quan (杨铨), Jin Yuelin (金岳霖) and Wu Dayou (吴大猷), who were educated in the U. S., were famous intellectuals in China before the establishment of People's Republic of China. In different periods of the 20th century, they, respectively, gave three lectures on the progress of modern Science and the modernization of Chinese education. Some fundamental tensions between natural sciences, modern education and Chinese society can be perceived in these lectures given on different occasions and in different contexts. From the lecturers' point of view, what was the fundamental tension between modern science and traditional Chinese knowledge? What was an ideal social environment to promote the development of natural sciences and modern education in China? What was the correct role that a modern government should play? These issues are related to the existence of science in traditional Chinese society, the nature of science, the purposes of education etc. More specifically, these three lectures share the following basic opinions: (1) There was no science in traditional Chinese society, and science and technology are essentially different; (2) science, literature, and philosophy all have great value; education has its own purpose; (3) It is necessary for a government to construct suitable conditions and promote the development of science. These common issues and opinions are typical

among Chinese intellectuals influenced by Western scientific culture in the first half of the 20th century. They are still significant to understand scientific development environment in contemporary China.

Keywords: Yang Quan, Jin Yuelin, Wu Dayou, Science, Technology, Education

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Between Scientific Education and Engineer Training: The early history of the École Polytechnique (ID 376)

Dazhi Yao *(Chinese Academy of Sciences, Beijing, China)*

As one of the greatest educational creations during the French Revolution, the *École polytechnique* played a central role in the history of higher education and science in France. Because of the *École polytechnique*, as well as other new institutions of scientific higher education, a scientific teaching profession developed massively during and immediately after the Revolution in France. The *École* is not only the core for the French system of *grandes écoles*, but also a seedbed of eminent scientists. Furthermore, from 1794 to 1830 no institution in Europe could compete with its reputation for excellence in the exact sciences and mathematics.

The early development of the *École polytechnique* implied a basic tension caused by two conflicting goals, that is, advancing scientific knowledge and teaching technical practice. The presentation portrays a general interpretation of programs, courses, examination systems, and theory and practice at the *École polytechnique*. Some controversial issues and debates, regarding the *écoles d'application*, course syllabuses, and administrative groups, evolved gradually in the early 19th century. Sometimes, they represented a certain amount of friction between engineers and scientist politicians who were active in establishing the *École polytechnique*, or between the goal of scientific education and the need for technical training. One of reasons that caused the decline of the *École polytechnique* seems to have been its submission to the logic of technocratic reproduction especially after the middle of the 19th century. However, the *École polytechnique* was originally designed to train engineers and higher civil servants to a great extent.

When we discuss how this internationally known school functioned and changed in the context of elitist engineering education and scientific education in its early history, we must realize that this institution was not only a land of scientific inquiry, but also a place in which ostensibly professional practitioners were trained. Various issues in the early history of *École polytechnique* were intertwined with the two basic demands of pursuing theoretical knowledge and teaching general technical knowledge of practical value.

Keywords: École polytechnique, Scientific education, Technical training

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The Greenhouse of China's Technical Education: Foochow Arsenal and its Attempts to Transplanting a French Model (ID 243)

Mingyang Li *(Chinese Academy of Sciences, Beijing, China)*

One of most important aspects of the modernization of education is the transformation of technical education from traditional apprenticeship into professional engineering education. In Europe, transformation has begun since the *grands écoles* were established in France at the end of 18th century. However, China did not have any modern institution of technical education until the Foochow Arsenal was built in 1866. In 1860s, Chinese government still believed in the French model and hired Paul d'Aiguebelle and Prosper Giquel, two former French military officers and engineers, as the directors of Foochow Arsenal. With the support from Tso Tsung-Tang and Shen Pao-Chen, the two French directors investigated French technical education and industry, bought French equipments and raw materials, drew up a 5-year plan, and hired a group of French engineers as teachers for the school——it was as if a French *école* had been totally moved into a Chinese context. In fact, one can notice some differences between Foochow Arsenal and other enterprises built during the Self-Strengthening Movement from 1861 to 1895, in which several influential Chinese ministers initiated institutional reforms and military industry by introducing western technologies. Firstly, the naval school and the manufacturing school were combined while the students were educated in English and French respectively. Secondly, the school was associated with the shipyard, which offered the students plenty of chances to practice. More importantly, four groups of students were sent to France and Britain for further learning and training.

Foochow Arsenal played a special role in the history of China's technical education. This paper will examine how the French model was transplanted to China and how it worked and failed in the context of traditional bureaucratic system and geopolitical tensions. The transplanted model of technical education that grew up in the greenhouse could hardly be compatible with the traditional education system.

Keywords: Technical Education, Foochow Arsenal, Prosper Giquel, Self-Strengthen Movement

Symposium 240: Statistics and Power – Power of Statistics?

Organizers & Chairs: ***Annette B. Vogt*** *(Max Planck Institute for the History of Science, Berlin, Germany),* ***Ida H. Stamhuis*** *(Vrije Universiteit Amsterdam, Amsterdam, the Netherlands)*

In the symposium we will bring together investigations on the history of (proto-) statistics with the focus on the interaction between the power of state, civil society, group and person, on the one hand, and the power of statistical knowledge and techniques, on the other, at different times and in various countries. Case studies on various fields of statistics – from proto statistics to population, medical and mathematical statistics – and on various techniques – from systematisation to classification, quantification and probabilistic models – are welcome.

Between 1750 and 1950 statistics developed enormously, theoretically as well as practically, and statistics became a powerful methodological tool in various knowledge fields, ranging from economics to the life sciences. Over the same period, statistical education and state statistical offices were developed in quite various ways in different countries. In our session we will investigate how these processes were interconnected and will study these processes from a long-durée and a comparative perspective. Possible questions might include:

– Do statistical data have power? How was data acquisition linked with levels of power of the individuals or institutions? How do differences that existed between data collections and data compilations in earlier centuries compare with the problem of "big data" in the 21st century?

– When, where, and how have producers of statistics influenced political, social and teaching institutions, politicians or decision makers? To what extent did statistical organisations become powerful in relation to the state and society? How were statisticians dealing with the problem of international communication and cooperation and national production of statistical knowledge, i.e. the local/national versus global/international statistical data compilations?

– Did statistics as a discipline have power? When, where, and how did statistics become a powerful tool to describe elements of reality and to understand those developments better? What does it mean to say that statisticians have power to predict certain occasions, or that statistics is linked with forecasting?

Keywords: statistics, comparative perspective, long-durée perspective, data and tables, facts and figures, new categories in statistics, Germany, The Netherlands, The USA, mathematical statistics, statistical physics

History, data and tables: statistical evidence in 18th century histories of Dutch commerce (ID 388)

Ida Nijenhuis *(Huygens Institute for the History of the Netherlands, The Hague, the Netherlands)*

Recent historiography has characterized *Hollands Rijkdom* (Leiden, 4 vols. 1780–1783) by Elie Luzac, the Leiden-based enlightened conservative writer and publisher, as the first serious history of Dutch commerce. One of the reasons for this designation was his use of historical sources, financial data and various kinds of tables. Luzac's publication was not unique: during the second half of the eighteenth century more and more histories of Dutch commerce used statistical evidence. In doing so they exemplified what Lorraine Daston in *Histories of Scientific Observation* (2011) has called the arrival of observation and experiment, both as a key learned practice and as a fundamental form of knowledge. Luzac was convinced that the 'science of commerce' would be instrumental in furthering human happiness and perfection. The use of statistical and historical evidence in his work and that of other authors on the history of commerce reflects the arrival and application of a scientific, Newtonian method. Luzac claimed that history was the source of his considerations and reasoning. He stated that his sources, compiled in appendices to his volumes, were presented in their original form as far as possible and

that he approached his subject in the manner of experimental physics. But why was this important to him and to his readers? And why did other authors (as, for instance, Herman van den Heuvel or Cornelis van der Oudermeulen) also attempt such 'scientific' approach in their histories of commerce? Did they aim for evidence in order to convince their readers and to influence those in power? In my contribution to this session I want to investigate whether the choice for specific statistical evidence by several writers on the history of Dutch commerce was linked to its presumed power of persuasion.

Keywords: statistics, the Netherlands, history of Dutch commerce, statistical evidence

Kluit's assessment of facts and figures in the new statistics (ID 402)

Ida Stamhuis *(Vrije Universiteit Amsterdam, Amsterdam, the Netherlands)*

Notwithstanding its innovative character, the first teaching of statistics or political economy in Leyden by Adriaan Kluit (1735–1807) in 1802 did not come like a bolt from the blue. In statistics or political economy, the state was the focus of attention. According to Kluit, the innovative character of statistics was that it was based on facts and figures rather than on preconceptions. In the 19th century official statistical institutions would emerge and become settled. The quality of the facts and figures would correspondingly improve. Kluit however, could not yet rely on this official information. Instead, he obtained his facts and figures from several different kinds of sources: (often voluminous) surveys, publications of learned societies, articles in newspapers, and few official compilations. I will discuss how he used these sources. Did he discuss their quality and reliability and their power of persuasion? Which criteria did he used to assess this? I will illustrate my exposition with Kluit's arguments in his lecture notes and in his published correspondence of ideas on the size of the population of Amsterdam with the professor of mathematics Jan Hendrik van Swinden (1746–1829), and the professor of medicine Gerardus Vrolik (1775–1859).

Keywords: statistics, quantification, facts, figures, The Netherlands, Kluit, Vrolik, Van Swinden

Self-knowledge through numbers. Self-instructors in phrenology as selftracking technologies, 1850–1900 (ID 390)

Fenneke Sysling *(University of Utrecht, Utrecht, the Netherlands)*

This paper takes the nineteenth century phrenology in the US as an example of how quantification was used by both scientists and the larger public. It proceeds from the observation that quantified knowledge about mental characteristics was considered to be a convincing basis for self understanding and self improvement. Phrenologists believed that the human mind could be categorized according to different mental faculties, with each particular faculty represented in a different area of the brain. On the head the development of these areas could be studied by analyzing the bumps. While scientists started to see the data produced by individual measurements as useful to produce knowledge about larger populations, individual consumers of phrenology used quantification in phrenology too. With the help of phrenological 'Self-instructors' they measured the circumference of the head and studied the bumps with techniques of quantification. Men and women who used the Self-instructors were thus able to transform their own self-understanding and worked towards self-improvement by engaging with quantification. In my contribution I will analyze to what extent phrenology's powers of persuasion were based on these techniques and I will show how they produced different outcomes for different users. By analysing this nineteenth century mode of head quantification, I hope to contribute to the history of quantification and to point to the different ways in which quantification produced new categories and new self-understanding. This case study demonstrates that the persuasive force of statistics was so strong that it not only traveled from the social to the individual realm, but that it also had the power to change an individual person's self understanding.

Keywords: quantification, measurement, phrenology, USA, techniques of quantification and statistics

How statistics entered physics? (ID 395)

Olivier Rey *(CNRS, Paris, France)*

Very often, the world raises problems for science that science grapples with using its own methods. Such is the case with thermodynamics, which to a large extent arose from the industrial revolution, and the questions of energy transfers in production processes. However, the kinetic theory of gases in the second half of the 19th century offers the reverse picture. The problem researchers had to deal with in this case was a theoretical one, internal to physical science: how could one reconcile new thermodynamics with the mechanical conception of the world inherited from Newton? According to that conception, all physical phenomena should result from particles and the forces which make them interact. Here, the method implemented to answer the question was imported from the study of human affairs, where statistics had begun to prove dramatically powerful. The spectacular regularities that statistics had revealed and emphasized in social life – especially through Adolphe Quetelet's biometrical works, which had been translated into English and had a strong impact in the United Kingdom – were a decisive inspiration to Maxwell's statistical approach in physics. The comparison with the power and efficiency of statistics in the social field, together with its own authority, helped Maxwell to convince doubtful physicists of the validity of his approach. Conversely, the development and the success of statistical methods in physics became later a strong support to an extensive use of sophisticated probabilistic and statistical schemes in social sciences, including economics.

Keywords: kinetic theory of gases, statistical physics, Maxwell, Quetelet, thermodynamics

Graphs and graph-like maps as tools of power then and now (ID 561)

Harald Gropp *(Universität Heidelberg, Heidelberg, Germany)*

While modern maps try to display the earth or parts of the terrestrial surface as exact as possible, there are graph-like maps available, e.g. the map of a bus network. Mainly before the 16th century. there are maps which look distorted, but which are meant to be graph-like maps or cartograms. A prominent example is the Tabula Peutingeriana, a medieval manuscript of ancient origin? There are millennia old street maps which have survived. Not only streets but also rivers may play the role of edges in a graph. This will be demonstrated by maps which are not so well known in a European context.

Altogether the question will be investigated why certain maps are displayed in a certain manner and to whom this serves, i.e. which power relation is represented. This will concern graphs and graph-like maps but also other maps and plans where the "geometric layout" serves certain purposes.

On the one hand, this paper will contribute to the discussion on the power of maps. On the other hand, a closer connection of graphs and maps in relation to networks will hopefully support the discussion on concepts which were and are deeply interconnected then and now.

Keywords: graph. map, cartogram, power relation, Tabula Peutingeriana

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Victorian Statistics: From the London Statistical Society to the Royal Statistical Society (ID 610)

Lukas M. Verburgt *(University of Amsterdam, Amsterdam, the Netherlands)*

This paper discusses the complex connections between philosophy of science, probability theory and the institutionalization of statistics in Victorian Britain. More specifically, it explores the relation between two philosophical and historical points. Firstly, given the Baconian-Newtonian framework within which they worked, the towering figures of 19th-century British thought were hesitant to take seriously the ('rationalist') link between induction and probability, let alone the reduction of induction to probability. Secondly, despite their misgivings and reservations about 'inverse probability', scientists like Whewell, Babbage, and others were actively involved in the problematic aim of founding statistical societies (the London Statistical Society and the Royal Statistical Society) on a 'continental' model. The paper concludes with an analysis of the implications of the relation between these two points for the history of Victorian philosophy of science, probability theory and statistics.

Keywords: statistics, Great Britain (Victorian time), philosophy of science, theory of probability

Euler and Lagrange's involvement in the insurance policies of the German states (ID 523)

Maria Teresa Borgato *(University of Ferrara, Ferrara, Italy)*

Statistical studies were originally mostly motivated by the study of populations and for good governance and social security. One of their major applications was the field of insurance. Some types of insurance, like marine insurance, have ancient origins, whereas the philosophical and scientific bases of insurance are to be found in seventeenth-century rationalism. Statistics provided a way to destroy the superstition that caused Man's resigned attitude to fate. Leibniz attributed an ethical foundation to insurance and saw its great potential to liberate man from his evils. The acceptance of rationalist ideas on the part of Lutheran orthodoxy can mainly be traced back to the teaching of Caspar Neumann (1648–1715), who influenced Johann Christian Kundmann (1684–1751) and Johann Peter Süßmilch (1707–1767). On the other hand, the long tradition of assistance to widows in German countries (especially to Protestant pastors' widows) favored the evolution toward social insurance from the early decades of the eighteenth century, in the wake of the experience of private insurance companies, active above all in Great Britain. Leonhard Euler devoted several works to mathematical statistics and actuarial science, and in five memoirs he dealt particularly with life insurance: immediate or deferred life annuities, insurance on life or death, on one or two lives. All have a common theoretical framework, based on mortality tables and the actuarial calculation. Two of these memoirs contain an insurance project for widows (1770, 1776) and are linked to the two major German institutions devoted to this purpose: the *Calenbergische allgemeine Witwenverpflegungs-Gesellschaft* of the Principality of Calenberg, and the *Königlich-Preußische allgemeine Wittwen-Verpflegungs-Anstalt* of the Kingdom of Prussia. Joseph-Louis Lagrange, who succeeded Euler at the Berlin Academy of Sciences, was himself involved in the Prussian institution for widows' pensions, and, in contrast with the ministerial authorities, foresaw its bankruptcy (1776). Lagrange's memoir, which follows Euler's theoretical framework, remained unedited and has only recently been published. A second memoir by Lagrange, on orphans' insurance up to their coming of age, written in the Berlin period (1781), was published only seventeen years later, when he was in Paris.

Keywords: statistics, actuarial sciences, Euler, Lagrange, pension funds, widows' funds

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Between Mathematics and Social Sciences: The Statistical Field in Germany, c. 1880–1935 (ID 401)

Jochen F. Mayer *(currently: independent scholar, Edinburgh, UK)*

This paper revisits the hypothesis that there was an increasing 'split' in late 19th century German statistics between mathematical and social scientific concerns for the study of society (Oberschall 1965; Porter 1986). By 1900, the statistical mathematics of Lexis and von Bortkiewicz, so the argument goes, had become interested primarily in mathematical problems rather than social sciences, while mainstream research in social statistics gave way to a rather narrow accumulation of data as embodied in the work of v. Mayr. Combining Bourdieu's notion of scholarly 'fields' with approaches in scholarly network research, the main aim of this paper is to give further empirical evidence which may help to explain why this split occurred and developed to the point where mathematically trained statisticians were almost completely marginalized from mainstream statistical activities even before WW I.

Drawing on a sample of journal articles published between 1880 and 1935 in two prominent academic journals (*Jahrbücher für Nationalökonomie und Statistik; Allgemeine Statistische Archiv*), the first part of the paper reconstructs co-citation networks to show that mathematical statisticians had formed a small but vibrant international network. This analysis shows that from roughly 1910 this group was marginalized by the persistence of administrative statisticians strongly embedded in contemporary sociology and 'state sciences'. I will then go on to explain this marginalization with reference to the relative strengths and weaknesses of the statistical networks as measured by the internationality of citation practices and by the relative proximity to the 'temporal powers' of the state. The final part shows how circulation and content structure of statistical textbooks published in the period underinvestigation helped to consolidate the social statisticians' 'visions and divisions' of the statistical field.

Keywords: German social statistics, mathematisation, empirical social research, Weimar culture, historical network research, scholarly fields

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The invention of new categories in German statistics in the 1920s – Three different reasons to make statistics more powerful (ID 371)

Annette B. Vogt *(Max Planck Institute for the History of Science, Berlin, Germany)*

This paper describes the invention of three new categories in statistics in Germany during the early 20th century, and I will analyse how these categories were subsequently implemented in the official statistics. These categories are: labour market statistics (by Ignatz Jastrow, about 1900), business cycles statistics (by Ernst Wagemann in 1925), and the statistics of unemployment (by Wladimir S. Woytinsky in 1929), implemented in each case by the Imperial Statistical Office.

Ignatz Jastrow and Ernst Wagemann were teaching at the Berlin School of Economics and the Berlin University respectively, and they were able to publish their work in their own self-edited journals. Wladimir S. Woytinsky, by contrast, was employed in a non-academic institution, but he also was able to organise the publication of his new statistical material.

The following questions will be addressed: What motivated these three statisticians, first to invent the new categories, and second to deliver them? Which strategies did the three statisticians use to transfer their new categories to the system of state statistics carried out by the State office? How did power operate – in the double sense as power of the statisticians versus the power of the State Office, and as the power of the new statistical knowledge introduced by the statisticians?

Keywords: statistics, Germany, categories in statistics, state institution, statistical offices

Symposium 247: To Learn and "Correctly" Understand: Popularization of Science in Central Europe 1944–1989

Organizers: ***Michaela Kůželová*** *(The Czech Academy of Sciences, Prague, Czech Republic),* ***Leszek Zasztowt*** *(The Polish Academy of Sciences, Warsaw, Poland)*

The aim of this symposium is to analyse the phenomenon of popularization of science and technology in Central Europe from 1944 to 1989. In that time, science was undoubtedly part of political propaganda – "good", "materialistic", and "peaceful" Communist science was put in contrast with "bourgeois", "backward", "idealistic", and "aggressive" Western science. Moreover, science and technology were considered as foundation and essential part of the future socialist progress and modernity. Thus, popularizing science could be perceived also as diffusion of Communist ideas or as legitimization of socialist regime and ruling power. Specific ideology-oriented discourse about science spread in newspapers, magazines, popular books or in the radio and later in TV together with obligatory quotation of Marx, Engels, Lenin or Stalin and glorifying reports about successes of Soviet science were only the most visible strategies of science popularization in the spirit of communist ideology. However, the mechanism of popularization was far more diverse and naturally depended on discipline, country and period as well. Contributions of this symposium cover popularization of scientific disciplines ranging from technology and hard sciences to social sciences and humanities. The latter is represented by the historiography whereas hard sciences are illustrated by the example of physics. In conformity with the symposium's and conference's goal, popularization is understood not only as an effort to inform "ordinary people" about functioning of science and its consequences, but also as an endeavour to legitimate the power (the communist rule). This effort could be easily seen both in the historiography (the interpretation of national history as teleological road to communism) or and in physics ("peaceful uses of atomic energy" as a tool that would help reach communism) or in other scientific branches as well. Symposium's contributions analyse this power's involvement into science at different levels from the highest policy-makers (e.g. Central Committee of the Communist Party of the Soviet Union) through different institutions and authorities to the scientists themselves. Thus, this symposium focuses on the popularization and ideological pressures at the same time since its contributions work on the presumption that these two phenomena were in many cases closely interconnected.

Keywords: Science, Popularization, Historiography, Ideology, Czechoslovakia, Poland, Hungary

A Miraculous Ascension: Materialism as a Political Tool for the Prosperity of Socialist/Communist Society (ID 252)

Leszek Zasztowt *(The Polish Academy of Sciences, Warsaw, Poland)*

Scientific consciousness and the diffusion of knowledge were two crucial elements, as the so called fundament base (in Marxist terminology), for a fluent social change of human minds after the World War Two in East Central Europe. People had to be transformed in to a new kind of human beings (depicted later as *homo sovieticus*), who might and should be deeply devoted to creating a new political system of declared liberty, equality, and brotherhood. The end of war was a positive factor in that process. Those ideas taken straight from the French revolution were however understood in a quite specific way. In relatively short time one could understand that the people are equal, but there are also those who are "more equal" than others, as in George Orwell *Animal Farm.* There were also those who had been condemned and excluded from the society. What was the place of science popularization in that process, and did the communist authorities succeed in creating a new, materialistic mind of the citizens? Is it possible to use science as an instrument of propaganda for political purposes? Is science – in a specific political camouflage – useful as a core for political propaganda and indoctrination? In this text I try to answer some of those questions. The society would be the battle field, and the laboratory for all those experiments. How reacted conservative, Catholic, Polish community for the requirements of the communist elites, imported mostly from the USSR? What was the final response

for those new stimula and what was the result? Was the miraculous ascension to the communist paradise possible? Was it a dream or nightmare?

Keywords: Science, Popularization, Materialism, Poland, Propaganda

The Soviet "historical policy" in Eastern Bloc (by the example of Poland and Czechoslovakia) (ID 251)

Jan Szumski *(The Polish Academy of Sciences, Warsaw, Poland)*

My paper attempts to analyze the results of Soviet "historical policy" in Eastern Bloc in 1945–1964 by the example of Poland and Czechoslovakia. The main emphasis of the paper is focused on the issue of the role of policy-makers, especially the Central Committee of the Communist Party of the Soviet Union (CPSU) and its specialized departments within the contacts between the party-state and academic elites of Eastern Bloc countries. All the decisive levers of real power in the Soviet Union were concentrated in the hands of the Central Committee of the CPSU.

The range of problems within the responsibility of the CPSU was unusually broad. With help of the wide branched bureaucratic apparatus, the ruling party-state elites managed to initiate, coordinate and monitor scientific research and popularization in the field of historical sciences.

Similar system of relations at the level of "power and science" established in the Stalinist period, the Soviet Union tried to distribute to the socialist countries. The Central Committee of the CPSU initiated meetings with Polish and Czechoslovak historians and monitored their ideological content and interpretation of historic events, and it authorized the development of collaborative projects and following implementation of decisions into life.

Personal experience of the author, who managed to work with the documents of the Soviet policy makers, allows to state, that the history of Polish-Soviet or Czechoslovak-Soviet relations in the field of historical science, and even the study on the individual topics cannot be completely represented without any reference to the documents of the Communist Party and the state authorities. The inaccessibility of source base does not allow, however, fulfilling a complete study of a number of problems.

Keywords: Poland, Czechoslovakia, Communist Party of the Soviet Union, Historiography, Ideology

System versus History: Mechanics of Attempted Revisions in Polish Historiography after 1944 (ID 257)

Jiří Vykoukal *(Charles University in Prague, Prague, Czech Republic)*

Contemporary interpretations of the development of Polish historiography after 1944 have often come with a Manichean picture of a "good" discipline defending its dignity and academic and scientific values against political and ideological deviations introduced by worshippers of the Soviet Bolshevik doctrine. However, the fact that Marxists were the only force willing and capable of doing their version of revision, may sometimes overshadow other fact of the authentic need of re-conceptualization of historical research reflected by various authors including the ones with non-Marxist background. At the same time it should be emphasized that the Marxist intervention against the Polish historiography was not just a politically motivated utilitarian act of violence, but also an attempt to make national history a part of strictly systemic vision of society ousting then dominant historical narratives from their positions. What seemed to be just a continuation of a traditional dichotomy of nation-based historiography versus state-based vision of national history envisaged in fact the understanding of history integrated into a new vision of societal system. The paper will try to identify the range of potential (and also unrealized) re-conceptualizations in Polish historiography after 1944 as a prerequisite for answering

the question of the content and mechanics of the Marxist revisionism as a form of potentially non-historical strategy of thinking about history.

Keywords: Poland, Historiography, Marxism, Revisionism

Béla Köpeczi: The Historian, the Cadre and the Politician (ID 255)

Réka Krizmanics *(Central European University, Budapest, Hungary)*

The Kádár regime had a hard time with establishing its legitimacy after the 1956 revolution. The initial years of repression were followed by the period of negotiations and that of making of different compromises, among others, with intellectuals. Dogmatism was gradually withdrawing (though never disappearing entirely), which allowed for more relaxed scholarly work. However, the institutional structure and the means of state control remained intact: the Hungarian Academy of Sciences often served as a safe haven for dissent thought and teaching at universities (especially at ELTE – Eotvos Lorand University, Budapest) was still impossible for those who were not deemed to be ideologically reliable. When it comes to the influence on scholarly work, we can see that different committees, subordinate in a direct or indirect way to the Central Committee of the Hungarian Workers' Party, had overlapping competences and exercised power in different manners throughout the 1970s and 1980s. The scholarly and the administrative aspects were further complicated by individual political aspirations, too. However, when we dive into the biographies of Hungarian historians of this period, we can only find few who were successful on all these fields. The central figure of my paper, Béla Köpeczi (1921–2010) is remembered as a prominent historian of the early modern age, a skillful manager and a popular politician. As a historian, he did not only publish for the narrower circle of colleagues but participated in the edition of different encyclopedias that specifically targeted a larger audience, thus he had a clear popularization agenda as well. Concentrating on several aspects of his peculiar career, I will highlight the parallel and intersecting working mechanisms of the most important factors of a historians' work in Hungary during the 1970s and 1980s.

Keywords: Hungary, Historiography, Béla Köpeczi, Politics

Faster to the Shores of Communism: Czechoslovak Popularization of Atomic Energy in the 1950s (ID 249)

Michaela Kůželová *(The Czech Academy of Sciences, Prague, Czech Republic)*

"Atom – it is the wind that tightens sails of the mankind's boat and drives it to the shores of socialism and communism," wrote Czechoslovak journalist and ideologist Gustav Bareš in 1958. This statement was neither surprising nor unusual. On the contrary, Czechoslovak press, popular books or radio broadcasts from the 1950s were full of similar phrases. Since it was believed that socialist countries are better prepared for the "atomic age" than capitalist ones, ideological dimensions of nuclear physics were very often promoted. According to communist propaganda, atom was object of two different lines of politics: line of war and death (capitalist countries) and line of peace and life (socialist countries). This dichotomy, together with the belief that peaceful use of atomic energy would make the transition to communism faster, were main bases of the promotion of nuclear physics in Czechoslovakia during the 1950s. This contribution at first outlines main aims of the popularization of nuclear energy in that time including legitimization of the Communist regime and narrow alliance with the USSR. Second, this paper describes means that were used for the popularization of the atomic energy in Czechoslovakia. Fifties could be undoubtedly seen as the golden age of the atomic energy popularization: the amount of articles in the press or radio broadcasts was impressive. However, this classical means of popularization were not the only ones. Finally, the contribution analyses concrete products of the popularization and shows, focusing on peculiar connection of Stalinist discourse and scientific

language, how were ideological and political questions reflected in texts and speeches about atom. Although natural sciences could be seen as "more objective" or "more internationalized" that social sciences and humanities, this paper shows that in some cases they were subjects of ideology and propaganda as well.

Keywords: Czechoslovakia, Atomic Energy, Popularization, Ideology, Propaganda

Symposium 263: Science, self and power: Self-Orientalism and others performances of identity in relation to Science (19th–21st century)

Organizers: ***Kenji Ito*** *(SOKENDAI – The Graduate University for Advanced Studies & IASCUD, Hayama, Japan),* ***Agathe Keller*** *(CNRS-Université Paris Diderot & ERC-SAW, Paris, France)*

This symposium explores different ways of constructing cultural identities and examines various forms of cultural diversity in relation to science. It will pay particular attention to the process of self-orientalization. Self-orientalization refers to the ways non-European actors inflect their cultural identities by Orientalist essentialism, constructing and presenting themselves as "exotic," fundamentally different from the "Occident." This notion has emerged from post-colonial studies and become used in cultural studies and tourism studies. We propose that this notion is also useful to discuss construction, imposition, and self-fashioning of the cultural identities of scientists. What discourses on nations, religions, people, culture, civilizations forge such identities? What are the different ways that one self-orientalizes? What images of sciences are such ideas built upon? What power relations and identity politics causes self-orientalization? Do such processes inflect scientific practices or scientific collaborations? Have they induced peculiar scientific text productions? Created specific school curricula? These are some of fundamental questions of this symposium.

More widely, this session aims to discuss historiographical issues related to writing cultural diversity in the history of science. Self-orientalization can be seen as one way of exploring how cultures have been written and spoken in the history of science. This symposium sheds light on how the notion of culture caused problems in such studies, and how ways of looking at scientific cultures in history can be relevant to contemporary controversies related to culture. Furthermore, it raises the question of how one can write a global history without falling into pitfalls of essentialism, doing justice to its diversity.

This symposium will discuss these theoretical and historiographical questions through specific examples. Case studies will include a Japanese nuclear physicists presenting himself Oriental thinkers, practitioners of "Vedic Mathematics" publicizing simple computations found mystically, or an American physicist attempting to characterize the "American physics" that he practices as "down to earth."

Keywords: self-identity, image of science

Self-Orientalism and Politics of Cultural Identities in the History of Japanese Science (ID 311)

Kenji Ito *(SOKENDAI – The Graduate University for Advanced Studies, Hayama, Japan)*

What I call self-Orientalism is the tendency to present the culture that one identifies with, as something exotic to others, often in such a way to satisfy the Orientalistic expectations of the others. This idea comes from the realization that, as theorists of post-colonial studies suggest, natives are not just victims of but often complicit in Orientalism. In this paper, I develop theoretical considerations of the notion of self-Orientalism and discuss how this happens in the history of science by focusing on the aspects of identity politics and power relations. While self-Orientalism can be a strategic self-fashioning to exploit European fascination in foreign cultures, it also presumes unequal power relations, encouraging or even compelling non-Europeans to be what they are not but expected to be. Non-European scientists in the late 19th and early 20th centuries were often forced to make a choice: either to lose their original cultural identities or to exaggerate their cultural differences not to lose them and to compete with Western identities. I argue that Yukawa Hideki was one of those scientists who chose the latter. As examples, this paper closely examines Yukawa's and other scientists' writings and analyzes how they presented their work and themselves in Orientalistc ways.

Modes of Self-orientalism in « Vedic Mathematics » (ID 276)

Agathe Keller *(CNRS-University Paris Diderot & ERC-SAW, Paris, France)*

The current government of India, an emanation of Hindu Nationalist parties, promotes « Vedic science » and in particular « Vedic mathematics » as the mathematical counterpart to yoga, a « hindu achievement » to be exported outside of India. While it could become compulsory to teach « Vedic Mathematics » in elementary schools in India, there are also Vedic Mathematics iPhone and Android applications, blogs, workshops, books. Before being a mathematical curriculum, a ted talk, etc., « Vedic Mathematics » is a book which was published for the first time in 1965, in Varanasi. It is a posthumous work, attributed to a religious figure, the Govardhan Matha Śaṅkarācārya of Puri, Swami Śrī Bhāratī Kṛṣṇa Tīrthajī. The text is bilingual, composed of sūtras in Sanskrit with a commentary in English. It describes mathematical, mainly arithmetical, procedures. By its title, relating to the most sacred texts of high cast hindus, such a book, and its of-shoots question the relationship the mathematics sets forth have with religion. All promoters of the book and its algorithm also dress it as a charge against the Indian educational system, in the broadest sense, from primary school to university. In this symposium, I will analyze how Vedic Mathematics can be seen as the recreation of a tradition in mathematics, a kind of self-orientalization for its inventor, Bhāratī Kṛṣṇa Tīrthajī. The different ways in which « Vedic Mathematics » is constructed by those who publicize it will be described, emphasizing the stereotyped vision not only of the Indian subcontinent's people and culture but also of their mathematics it implicitly rests on.

Keywords: Indian mathematics, Politicization of history of science

Relativist Nationalities: Cultures, languages, and power as performance among Cold War physicists (ID 280)

Aaron Wright *(Harvard University, Cambridge, USA)*

This paper uses the example of a satirical play performed by physicists to elucidate the meaning of "American" physics in the Cold War. It shows physicists who were aware of some of the contradictions of an "American" science that was being done by European refugees. This play was performed after a conference on General Relativity in 1962, hosted by Leopold Infeld in Warsaw. Infeld himself fled European antisemitism to become Einstein's assistant at Princeton. However, conservative and antisemitic attacks led him to leave a professorship in Toronto to attempt to rebuild physics in Poland. Alfred Schild was a sort of "American" at the conference play. He was announced as being from "the Billie Sol Estes Peoples Friendship University of Texas" by a young Protestant American physicist. Schild was a professor at Texas, but he was born in Istanbul to Viennese Jewish parents; he grew up in England and was put in an internment camp in WWII *by the British* for being "German" until he was allowed to move to Canada. He got his PhD at the University of Toronto under Infeld. Nationality, culture, and Cold War allegiance were at play, and not only on stage. Other leading physicists were present, and Richard Feynman took the stage to lewdly parody the American "physical" approach. This paper uses this performance to argue for the performativity of nationality in science. And it reflects on how this particular conference—situated within the Eastern Bloc turmoil of 1956–1968—allowed a self-aware performance of nationalist fictions

Keywords: Nationalism, Identity, Physics, Relativity, United States, Poland, Cold War

Symposium 264: The Power of Experiments: The Interdisciplinary Reconfiguration of Dense and Rare in Early Modern Europe

Organizer: ***Cesare Pastorino*** *(Technische Universität Berlin, Berlin, Germany)*

The early modern history of dense and rare is an important case study for the power of experiments and technologies to transgress and modify disciplinary divides. These notions already featured in the Aristotelian frameworks of matter theory. However, in the Renaissance, they were gradually modified, attacked or reshaped by contributions coming not only from other intellectual traditions, but also deriving (directly or indirectly) from experimental and quantitative practices.

In fact, we suggest that, in the early modern period, these topics were part of a strongly interdisciplinary investigation involving experts in a striking variety of technical practices and learned disciplines – ranging from natural philosophy, engineering and mathematics, to chemistry, the mechanical arts, antiquarian metrology and numismatics. The dense/rare theme was an overarching category that provided a reference frame for connecting different areas of experimentation, learning and natural-philosophical reflection, e.g. the experiments of chemistry; the practical study of substances and the determination of specific gravities; the experiments and reflections on the properties of "air" and on living bodies (spiritual/pneumatic matter and its "condensation" in bodies); the study of meteorological phenomena (the meteorological treatises of Telesio, Drebbel, Della Porta); and the technological developments in pneumatics and hydraulics.

This especially rich technical and cultural perspective has hardly been considered as a whole. Traditional scholarly treatments have fragmented this investigation inside the corresponding modern disciplinary 'subfields' – the various histories of philosophy, physics, chemistry, etc. Often, these studies have merely looked for the antecedents of modern disciplinary concepts and methodologies, like in the case of measurements of specific gravities. In this way, important reflections, practices or even entire complex experimental traditions, –for instance, the non-hydrostatic techniques of measurement– have been overlooked.

Overall, experimentation on dense and rare brought systematic and often quantitative challenges to established views on the nature of matter. This panel will give attention to a number of significant cases in which experimental set-ups and specific technologies forced the correction, re-conceptualization and refinement of theory. At the general, methodological level, following the shifting discourse(s) on dense and rare serves to exemplify how, already at the very beginning of the early modern period, experiments became powerful exploratory tools, leading to important conceptual innovations. Remarkably, these experimental investigations happened in a wide variety of disciplines, sometimes even outside the realm of natural philosophy proper. Then, the case of dense and rare illustrates very well how early modern experiments had often a life and power of their own, transcending the limits of distinct disciplines and practices.

Keywords: History of Experimentation, Matter Theory, Specific Gravities, Interdisciplinarity, Historiography of Science, History of Technology, Giovan Battista Della Porta, Francis Bacon, Thomas Harriot, Juan Bautista Villalpando

The rare and the dense: air quantification in Giovanni Battista Della Porta (ID 265)

Arianna Borrelli *(Technische Universität Berlin, Berlin, Germany)*

From a presentist point of view, Giovanni Battista Della Porta was a scholar whose life, work, and writings spanned a very broad range of disciplines, but belonged to none. There is hardly a subject about which he did not publish at least a few passages, if not a whole book, and then of course there are his theater plays, his activity as a physician and his experimental research on various subjects, including demonology. Yet, although Della Porta's methods do not seem to belong to any of today's scientific disciplines, they share a key feature with the practices of modern science, because his natural

magic was a form of knowing whose goal was the creation of natural phenomena, and the case of the dense and rare offers a very good example of this fact.

"Natural phenomena" as conceived today are the ideal, recurrent forms in which the laws of nature manifest themselves in individual occurrences and, according to philosopher Ian Hacking, it is only in the modern laboratory that such phenomena could be "isolated", "purified" and thus "created" (I. Hacking, *Representing and intervening* (1983), pp. 220–232). In the early modern period there were no modern laboratories, but I shall argue that some practices of experimental creation of "natural phenomena" in Hacking's sense can be identified also in that historical context, and that those practices encompassed both manipulations of instruments and verbal, visual or diagrammatic descriptions of such manipulation. These descriptions had a function similar to today's operational definitions and often also possessed quantitative character, in that a physical quantity was identified by procedures to quantify its properties.

As case study in support of my thesis I shall discuss how Giovanni Battista Della Porta described instances of the "rarefaction" and "condensation" of air in his writings from 1558 (Magia Naturalis IV) to 1610 (De aeris transmutationibus), arguing that his increasingly detailed, standardized and in the end also quantified descriptions can be seen as the isolation, purification and creation of a highly non-trivial phenomenon which we may, at least in first approximation, conceive as air density. Moreover, there are grounds to argue that this development provided an operational template for quantifying and conceptualizing air pressure as a form of "weight of the air".

Keywords: History of Experimentation, Giovanni Battista Della Porta, Air Quantification, Natural Phenomena

"The curious ways to observe weight in Water": Thomas Harriot's experiments on specific gravity (ID 286)

Stephen Clucas *(Birkbeck, University of London, London, UK)*

In February 1610, Sir William Lower wrote to his friend, the English mathematician Thomas Harriot, about his "curious ways to observe weight in Water", which (according to Lower) had pre-empted the findings and methods of Marino Ghetaldi's *Promotus Archimedis*, published in Rome in 1603. In this paper I will present an analysis of an extensive series of experiments concerning specific gravity which Harriot conducted at Syon House in London in the early 1600s, and his critical engagement with the work of other European mathematicians and natural philosophers who had worked on this problem, including Giovanni Battista della Porta, Gaston du Clo, and Juan Bautista Villalpando. Harriot's experiments spanned a vast array of substances (including metals, various kinds of minerals, and even 'lobster shells'). In his experiments we see him accounting for variations in the specific gravity of porous materials (such as calcareous sandstone), and using his knowledge of the specific gravities of chemical substances, such as salts, to assess compounds. As Matthias Schemmel's work on Harriot's theories of falling bodies has shown, Harriot carried over his knowledge of specific gravity into his investigations of free fall. As such Harriot's investigations reveal a remarkably sophisticated programme of physical inquiry in the early seventeenth century.

Keywords: History of Experimentation, Specific Gravities, Thomas Harriot, Giovanni Battista Della Porta, Gaston du Clo, Juan Bautista Villalpando, Marino Ghetaldi

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Quantitative estimates, phenomenological investigations and operational concepts in Francis Bacon's 'History of dense and rare' (ID 267)

Dana Jalobeanu *(University of Bucharest, Bucharest, Romania)*

Francis Bacon's *Natural and Experimental History of Dense and Rare*, published posthumously in 1658, is the most quantitative and experimental of Bacon's natural histories. It reads like a vivid illustration of the continuous interplay between, on the one hand, observations, experiments and 'history,' and, on the other, various layers of theoretical and methodological considerations (Jalobeanu 2015, 2016, Pastorino 2011). One can find in it quantitative, complex, experimental reports with a wide range of functions. Some are used to criticize alternative theories, others to formulate theoretical and methodological observations, and support provisional rules and operational definitions. And yet, many of these experiments were never subjected to a full investigation. The purpose of this paper is to fill this gap. My investigation will focus on two features of Bacon's experimental inquiries. I will first show how Bacon used quantitative estimates of experimental results to formulate operational concepts (e.g. the concept of 'metals,' 'stones' etc.). Second, I will inquire into a peculiar aspect of his experimental recordings, i.e. what I will call the 'phenomenological' character of the experimental investigations. I show that in many cases of complex experiments, Bacon relies on detailed visual descriptions of the experimental set-up in order to establish empirical correlations between what often looks like ad-hoc experimental parameters. My claim is that such descriptions occur mostly when the experimental investigations enter into an open conflict with Bacon's speculative theory of dense and rare. Thus, a thorough exploration of Bacon's phenomenological investigations of rarefaction and condensation can give us a good illustration of the 'power' of experiments in Francis Bacon's natural and experimental history.

Keywords: Francis Bacon, History of Experimentation, Quantification, Theory of Matter, Natural and Experimental Histories, dense and rare, rarefaction and condensation

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Writing a New, Interdisciplinary History of Specific Gravities in the Long Sixteenth-Century (ID 266)

Cesare Pastorino *(Technische Universität Berlin, Berlin, Germany)*

The received history of the determination and use of specific gravities in the long sixteenth-century presents significant lacunae. Usual accounts of this notion -in modern terms, the weight of a unit volume of a particular substance or object- often refer to a list of major figures, including the likes of Tartaglia, Della Porta, Stevin, Harriot, Villalpando, Galilei and Ghetaldi. These authors are justly famous for important quantitative experimentations and measurements.

However, a deeper investigation of the evaluation and use of this notion shows a much richer and largely unexplored territory. Specific gravity of particular materials emerged as an important principle in a striking variety of technical practices and learned disciplines, ranging from money manufacturing, anti-counterfeiting techniques, mining and metallurgy, alchemy and instrument making, to ballistics and military arts, antiquarian metrology and numismatics, mathematics and natural philosophy. This

remarkably rich technical and cultural perspective for specific gravities has hardly been investigated in the past. This paper will show the necessity of an alternative history of this subject.

A good case in point is that of the Jesuit polymath Juan Bautista Villalpando (1552–1608), often mentioned for his table of accurate measurements of specific gravities. Villalpando published his results in his *In Ezechielem Explanationes et Apparatus Vrbis Templi Hierosolymitani* (1604), a monumental work offering a reconstruction of the Temple of Solomon based on the interpretation of the vision of the biblical prophet Ezechiel. In fact, Villalpando's measurements did not belong to a natural philosophical research program. Instead, they were produced in order to compare ancient Roman and Hebrew units of weight, in a fully antiquarian context, and as a part of Villalpando's exegetical tour de force. Villalpando's case, like that of other sixteenth-century investigators of specific gravities, points to the necessity of producing a new, interdisciplinary history of this notion.

Keywords: Specific Gravities, Historiography, History of Experimentation, Juan Bautista Villalpando

Symposium 268: The Science of the Human: Naturalization and Control

Organizer: ***Stephen Gaukroger*** *(The University of Sydney, Sydney, Australia)*

From the end of the eighteenth century, various attempts have been made to shift the study of human behaviour out of the traditional realms of speculative thought into a form of scientific or empirical study. This project took on a new standing in the rise of anthropometry, especially the measurement of functional capacities. The object of study now became a statistically compliant notion of a 'normal' human being, beginning with the idea of defining disease in terms of deviation from a norm, and moving on to the classification of humans beings generally in terms of norms, averages, and types. The symposium explores a number of conceptual issues underlie these developments. First, there is the move from the traditional study of features of individual humans beings, and abstractions from these, to a more 'scientifically' amenable object of study: collective or aggregate features. This is accompanied by a highly contentious shift from a quantitative measure of an aggregate—such as the average height of men—to the measure of an artificial reified entity—such as the height of the 'average man'. Second, there is the way in which a seemingly descriptive enterprise almost immediately takes on a normative aspect. What is especially intriguing here is the attempt to generate normativity out of scientific description, implicitly denying its construction of a set of values. Third, connected with this, there is a shift from thinking in terms of human qualities in terms of excellences to one in which the average functions as the goal. The symposium raises the question of the extent to which these developments can be considered not just as a revolution in understanding human qualities and behaviour, but also as tools for the 'normalization' of these. More generally, what is at issue is just what is involved in the subjection of human qualities and behaviour to quantitative methods.

Keywords: Naturalization, Control, empirical study, human qualities

How Does One Naturalize the Human? (ID 269)

Stephen Gaukroger *(University of Sydney, Sydney, Australia)*

In the second half of the eighteenth century, there emerged an approach to the understanding of human behaviour that took the questions out of the realms of theology, metaphysics, and civic humanism, and promoted the use of empirical evidence in studying human behaviour. Crucial to this enterprise was a rethinking of the object of study. Traditionally, human behaviour had been thought of either in terms of the behaviour of individual human beings, or abstracted qualities which could provide the foundation for an account of universal human features. While matters were construed in these terms, rewriting the exercise in empirical terms was impossible. But in the course of the eighteenth century, in moral philosophy and political economy, a notion of aggregate or collective human behaviour developed which was quite different from individual behaviour or any universal human characteristics arrived at by abstraction. Such collective behaviour allowed the naturalization of the human, because it meant that human behaviour could be studied using empirical disciplines as varied as history, political economy, and comparative anatomy. At the same time, this provided the ground for the application of quantitative techniques, and, more problematically, the establishment of norms of behaviour.

Doing Things with Anthropometry in the Nineteenth Century (ID 270)

Peter Cryle *(University of Queensland, Queensland, Australia)*

Anthropometry in the nineteenth century lent itself to a number of purposes. Paul Broca, the perpetual secretary of the Société d'Anthropologie de Paris, was the leader of a sustained, methodologically self-conscious attempt beginning around 1860 to identify natural series of humans who could be declared

to belong to the same race. His interest was in "characters" recurring over many generations. Broca was so concerned to stabilise objects under observation that he systematically preferred to measure not living bodies, but skeletons, and particularly skulls. During the last decades of the century, Cesare Lombroso led the Italian positive school of criminal anthropology in its endeavours to identify socially dangerous individuals by their physical characters. Both Broca and Lombroso depended on institutional support for access to their subjects. Broca had authorised access to skulls found in excavated cemeteries, while Lombroso's subjects were usually made available to him by the directors of prisons and asylums. But the most significant locus of scientific power in their work was not institutional in that sense. It was in the epistemic practices that made individual bodies and sets of bodies available to science. This paper will compare the research programmes of Broca and Lombroso with the later work of the Belgian Adolphe Quetelet, who in 1870 published a treatise on anthropometry that included a detailed study of "ideal" human forms. Quetelet examined classical artistic canons of beauty and attempted to square them with data drawn from population measurements taken in his own time, thus appearing to give to anthropometry a humanistic purpose not found in Broca and Lombroso.

Composite Statues and the Statistically Average American Male and Female, 1890–1945 (ID 271)

Elizabeth Stephens *(Southern Cross University, Sydney, Australia)*

At the end of the nineteenth century, anthropometrics became the subject of a new kind of public display. Between 1893 and 1945, three sets of composite statues were produced in the United States, modeled using the statistical averages of three large anthropometric databases. The first set of composite statues was commissioned in 1893 by Dudley Allen Sargent for the Chicago World Fair, their dimensions calculated from the measurements of young white American men and women Sargent collected in his role as Director of Physical Education for Harvard. He called these statues the "Typical American Male and Female." A subsequent composite statue was made in 1921 by Jane Davenport and modeled from her father Charles Davenport's state-funded anthropometrics collection of soldiers mobilized and demobilized during the First World War. Called the "Average Young American Male," this statue was exhibited as part of the Second International Congress on Eugenics at the American Museum of Natural History in New York in 1922. A final set of composite statues, made by the gynaecologist Robert Latou Dickenson in collaboration with the artist Albram Belskie, became the feature exhibit at the opening of America's first permanent health museum in 1945, and named Norma and Normann.

These three sets of composite statues represent three different ways of understanding the statistically average body in the first half of the twentieth century: as typical, average, and normal. This paper examines the role these statues played in public health discourses between 1890 and 1945. While composite statues may seem to play a minor role in early twentieth century scientific cultures, their popularity in sites of public display did much to extend the application of anthropometrics and statistics at this time.

Images of power and ideology: representation of human evolution in Mexican popular visual culture (ID 80)

Erica Torrens *(National University of Mexico, Mexico City, Mexico)*

During the 1990s occurred a change in the social studies of science and technology known as 'pictorial turn' (Mitchell 1994). This change implied a renewed interest in the study of scientific representation to show not only its relevance in the construction of scientific knowledge, but also in its validation process, and in its dissemination and teaching. This growing interest in the visual side of science generated a series of theoretical and methodological precepts which offered new ways of thinking and

writing about the history of science. Some of these new narratives have illuminated not only science but other human activities, and importantly, the strong role of visual scientific representations as power and ideology vehicles. This paper explores the influence of European reconstructions of human past in the iconography of evolution in Mexican popular visual culture (specifically in textbooks –which are free and Universal in Mexico- monographs -which are one of the most used educational resources in this country- and murals in public buildings). Its aim is to show the lasting impact and power that both early and biased visualizations of human ancestry have had in contemporary scientific education in Mexico. This in turn seeks to enlighten the global dynamics that shape and reshape local narratives.

Keywords: Evolution, Visualization, Human origins, Iconography, Power, ideology

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Symposium 282: Environmental Science and the Politics of Power, 1890–1970

Organizers: ***Raf De Bont*** *(Maastricht University, Maastricht, the Netherlands),* ***Simone Schleper*** *(Maastricht University, Maastricht, the Netherlands)*

Throughout the course of the past century, the organization and political impact of the environmental sciences have undergone several significant changes. These sciences have been used in territorial politics of nation states, they have served as an instrument of colonial governance, and they have been used to legitimize the policy plans of international organizations. What has remained constant, however, is the unavoidable tie-up between conceptualizations of the environment and social order – in short, between science and power.

In this session we want to explore the different ways in which the environmental sciences have been entangled with power politics from the turn of the century to the Environmental Revolution of the 1970s. Bringing together in-depth case studies and accounts of long-term developments, papers in this session reflect on breaks and continuities in the recent history of the environmental sciences and its relation to environmental governance. In this we will focus on discussions that are still at the core of environmental politics today. We will look into the negotiations of the local, national and global practices of environmental management, the delineation and standardization processes that set the parameters of environmental discussions, and the boundary work that is involved in deciding who the 'true' spokespersons of nature are.

The case studies will address these mechanisms for different geographical and chronological contexts. Wilko Graf von Hardenberg will discuss how science and politics interacted in the international negotiations that led to an agreement on the standard sea level in the early 1900s. Emily Brock, for her part, will probe how forestry and military planning intersected in the management of forestland in the Philippines in the 1920s, while Raf De Bont will study the role of science in 'internationalizing' the Albert National Park in Belgian Congo in the mid-century. Simone Schleper, finally, will take us to the world of international organizations and will explore the role of different types of systems thinking in the establishment of international environmental governance in the 1970s.

Keywords: Environmental Sciences, Politics, Twentieth Century

Point Zero. Science and Politics of the Mean Sea Level. (ID 287)

Wilko Graf von Hardenberg *(Max Planck Institute for the History of Science, Berlin, Germany)*

In daily news references to climate change are replete with mentions of the mean sea level. In such accounts it is treated as a *natural*, clearly identifiable element, an unavoidable baseline for our current apprehensions of anthropogenic global warming. In this paper I relate the history of the concept as a social construct, part of the nineteenth century movement towards a new understanding of the environment through its transformation in discrete, more legible features. My aim here is to use the case of the mean sea level to question where ubiquitous elements of analysis like this came from, what they serve, and if they still correspond to current needs.

In particular, I look at the joint role of scientific research and international politics in determining the slow shift of mean sea level from an element of geodesy to a baseline for the new climate sciences. To do this I focus on the hunt for a global point zero of altitude that took place before the 1920s, later researches about land subsidence and the sea as a surface level, the constant development of more precise national measurements, and the diplomatic compromises reached to overcome the lack of international standards and baselines. Crucially relevant in this debate is what has been termed 'governmental internationalism': international power relationships, the contrasting demands of different

nation-states, the setting up of intergovernmental scientific committees, and the organization of dedicated congresses were central in determining the conditions for the standardization processes that led to the definition (and constant re-definition) of the mean sea level.

Keywords: mean sea-level, standardization, diplomacy, Anthropocene, baselines, geodesy, climate change

Difficult Ground: Forest Management and Military Strategy in the Early Twentieth Century Philippines (ID 289)

Emily Brock *(Max Planck Institute for the History of Science, Berlin, Germany)*

The United States' late-colonial military conflicts in the Philippine archipelago took place within an exceedingly complex environment of closely-spaced islands each dominated by steep mountains covered with patchworks of forests and agriculture. The upland forests of island interiors quickly become contested areas, unpredictable and difficult to navigate for both invaders and defenders. While shorelines could be easily controlled by outsiders with naval superiority, forestland on islands large and small held resistance forces employing guerrilla tactics. The forested centers of Philippine islands were thus the natural peripheries of colonial control.

This paper focuses on American efforts to transform the interiors of large and small Philippine islands from traditional multi-use landscapes into zones controlled and defined by the military and the government. Targeting specifically restive areas of the archipelago, foresters associated with the US Army redefined these forestlands in ways that delegitimized both peaceful and rebellious Filipinos. The American military force in the Philippines, together with the government-supported Insular Lumber Company, declared goals of transforming island forests into generators of lumber for export.

To maintain order over even inaccessible and restive parts of this American possession, Pinchot-type public land management systems were reimagined for tropical islands. By converting forest into timber plantations, the colonial government controlled the landscape socially and politically as well as economically. Colonial-era forest planning consolidated and redefined Philippine forests in ways that have echoed long into the post-1946 era of independence.

Keywords: Forest Management, Forestry, United States, Philippines, Military History, Environmental History, Economic History, Lumber Industry

Colonial Nature and International Science: The Case of the Albert National Park, Belgian Congo (ID 284)

Raf De Bont *(Maastricht University, Maastricht, the Netherlands)*

The 'first real international reserve' – this is how the Dutch conservationist Pieter-Gerbrand van Tienhoven enthusiastically described the Albert National Park (Belgian Congo) in a letter to his friend, the American zoologist Harold Coolidge. The internationality Van Tienhoven referred to, concerns the fact that a substantial number of non-Belgian scientists had been asked to enter the administrative board of the Park in 1929. In the following decades the rhetoric of the Park's internationalism would be further expanded. Its nature would be hailed as a source of universal scientific insights and as a model of global heritage. Such rhetoric implied the Park's management was linked with values such as universalism and inclusiveness, as well as objectivity and neutrality. My paper will explore the internal logic of this framing as well as its practical consequences.

In line with present-day historical research into the ideologies of internationalism, my paper probes how the universalist ideals of the park's promotors served the political interests of specific networks of

people. The paper studies how these ideals were translated in concrete plans for nature management. The organization of the park, I will indicate, particularly aimed at increasing the accessibility for a global network of biologists, while limiting the right of entry for everybody else: settlers, tourists, and – most of all – the local population. The paper, thus, tells the story of how a particular space was construed as 'international' by highlighting the discourses and practices that were needed to enable this construction.

Keywords: Albert National Park, Scientific Internationalism, Colonial science

Powerful Systems – Nature Conservation and Environmental Experts, 1960–1980 (ID 288)

Simone Schleper *(Maastricht University, Maastricht, the Netherlands)*

The 1960s and 70s constituted two turbulent decades for international environmental policy-making. After the heights of post-war economic expansion the reorganized world community was shaken up by seemingly new pressing problems such as over-population, pollution and the limits of natural resources. UN agencies like UNESCO and later UNEP, scientific organizations like IUCN, as well as new social pressure groups became increasingly aware of the interrelatedness of a global society and the global environment. With new problems came the quest for new mechanisms of control. Within science, systems thinking and advancements in computer technology seemed to offer new ways of studying environmental processes. Yet, critical questions remained concerning the scale and scope of the environmental *problematique*. How to weigh up human needs and those of nature? Who were the experts in global environmental questions and how should their advice be implemented through international institutions and on the ground?

Using documents from organizational archives and private collections, this paper discusses how the scientific expertise and political authority of one group of environmental experts, ecologists working in international nature conservation organizations, was negotiated during this period of new environmental concern. The paper extends existing literature on environmental regimes in three significant ways, arguing for the need of long-term studies, a new emphasis on the history of ideas, and the inclusion of multiple international actors' perspectives. Three cases will be compared: the International Biological Program (1964–1974), the UN Conference on the Human Environment (1972) and the World Conservation Strategy (1980). Through these cases I will show how different conceptualizations of nature and society in terms of open and closed systems largely determined the course of international environmental policy-making.

Keywords: nature conservation, systems ecology, international organizations, expertise

Symposium 290: The power of the historiography of science

Organizers: ***Zhihui Chen*** *(CNRS-University Paris Diderot, Paris, France),* ***Jiří Hudeček*** *(International Sinological Centre, Prague, Czech Republic),* ***Martina Schneider*** *(CNRS-University Paris Diderot; University of Mainz, Mainz, Germany)*

It is well known that history of science played and continues to play an important role in the processes of nation building. For example, histories of the sciences in Germany were published exactly at the time when the German nation state came into being. However, there are also various other ways how state and history of science interact with each other. This is illustrated by the fact that the history of the mathematical sciences was part of the topics to be studied for a state examination to become civil servant in late imperial China for a short period of time. This is likewise illustrated by how in the context of the professionalization of the history of science in Republican and People's Republican eras of China, the history of mathematics and the history of astronomy became entangled with political power.

These examples point to a larger issue at stake, namely the power (and/or powerlessness) of the historiography of science in general. What kind of powers, real or (self-)ascribed, do the historians and the histories of science have? In what way do the actors themselves perceive and reflect upon matters of power? How are these issues reflected in how they carry out research and write about the history of science? How can their impact be detected, e.g., in the shaping of certain narratives, in the promotion of specific topics of discussion and methodologies, and in mobilizing research resources? The power of the history of science can probably best be captured in contexts in which alternative historiographies exist. One might, for instance, inquire into the dynamics between the centers and margins of historiography of science. One might also analyze how alternative counter-histories change the historical discourse.

In this session we start exploring some of these questions focusing on the last two centuries. Before the professionalization of the history of science, an examiner in the late imperial China could put a question on the historiography of astronomy in the civil service examinations; a botanist attempted to build up the politics of his discipline by his panoramic historical writing. Some historians shaped heroic figures of science for their nation, such as the narrative of Descartes in the 19th century France; or started discussing a scholar's nationality, for example Copernicus. In the 20th century, the professional historians of science could participate in the think tanks and have influences on the policies on science both in China and America. These cases and the approach from the perspective of power allows us to reverse the common perspective, which treats historiography of science as a passive recipient of "influences" and "motivations" from outside; instead, we can study it as an active factor which aims to influence social consciousness and practice.

Keywords: historiography of science, power, politics, national states, values

Taming Maxwell's Demon: The Bowman Committee and the Planning of Science for the Public Good (ID 291)

Roger Backhouse *(University of Birmingham, Birmingham, UK),* ***Harro Maas*** *(University of Lausanne, Lausanne, Switzerland)*

This paper examines the working of the Bowman committee, that advised Vannevar Bush on government support for science after the war, through the eyes of its secretariat that included two historians of science, Henry Guerlac and I. Bernard Cohen, and two economists, W. Rupert Maclaurin and Paul Samuelson, who would go on to become stars in their own disciplines. It argues that the Bowman Committee provided a forum in which different conceptions of the relationship between science and society were debated against contemporary ideas about government science planning (which MIT's president Karl Compton compared with Maxwell's demon). The vision of science as an essentially democratic and universal endeavor of independent minds that should be shielded from state interference,

which was forcefully put forward by I. B. Cohen (and Harvard president James Bryant Conant), surfaced as dominant vision within the Bowman committee. This vision was detailed in arguments about pure and applied science which subsequently gave shape, at least nominally, to American science policy in the post war period. The secretariat made the case that Federal science funding should be channeled through universities in the manner in which private foundations operated, a conclusion that was not pre-ordained, but that fitted Cohen and Conant's vision.

We argue that the views of our protagonists had implications as well for the subsequent evolution of the disciplines from which they came. In summer 1944 Maclaurin, Head of the industrial relations section at MIT, had sounded out Henry Guerlac, former junior member of Harvard Society of Fellows and at the time on I. I. Rabi's request hired as Radiation Laboratory's official historian, if he would be interested in a staff position at MIT's economics department to study the process of innovation. The paper contends that different views on pure and applied science within the Bowman committee were a factor behind Guerlac's departure for Cornell and the dashing of Maclaurin's hopes to continue the collaboration between historians of science and economists in the study of innovation at MIT.

Keywords: Second World War, US Science Policy, innovation, Bowman report, visions of science

Historiography and the Politics of Discipline-Building in 19th Century Botany (ID 293)

Ulrich Charpa *(Ruhr-Universität Bochum, Bochum, Germany)*

In the historiographical sections of his famous Grundzuege, of which 4 editions were published until 1863, the German Botanist Matthias J. Schleiden (1804–81) unfolds a historical panorama in order to promote a conception of his discipline: a discipline that is an ordinary natural science, determined in revealing natural laws, and with Galilei, Kepler and others regarded as historical heroes. As can be easily shown Schleiden's own scientific practice (microscopical research) is not in line with his physicalist conception of historical dynamics. Subsequently, in Schleiden's epoch microscopical studies remained an isolated branch of research, not related to Genetics or Evolutionary Biology, not to speak of being reduced to a Chemistry or Physics of the microscopic objects. On closer examination, Schleiden's historiography of his discipline appears to be a camouflage that perfectly serves at least three purposes:

a) the demarcation of Botany as a scientific discipline from the domain of amateur natural history; b) presenting the very specific alliance of Botany and (at that time in fact prescientific) microscope building as an exemplar of the modern mutual exchange of science and technology; c) initiating a stronger support by the authorities due to the new disciplinary status and alliances (one of Schleiden's successes was the foundation of the Jena Physiologische Institut with its revolutionary emphasis on lab teaching).

In order to contrast Schleiden's approach I refer to his contemporary Hugo von Mohl (1805–1872) whose historiography is strictly confined to recent intradisciplinary contributions in his field. This matches his general disinterest in transgressing the boundaries of his narrow research domain. He avoided to have disciples and even refused to making his specialist work widely available in scientific text books. The influence von Mohl nevertheless exerted was on other specialists in a subdiscipline by naming, criticizing and celebrating his colleagues and positioning them into a historical chain.

Keywords: scientific discipline formation, functions of historiography, Botany, Schleiden, von Mohl, 19th century microscopy

Values in the historiography of mathematics and the "measure" of "peoples" – The case of 19th century historiographies of mathematics in ancient China (ID 294)

Karine Chemla *(CNRS-University Paris Diderot, Paris, France)*

In previous work I carried out on the part played by abstraction in 19th century historiographies of mathematics in ancient China that European scholars composed, several facts have appeared. In the 19th century abstraction as a value was understood and assessed in various ways depending on the scientific European milieus considered. These differences are correlated with how abstraction is put into play in different historiographies of mathematics dealing with ancient China and other parts of the planet. These historiographies regularly drew, from work on ancient mathematical writings (and how these writings testified to the valuing of abstraction), conclusions about oppositions between "the Chinese" and "the Europeans". Moreover, some scholars perceived that these differences between "peoples" corresponded to distinctions between social groups within Europe. Finally, for some influential thinkers these conclusions justified action "the West" had to take in China.

This paper intends to examine the same issues with respect to computation. Indeed, in 19th century European discourses about ancient science, "the Orientals" were regularly contrasted with "the Europeans" on account of the part computations played in their scientific activity. I will outline the various attitudes towards computations encountered in different scientific contexts, and how they relate to drawing boundaries between different social groups in Europe. Focusing on the case of China, I will also examine how this variety of attitudes can be correlated with the treatment of computation in different historiographies of ancient mathematics. Finally, I will analyze how historiographies of computation led to two forms of exercising power, that is, "measuring" the "value," or alternatively determining "specificities," of "peoples," and I will evoke how these views were used in general political discourses. A specific attention will be devoted to the relationship between arguments on "abstraction" and arguments on "computation" in the historical discourses examined.

Keywords: historiography of ancient mathematics, China, history of computation, history of abstraction, European historiography of science

The astral-mathematical knowledge, its historiography and the power of civil examination in 18th and 19th centuries China (ID 295)

Zhihui Chen *(CNRS-University Paris Diderot, Paris, France)*

The power of examination, by means of which most talent officials were selected, played an important role in the structure of power in late imperial China. Generally speaking, the contents and criteria of civil examinations (keju kaoshi 科舉考試) were confined to the doctrines of Neo-Confucianism. However, examiners could also be endowed their individual powers to some extent, especially the power of setting questions on the policies of the classics and the histories (經史策論). Therefore, it can be seen that some examiners put contents about mathematics, astronomy and the history and historiography on these fields into the examinations they oversaw.

This paper will examine some cases in 18th and 19th centuries China, discuss in what situations, and how, examiners operated their power in the context of the examination to select the eligible candidates who specialized in the astral-mathematical knowledge. The presentation will also analyze how the examinees expressed the astral-mathematical knowledge and its history in their answers; and the examiners' criteria for selecting excellent answers. This paper will focus on some cases. For instance, Ji Yun (紀昀, 1724–1805), a famous scholar and the president of several civil examinations, often put a historiographical question on the use of diagrams in the monograph on calendrical systems of the History of the Ming. In a provincial examination in 1804, the examiner put a series of questions referring to the history of mathematics and astral sciences, which the mathematician Li Huang (李潢) had

recommended. The employment of examiner's power and some answers to those questions will be examined in this paper.

Keywords: historiography of astral-mathematical knowledge, history of astronomy, history of mathematics, power of civil examination, late imperial China

The power of historiographic labels and the power of national historiographies of science: The Bacon-Descartes case (ID 296)

Mihnea Dobre *(Western University Vasile Goldis Arad, Arad, Romania)*

Among the nineteenth-century French historians of philosophy, there was a great interest in discussing Francis Bacon and René Descartes together. Francisque Bouillier and Joseph Fabre, for example, claimed that Bacon was a precursor of Descartes and did important work in philosophy, yet failed to match Descartes's achievements in science, including the discovery of the experimental method. This is a remarkable example for how nationalist historiographies have shaped the discussion about the emergence of modern science. By taking the task of searching for the founding fathers of the modern science, especially those claiming that "knowledge is power," such historians focused on find heroic figures of their own nation and to present them as "more important" than their contemporaries of other nations. In my paper, I would like to claim that it is not only a nineteenth-century or early twentieth-century nationalist exaggeration, as one can find similar discussions in the seventeenth and eighteenth centuries.

Moreover, such overstatements of Descartes's role in comparison to Bacon with respect to the experimental method can be very illuminating if placed in the larger context of the historiography of early modern experimentalism. In my paper, I shall address the topic of the power of the historiography of science through a twofold analysis. On the one hand, I shall reflect on the Bacon-Descartes connection, as it is presented by the late- nineteenth and early-twentieth century historians of science. On the other hand, I shall discuss how such histories influenced the larger narrative of the history of science in the early modern period and encouraged historians to operate with mutually exclusive categories, such as the Rationalism-Empiricism distinction, that was allegedly describing early modern figures.

Keywords: Historiography of science, Bacon, Descartes, Rationalism-Empiricism distinction, scientific method

Indian astronomy being observed: late 18th and early 19th century European scholars' historiographies of Indian astronomy (ID 298)

Sho Hirose *(CNRS-University Paris Diderot, Paris, France)*

Studies by European scholars during the late 18th and early 19th centuries have formed one of the bases of historiographies of Indian astronomy. Many of these authors were interested in planetary theories since they used as epochs very old dates. There interests are widely variegated; some used these dates for chronology purposes, others examined the possibility and accuracy of observation from which these data might have derived, or chose to focus on the computations. How did their views about the "people" or society of India affect their selection of topic and manner of argument, especially when the scholars were from the colonial power of Great Britain? Conversely, how were their conclusions used to argue views about the "people" or society of India? These are the questions examined in this presentation.

Some authors assess knowledge found in ancient Sanskrit documents, or gathered while discussing with pandits, negatively, and on the basis of these conclusions express their sense of mission to "illuminate" the Indian people. In such cases, a power relationship is justified by claims about science and

its history in India. The most extreme case of this type is that of John Bentley, who harshly criticized traditional knowledges as falsehood that needed to be removed. However this is not the case for everyone. Already in the 18th century, Samuel Davis expresses that examining Sanskrit books made him rethink his idea, shared with many others, that astronomical knowledge among Indians were something insignificant. Like in these two examples, I shall look into the different ways ancient texts were accounted for. In this respect, local pandits played an important role by translating and explaining the texts for the European scholars, and sometimes even recommending treatises to be studied upon. Thus, I will also discuss how different attitudes of authors vis-à-vis Indian people appear to have affected how they learned from these informants, in the context of power relationship that also await analysis.

Keywords: historiography of astronomy, India, planetary theory, chronology, colonialism

Lessons from the Past: History of Chinese Mathematics, Consciousness and Power in Republican China (ID 362)

Jiří Hudeček *(Charles University, Prague, Czech Republic)*

Chinese Historians who worked on the history of mathematics in the Republic of China and were active between 1917 and 1949, such as Li Yan 李儼 (1892–1963) and Qian Baocong 錢寶琮 (1892–1974), wrote for both antiquarian and programmatic reasons. With their detailed studies of Chinese mathematical achievements and of the traditional institutional framework, they weighed in debates about the value and viability of Chinese traditional culture. They also – more subtly – offered comments on the educational system and the balance between academic and practical motivations of study. Whereas Li Yan's standpoint was mostly implicit in his works, such as in his articles on the History of Chinese mathematical education, Qian Baocong inserted into his works and speeches more articulated comments about key topics, including how state and mathematics, and more generally science, should coexist. In this sense, they both offered lessons from the past. The presentation intends to show how their work prepared the ground for the establishment of a Cabinet for the History of Natural Sciences 自然科學史研究室 in the state-sponsored Chinese Academy of Sciences (CAS) after the founding of the People's Republic of China in 1949. Li Yan and Qian Baocong were both coopted to the Cabinet, the precursor of the present-day Institute for the History of Natural Sciences 自然科學史研究所 in Beijing.

Keywords: Historiography of mathematics, 20th century China, Li Yan, Qian Baocong, state science policy

Planning Historiography of Science: Chinese Historians of Science and the "Twelve Years' Plan" (1956–1967) (ID 366)

Václav Laifr *(Charles University, Prague, Czech Republic)*

In 1956, the Chinese Premier Zhou Enlai 周恩來 (1898–1976) launched the Twelve Years' Plan for the Development of the Natural Sciences. By contrast with other plans, this one was formulated by scientists themselves. Some of them were also important historians of science. This is the case of Zhu Kezhen 竺可楨 (1890–1974), who additionally was the Vice-President of the Chinese Academy of Sciences. On the other hand, Chinese scholars who were historians of science, but not scientists in the first place, also formulated their own Twelve Years' Plan for research and publication activities in the field of the history of science. The establishment of the Cabinet for Research in the History of Natural Sciences in the beginning of 1957 was one of the actions envisaged in the plan.

The planning process has been recorded in Zhu Kezhen's diaries, in the autobiography that the historian of astronomy in China Xi Zezong 席澤宗 (1927–2008) composed orally, and also in other documents. My paper intends to explain how historians of science participated in the planning process, how they interacted with the other members of the commission, and also how they used this unique opportunity to create a space for their own discipline.

Keywords: historiography of science, historiography of astronomy, twelve years' plan, early PRC period, Zhu Kezhen's diaries, Xi Zezong's oral autobiography

Mobilizing nationality in the historiography of science (ID 309)

Martina Schneider *(CNRS-University Paris Diderot; University of Mainz, Mainz, Germany)*

Up to this day issues of the nationality keep reappearing in the history of science. Be it that a certain way of doing science is attributed to a nation (or a people) by historians of science, e.g. French mathematics, be it that the scientists themselves claim that they are pursuing a certain national style of science, e.g. German physicists claiming that they were doing "German physics" during the Nazi period, or be it that the nationality of certain "scientific heroes" becomes a bone of contention. A "classical" (and still current) example for the latter discourse is the debate on Copernicus' nationality: was he Polish or German?

In my talk I will use this example to explore how (and in what contexts) this question was used and mobilized by different historians of science (and to a lesser extent by other actors) in various ways. One particularly interesting example, that will be studied in detail, is the apparently subversive approach to the question by the German historian of mathematics Moritz Cantor at the end of the 19th century. While affirming Copernicus' "German nationality" he implied that nationality is a matter of choice. Thus Cantor used the history of science in order to promote an alternative concept of nationality.

Keywords: historiography of science, nationalism, Copernicus, scientific heroes, Europe, 19th and 20th Centuries

Chorography of Knowledge in the Early Modern City (ID 497)

Fokko Jan Dijksterhuis *(University of Twente, Enschede, the Netherlands)*

The idea that a community can distinguish and praise itself by its learning, skills, ingenuity and talents is typical of a knowledge society. It is usually situated in the modern rise of the nation-state, with its rhetoric of progress, of contributing to science, technology, and arts understood as universal entities. However, it appears that early traces of the idea of knowledge as a cultural asset can be found in the urban cultures of the Low Countries. These cities were not just junctions of trade, power, and culture, but rose to cultural and political dominance in the Dutch Republic. As the cornerstone of political and economic power the city became the point of reference for cultural identity. Cities began fashioning there wealth and prestige, giving rise to new literary and artistic genres like the city descriptions and cityscapes. Exemplary is Rerum et urbis Amstelodamensium historia that built the reputation of Amsterdam by situating it historically – working back to Batavian times, describing its impressive achievements in trade and the high level of urban amenities, and, not lastly, the glorious expeditions that had set sail from the harbor. In this paper I want to trace how such urban chorographies depicted learning, skill, ingenuity and talent as assets of the town. How they reflected efforts to constitute a well-ordered society by means of urban projects. How knowledge was cultivated to bolster the strength and reputation of the cities of the early modern Dutch Republic.

Keywords: knowledge society, early modern city, chorography, Dutch Republic

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History of Science, Local Knowledge and the Influence of Ideology in Contemporary China (ID 522)

Bing Liu *(Tsinghua University, Beijing, China)*

In recent years, the understanding of 'local knowledge' has been an important issue, which can be closely related to the narrative of history of science in China. However, in the both fields of the philosophy of science and the history of science in mainland contemporary China, different scholars have different understanding towards the concept of 'local knowledge'. In some cases, the application of 'local knowledge' bases on the misunderstanding of the concept. Even worse, the application of it could be seen as just a superficial label sometimes. Therefore, the proper understanding of 'local knowledge' from different perspectives is a significant issue which should be analyzed.

This essay discusses following issues: what is the opposite side of 'local knowledge'; the relationship between 'local knowledge' and universal knowledge; how to deal with the relation between cultural relativism and the history of science in the context of 'local knowledge'; and how to define the concept of 'science' within the filed of the history of science.

By analyzing some typical arguments about 'local knowledge' in the academic community in mainland contemporary China, the following conclusions could be drawn. In China, the leading ideology is scientism and the tradition of philosophy is dialectical materialism. That is to say, the scientism ideology and the dialectical materialism, as a kind of ideological power, remain the mainstream in the field of history of science in China. Therefore, the acceptance of the concept 'local knowledge' tends to be limited. Obviously, this situation in China leads to the different understanding about the concept 'local knowledge', and the different attitudes towards the monist view of science and the pluralist view of science. The reason why many historians of science in China reject cultural diversity and cultural relativism in their field can be related to the monism standpoint of scientific knowledge, which can be seen as the real opposite side of 'local knowledge'.

Keywords: local knowledge, ideological power, history of science

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Symposium 299: Changing mathematical spaces: geometry and physics in the 20th century

Organizers: ***Tilman Sauer*** *(Johannes Gutenberg University Mainz, Mainz, Germany),* ***Gerard Alberts*** *(University of Amsterdam, Amsterdam, the Netherlands),* ***Jan Kotůlek*** *(VŠB-TU Ostrava, Ostrava, Czech Republic)*
Chairs: ***Gerard Alberts*** *(University of Amsterdam, Amsterdam, the Netherlands),* ***Ulf Hashagen*** *(Deutsches Museum, Munich, Germany)*

Geometry went through essential changes at the turn of the 20th century, namely from a well-established and easily depictable science to something much less tangible and ethereal. We will look at these developments through three different intertwining perspectives: as a physical science, geometry finds itself in the spell of public attention for Einstein's relativity theory and an attractive programme of finding a unified field theory. As a modern mathematical science, geometry is the branch of mathematics whose foundations were questioned earlier than those of other branches of mathematics, and thus geometry reveals the change of practice in mathematics. As an engineering science, geometry is called geodesy.

Traditionally, geometry seems to be intrinsically connected with visual imagination and models. In his talk, Ulf Hashagen will explain how and by whom were such models used at the turn of the 20th century: not as classroom models, but as objects in a public space. Non-Euclidean geometries, being brought to mathematicians' and the general public's attention around the time of these exhibitions, however, often work with structures of space that defy visualization. A wider, albeit only locally significant, context can be found in the work of the Czech philosopher of mathematics Karel Vorovka. This will be complemented by case studies on the interaction between geometry and physics and on the strong role of geometry in engineering education in the early 20th century.

Zooming in, we will focus on differential geometry and its relation to modern physics, starting with disclosing the background of an influential center of differential geometry in interwar Europe through the correspondence of Tullio Levi-Civita, a leading figure in the field. Another school developed in Prague around Georg Alexander Pick, a friend of Albert Einstein, and Ludwig Berwald. Yet, the communication between a mathematician and a physicist was not always easy and straightforward, as the correspondence between Albert Einstein and Václav Hlavatý. The conversations among the Dutch mathematicians on the cultural role of mathematics will make it clearer how mathematics and culture and politics can be intertwined.

Keywords: history of mathematics, history of physics, history of differential geometry, philosophy of mathematics, mathematical models, cultural role of mathematics, Albert Einstein, Tullio Levi-Civita, Jan Arnoldus Schouten, Václav Hlavatý

Geometry on Display: Mathematical Models in Fin de Siècle Scientific Culture (ID 300)

Ulf Hashagen *(Deutsches Museum, Munich, Germany)*

Nowadays mathematical models are part of a former world that is alien to mathematicians in terms of their scientific culture and tradition. As a consequence these objects of a former material culture of mathematics can only be found in museum displays or gather dust in the old display cases of mathematical institutes. However, in the `long century' before the First World War mathematical models were important scientific tools in research and teaching in the sciences and also an important part of the scientific culture of mathematics. An argument in support of this statement is that in the late 19th century mathematics became an exhibition subject. Since mainly mathematical models and mathematical instruments served as symbols for the public representation of mathematics, it seems appropriate to interpret `mathematical exhibitions' as representations of fin de siècle scientific culture. This cursory talk is confined to a consideration of the basic historical questions of who created the mathematical exhibitions, when, where, why, and how by giving an overview of the mathematical exhibitions in the

late 19th and early 20th century. In particular, the changing role of mathematical models in this context will be discussed.

In the time period between 1870 and 1914, six `major' mathematical exhibitions could be identified. Three exhibitions were located in Germany, two in Britain and one in the US. Four and two exhibitions were financed by the German and British Government respectively as well as curated by German and British mathematicians respectively. Moreover, one should mention that three of the exhibitions were independent ones, while the other three were part of a larger exhibition. The individual exhibitions were made on the occasion of national or international congresses or on the occasion of a science jubilee, while the other ones were part of a science exhibition, a world exhibition or a museum exhibition.

Visualization in mathematics: Karel Vorovka and his Philosophy of Mathematics (ID 302)

Magdaléna Hykšová *(Czech Technical University, Prague, Czech Republic),* ***Helena Durnová*** *(Masaryk University, Brno, Czech Republic)*

Karel Vorovka (1879–1929) started his career as a mathematics teacher. In 1917, he published the monograph *Essay on Visualization in Mathematics*, which represented one of the first Czech works in the philosophy of mathematics. Having been encouraged to use this treatise as his habilitation thesis, he opened the door to university teaching for himself.

In 1921, together with František Pelikán, he founded the journal *Ruch filosofický*, originally in response to the strong (neo-)positivism of the then leading Czech philosophical journal "Mysl". Soon it became a platform for the philosophy of exact and natural sciences, with a number of physicists contributing with their ideas about relativity theory.

Vorovka's philosophical attitude developed from psychologism to a position closer to logicism. At the beginning, he criticised logicism that considered mathematics as a part of logic, and claimed that not only natural sciences, but also geometry and mathematics have to be based on observations. He stressed the importance of a visualization based on the "external and internal" experience. Later, he admitted the reality independent of the human mind (e.g. the existence of mathematical theorems that were not yet discovered), and the necessity of the pure logical-mathematical thinking, especially in the cases where our space-and-time intuition does not suffice. Nevertheless, he still believed in rational intuition. Vorovka criticized Kant's idealism (he, e.g., claimed that a supposedly a priori Euclidean spatial form was broken through the construction of non-Euclidean geometries and their applications to cosmos, in defiance to Kant), as well as Mach's phenomenalism and a "rough materialistic" realism, and promoted critical realism as a convenient foundation of cognition. At the same time, he claimed that the realities that are subjects of natural sciences do not exhaust the whole reality and that science provides us with only one-sided aspects of them.

Geometry of the "Restricted three-body problem" and the contribution of Vincenc Nechvile (ID 303)

Petra Hyklová *(Charles University of Prague, Prague, Czech Republic),* ***Martin Šolc*** *(Charles University of Prague, Prague, Czech Republic)*

The "Three-body problem" attracted astronomers and mathematicians since Newton´s discovery of the gravitation law because there were numerous applications, either practical – like the lunar motion (Earth, Sun, Moon) important for the determining of geographical longitudes in maritime navigation, or theoretical – like the motion of asteroids influenced by gravitation of the large planets. As it was shown in 1887 by mathematicians Heinrich Bruns and Henri Poincaré, there was no general analytical solution of this problem. The motion of three bodies under mutual gravitational attraction leads generally to non-repeating configurations. However, some periodic solutions and analytically predictable motions can be found in case that the third body has a negligible mass with respect to the other two

bodies. This so called "Restricted three-body problem" has its circular or elliptic form depending on the shape of relative orbits of the two more massive bodies. The corotating-pulsating "Nechvile coordinates" allow to simplify the equations of motion as it was mentioned in 1866 by W. Scheibner and thoroughly studied in 1917 by K. Petr and V. Nechvile from Charles University of Prague. Nechvile contributed also to the geometric optics and investigated stellar motions in the Galaxy, for which he was awarded a Lalande Prize of the French Academy of Sciences in 1927.

The place of geometry at a technical university: the case of Emil Waelsch (1863–1927) (ID 304)

Pavel Šišma *(Masaryk University, Brno, Czech Republic)*

In this contribution, the personality of Emil Waelsch, a professor of mathematics and geometry at the German Technical University in Brno, will be introduced. Having been born in Prague, he studied at the German Technical University in Prague, where he later became the assistant of geometry professor Karl Küpper. During his frequent study trips, he visited Leipzig, where he met Felix Klein and Sophus Lie, and Erlangen, where he met Paul Gordan and Max Noether. In Erlangen, he earned his doctorate in 1888. After that, he was an assistent to Wilhelm Fiedler at ETH in Zurich.

After several unsuccessful attempts to get a position in Prague, he successfully applied for a position at the German Technical University in Brno in 1895. He spent the rest of his life in Brno, first as a professor of matheamtics, and since 1910, as a professor of geometry (at GTU in Brno). During this period, he was in contact with foreign mathematicians, whom he met at the regular meetings of the Deutsche Mathematiker-Vereinigung (he was a member of this society practically since its foundation). Although he never published a more extensive study, many of his results were quoted in the works of Rey, Study, Darboux, and Bianchi. He developed the so-called binary analysis, which he tried to apply to various problems in geometry, algebra, and also physics.

Levi Civita's school of differential geometry at the University of Rome (1918–1938) (ID 305)

Rossana Tazzioli *(Université Lille 1 Sciences et Technologie, Lille, France)*

Tullio Levi-Civita (1873–1941) is a prominent figure in nineteenth century Italian mathematics. He gave remarkable contributions to the theory of (special and general) relativity, the n-body problem, hydrodynamics and differential geometry. He was a student and then a professor at the University of Padua until 1918. In 1918 he moved to the University of Rome, where he contributed to found the so-called "Roman school of mathematics", together with Vito Volterra, Federigo Enriques, Francesco Severi, and Guido Castelnuovo. Many foreign students came to Rome in order to follow his lectures, among them we mention Vaclav Hlavatý, Gheorghe Vranceanu, Evan Tom Davies. Other mathematicians interested in differential geometry just exchanged scientific or personal letters with Levi-Civita, such as Ludwig Berwald, Myron Mathisson, or Aureliano da Mira Fernandes.

This talk aims at investigating the influence of Levi-Civita's work (papers and treatises) on the development of differential geometry and tensor calculus. To this purpose we largely use his private correspondence held in Levi-Civita's Archive at the Biblioteca dell'Accademia dei Lincei in Rome.

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Prague trace in the network of differential geometers between the two World Wars (ID 306)

Jan Kotůlek *(VŠB-TU Ostrava, Ostrava, Czech Republic)*

In the beginning of 20th century, the importance of differential geometry had risen immensely. In the formulation of his famous 23 problems in 1900, David Hilbert noted under the problem No 6 that investigations on the foundations of geometry will be necessary to treat physical sciences in the axiomatic manner. Formulation of General Theory of Relativity (GRT) in 1915, connecting geometry of spacetime with gravitation, confirmed this point of view. This stimulated research in differential geometry, first over the Europe, but later also in the U.S.

In Prague, strong tradition in mathematics stemmed from G. A. Pick (assistant of E. Mach). It received strong impetus by temporary stays of A. Einstein or W. Blaschke in 1910s and was continued by Einstein's successor Phillip Frank and Ludwig Berwald. As Pick was informal head of the group and maintained broad research agenda, Berwald specialized in differential geometry and became one of the leading characters the informal network with nods in France, Italy, Holland, Germany, but also in Romania, Poland, or in the U.S.

In Berwald's Prague group, there were not only German-speaking collaborators and students, as P. Funk or later M. Pinl and O. Varga. He also helped Václav Hlavatý, who was raised in the Czech tradition of Bohumil Bydžovský and Karel Petr (1868–1950), to join the international community. Hlavatý's one-semester stay with Jan Arnoldus Schouten in Delft in 1924 seems to form the turning point in his career. Hlavatý submitted his habilitation early after the return to Prague (1 October 1924) and became gradually more and more interconnected within the network. In 1937, his efforts were crowned by invitation for a stay to Princeton Institute for Advance Study, a Mekka of contemporary mathematicians.

The times of flourishing were ended by the turbulent political changes. The expansion of Nazism had devastating impact on the Prague mathematical circles. Berwald was killed in Lodz ghetto on 20 April 1942, Funk emigrated to U.S., Pinl was temporarily arrested and then worked in the war research. Hlavatý was sent on the forced leave after the Czech universities were closed by the Nazis on 17 November 1939. He was, at least, able to proceed partly his research and write textbooks during this inner exile. After the war he returned to his professorship, but his further political activities led him to emigration after the Communist coup d'etat. Even if his pupils proceeded in their research, Hlavatý's name must have been forgotten for more than 20 years.

Understandings and misunderstandings: The Einstein-Hlavatý-correspondence (ID 308)

Helena Durnová *(Masaryk University, Brno, Czech Republic),* ***Tilman Sauer*** *(Johannes Gutenberg University, Mainz, Germany)*

Emigrating from his home country, Václav Hlavatý found himself in a small corner of the US, in Indiana, yet at a blossoming university, the University of Indiana, the oldest university west of the Allegheny Mountains. In the environment where Alfred Kinsey not only escaped, but was supported by the IU president, in his pioneering research on sexual behaviour of people, Hlavatý found his field of differential geometry, which had been fashionable in the interwar period in Europe, now dwindling. Boldly, he aimed no lower than at a co-operation with Einstein. With a stubborn determination, he began working on Einstein's unified field theory early in 1950, and kept informing Einstein about his success from time to time. Einstein had considerable appreciation for Hlavatý's hard work, yet initially seemingly little understanding for Hlavatý's method. Hlavatý, however, did not give up and continued writing to

Einstein, until they agreed on a face-to-face meeting which, however, caused more misunderstandings than helped clarify positions. By analysing the extensive correspondence (up to 30 letters both sides), we will attempt to show what caused the initial misunderstanding and what it meant for Hlavatý to clarify his mathematical point so that it would mean something to a physicist.

The cultural role of mathematics as a political issue among geometers Dirk Struik, Hans Schouten and David van Dantzig (ID 382)

Gerard Alberts *(University of Amsterdam, Amsterdam, the Netherlands)*

Hans Schouten (1883–1971), electrotechnical engineer by first training (1908) and acquiring his PhD cum laude on a classification of systems of notations in the style of Klein's Erlanger Program (1914), established a school of research in differential geometry. Dirk Struik (1894–2000) and David van Dantzig (1900–1959) were just two in a row of research assistants at the Delft Technische Hoogeschool.

In the education of engineers, geometry's traditional cultural role as the epitomy of clear Euclidean thinking had taken the form of propaedeutic teaching in pure axiomatic mathematics. For the left-wing intellectuals mentioned here, this role was already Enlightenment at its best. Yet, with the use of geometrical technique in engineering on the one hand and more recently the crucial role of geometry in relativity theory on the other, the cultural role of geometry asked for a renewed explanation. Moreover all three scholars took effort in the popularization of relativity theory.

Revising the role of mathematics in engineering education was an issue of science policy and in that sense political. Directed to the public at large, if not for the labour class in particular, the renewed explanation of geometry was an endeavour with a political purport, emancipatory politics of the interbellum. Struik's, Schouten's, and Van Dantzig's popularizations may have had their common traits, their political views diverged and their styles of popularization varied accordingly.

Keywords: geometry, history of mathematics, cultural role of mathematics, interbellum, Hans Schouten, Dirk Struik, David van Dantzig

Symposium 316: Representing global power in Iberia: Diogo Ribeiro's world maps and Early Modern Science

Organizers: ***Antonio Sánchez*** *(University of Lisbon, Lisbon, Portugal),* ***Thomas Horst*** *(University of Lisbon, Lisbon, Portugal),* ***Samuel Gessner*** *(University of Lisbon, Lisbon, Portugal)*

Despite its natural connections with the development of scientific knowledge, the History of Cartography *per se* has never attracted much attention from the History of Science. Maps are, and have always been, a privileged means of recording, manipulating and displaying geographical knowledge – and so were important scientific objects which, at the same time, are capable of representing claims of power and dominion. Moreover, the conception, manufacture, circulation and use of maps during the early modern period is a basic component of the intellectual, social and material process we call the "Scientific Revolution". In spite of this importance the usual narratives of this process refer to cartography all too seldom. In part this reflects the fact that the History of Cartography consists of a relatively small community of researchers who maintain only little contact with the more general History of Science and Technology community. In our view much is to be gained with a better integration. Our proposal for this symposium shall be a step in this direction.

Integration means that our approaches to the study of old maps are enriched by the methodological and analytical tools of the History of Science combining the perspectives of historical epistemology, cultural history of mathematics, material culture, cartometrics, iconology, and iconography (heraldic). Integration of the History of Cartography into that of Science should also entail that we attract the interest of other researchers to an otherwise rarefied field of research with an understudied corpus of primary sources.

At the core of the symposium are a number of early world charts rooted in the cartographic production of the *Casa de la Contratación* in Seville from the first half of the sixteenth century. Some of these documents bear the name of the cartographer Diogo Ribeiro, who was trained in Portugal and has worked at the *Casa* from c.1518 until his death, c.1533. These central primary sources give rise to several inquiries.

Ribeiro represents, better than any other character, the paradigm of the Iberian cosmographer of the sixteenth century. He possessed theoretical knowledge and skills of map and instrument making. His name is linked to the important novel features patent on his planispheres. These maps projected a novel image of the world for the Emperor. Ribeiro was born in Portugal, where he was trained as a cartographer, and came to Seville in the context of the preparation of the Magellan-Elcano circumnavigation of the world, which started in 1519. In Seville, Ribeiro ascended to the post of royal cosmographer and instrument maker. He was able to conquer the trust of the Spanish imperial authorities and the respect of the diplomatic community.

Our symposium will demonstrate that these activities also incorporate broader issues typically pertaining to the History of Science, such as the cultural processes that contributed to the formation of global empires, the epistemic phenomena associated with the artisanal practices, and the variety of mathematical cultures, large scale networks of correspondence, multiple locales of knowledge including courtly, commercial, artisanal and academic places.

Keywords: Portugal, Spain, cartography, early modern, maritime culture, cosmography, instrument making, planisphere, Diogo Ribeiro, Casa de la Contratación

From the History of Cartography to the History of Science (ID 318)

Henrique Leitão *(University of Lisbon, Lisbon, Portugal)*

In the past decades, the discipline of history of science has undergone profound changes. Historians of science have abandoned the traditional disciplinary divisions and concentrated in the broad historical processes which helped to shape scientific concepts and practices; they have looked into issues of locality versus universality in the production of scientific knowledge and into the dynamic processes associated with the circulation of that knowledge; they have abandoned the traditional focus on experts and looked carefully into the work of technicians and artisans; they explored a multitude of different places as *loci* for the production of scientific knowledge; they investigated carefully the forms of visual representation and analyzed in detail the connections between artists and practitioners of science; they studied in novel ways the deep connections between power and scientific knowledge. But despite the great variety of these new approaches – of which the previous lines are but a summary – one cannot say that all paths have been traversed. In fact, somewhat surprisingly, the possibilities presented by cartography have been explored only in a superficial manner. Conversely, historians of Cartography, on their side, have not taken full advantage of these transformations in the history of science. Already in 1966, in his famous inaugural Nebenzahl lecture at the Newberry Library, R. A. Skelton noted that historians of cartography had been unable to profit from the post-war university expansion to create doctoral programs specifically focused on the subject. But the problem is not only institutional or about training. In fact, although the reflection about the nature of maps has been intense in the past decades, especially following J. B. Harley's work, the history of cartography has maintained some of its traditional insularity.

Maps are extremely complex artifacts that require a multilayered hermeneutical approach. They embody sophisticated knowledge and complex practices. Their production was an intensely collective phenomenon that was frequently the result of mere copying, but sometimes also the result of massive efforts of data gathering. The conceptual aspect that underlies Cartography – that is, the rationalization of space, based on obvious and sometimes highly advanced technical procedures, deeply imbued with symbolic value – is a topic of extraordinary relevance that has yet to attract historians of science.

In this communication I propose to approach Diogo Ribeiro's maps as artifacts relevant to the history of science. By this I do not mean only putting in evidence the external aspects (social, institutional, etc.), but also focusing on more internal ones. For example, recent work by experts in cartometry has shown that a detailed clarification of the technical and numerical aspects underlying the making of maps is a field of immense promise. Above all, I intend to propose possible avenues of research where historians of science and historians and historians of cartography might meet in a common pursuit.

Keywords: History of science, History of cartography

Ribeiro, Technology Transfer between Spain and Portugal, and the Perceived Value of Applied Science (ID 320)

Alison Sandman *(James Madison University, Harrisonburg, Virginia, USA)*

Diogo Ribeiro was one of a number of Portuguese experts to come to Seville in the context of the Magellan-Elcano circumnavigation of the world. The influx of experts, the preparations for the voyage (including the production of charts and instruments), and the political and diplomatic fallout from the new Spanish claims in the Spice Islands together had a profound effect on Spanish ideas about science.

Since the voyage was technically difficult, and since the value of the voyage lay in part in demonstrating that the islands lay in the Spanish side of the line of demarcation, these experts brought with them an emphasis on navigation as an applied science. This is clear not only from the illustrations of instruments given pride of place on Ribeiro's maps, but also from the manual put together by Ruy Faleiro, and the general tenor of the voyage preparations. The maps put together after the voyage – especially but not only Ribeiro's – similarly use the epistemic status of celestial navigation as an applied science to make

a case for Spain's legitimate ownership of the Spice Islands. In other words, they implicitly argue that the islands are Spanish not because of any actions by Magellan or Elcano or Charles V, but because of their longitude, and because the mariners now have the knowledge to determine that longitude and inscribe it on a map.

The incorporation of the Portuguese experts into the Casa de Contratación was a crucial part of a change in Spanish ideas about the nature of navigation and its place in the service of empire. Ribeiro illustrates a trend that would become increasingly strong over the rest of the 16th century – linking navigation to cartography, linking both to the use of astronomy in navigation and so the use of latitude and longitude, and defining the utility of navigation methods and maps explicitly in political terms. The construction of his planispheres as tools in the legitimation of territorial claims involved making claims about the value of applied science, and so played a part in reshaping not only navigational and cartographical culture, but also ideas about the uses of science.

Keywords: Diogo Ribeiro, Spain, Portugal, Transfer, Technology, Applied Science

Producing an Iberian image of the world: Ribeiro's cartographic production and the Padrón Real (ID 322)

Antonio Sánchez *(University of Lisbon, Lisbon, Portugal)*

The *Padrón Real* (Royal Pattern Chart) of the *Casa de la Contratación* (House of Trade) in Seville created in 1508 was a response to a specific political and diplomatic problem of great dimensions: the Treaty of Tordesillas (1494) and the events that followed, such as the fixation of the Meridian (and Antimeridian) or line of demarcation, and the disputes on the jurisdiction of the Spice Islands (the Moluccas). This is even more noticeable in Diogo Ribeiro's († 1533) planispheres produced in the years immediately following the first circumnavigation of the globe carried out by Magellan and Elcano between 1519 and 1522. These artefacts were technical and scientific responses to the progressive construction of geographical space in the modern age, as well as to the formation of the first global and enduring overseas empires.

This paper deals with a very significant development in sixteenth-century Spain: the establishment of cartographical practices at the *Casa* throughout the century. Although there are recent publications in the field of history of early modern Iberian science that have addressed the new empirical practices related to the maritime culture developed in this institution, there are still many unclear issues about the institutionalisation of these practices, the conditions and forms of production of nautical charts, and especially, the symbolic uses of those cartographic representations.

In an attempt to shed more light on these issues, this communication focuses on one of the most powerful mapping devices of the 16th century, the *Padrón* of the *Casa*. More particularly, this paper analyses the cartographic production of Ribeiro, one of the most prolific and skilled cartographers of the Spanish crown, and a figure directly linked to the *Padrón* since Ribeiro's appointment as cosmographer and maker of navigational instruments of the *Casa* by Charles V in 1523. The aim is to provide new evidences on the political uses of the *Padrón*, and consequently of Ribeiro's planispheres, as a representation of imperial sovereignty legitimized by the technical skills of artisans and practitioners. To do this, I will examine the technical, diplomatic and symbolic aspects of the maps signed by Ribeiro, as well as of those that are attributed to him.

In short, this communication tries to highlight not only the power of maps in shaping the official image of the world in this specific context, but also what were 'the maps of power' and how they were used to manage, legitimize and maintain imperial power. The analysis of their multifarious uses may help us to understand their hybrid, and even contradictory nature, while practical devices subject to close control by the crown and its propagandistic purposes.

Keywords: Padrón Real, Casa de la Contratación, Treaty of Tordesillas, cartography, Iberian science, Diogo Ribeiro

The Renaissance of the Spanish Nautical Cartography of the Atlantic and the Planispheres of the Casa de la Contratación (ID 323)

Joaquim Alves Gaspar *(University of Lisbon, Lisbon, Portugal)*

In 1503 the *Casa de la Contratación* was created in Seville and, in 1508, Amerigo Vespucci was designated by the Spanish Crown as the first *Piloto Mayor*. He thus became responsible for teaching pilots, approving charts and nautical instruments, and creating an official universal map known as the *Padrón Real*. Although an explicit reference is made, in the royal appointment letter, to the use of astrolabes and quadrants in navigation, no historical evidence exists that astronomical methods have been used by Spanish pilots during the first quarter of the sixteenth century, or that latitude charts have been produced by the *Casa* in the same period. On the contrary, the analysis of the scarce contemporary cartography clearly indicates: that navigation to, and in, the Caribbean Sea before the voyage of Ferdinand Magellan was practiced by the old method of the 'point of fantasy', based on magnetic courses and estimated distances; and that all charts supporting such navigation were of the traditional portolan chart type.

In 1519, Ferdinand Magellan was in Spain preparing for his voyage and a significant number of Portuguese professionals – cosmographers, pilots and cartographers – were involved. Two names are noteworthy: the cartographer Jorge Reinel who, in collaboration with his father Pedro, made a nautical planisphere in Seville that would become the model of the later cartography production of the *Casa de la Contratación*; and Diogo Ribeiro, who was appointed a few years later a cosmographer of His Majesty. Together, with Nuño García de Toreno, he was to play a major role in the modernization of the Spanish cartography of the Atlantic.

In this paper technical innovations in the nautical cartography produced by *Casa de la Contratación* around 1525 are presented and analyzed, using cartometric techniques. The study focuses mainly on three anonymous charts: the lost planisphere of c.1519 known as Kunstmann IV, attributed to Jorge Reinel; the planisphere of 1525, known as Salviati, attributed to Nuño García de Toreno; and the planisphere of 1525, known as Castiglione, attributed to Diogo Ribeiro. Some innovative features make these three charts of considerable historical importance: the representation of the entire circumference of the Earth; the graduation of the Equator in degrees of longitude; the representation of the archipelago of the Moluccas in the western hemisphere, according to the Spanish interpretation of the terms of the Treaty of Tordesillas; the correction of the distortion caused by magnetic declination in the representation of the Mediterranean and Black Sea; the representation of the Caribbean Sea according to the latitudes of the places; and the illustration of instruments and a table used in astronomical observations (Castiglione).

I will show how the construction of these planispheres by the *Casa de le Contratación* not only triggered the rebirth of the Spanish nautical cartography of the Renaissance but also served to illustrate eloquently the global ambitions of Emperor Charles V, by combining in the same medium the symbols of a global power with those of state-of-the-art technical innovation.

Keywords: Planisphere, Diogo Ribeiro, Casa de la Contratación, cartometric analysis, nautical cartography

The Power of the Casa de la Contratación: Historical background and reception of Ribeiro's Planispheres (ID 326)

Thomas Horst *(University of Lisbon, Lisbon, Portugal)*

Renaissance maps play an important role not only for map history, but also for the history of science. This can be demonstrated especially with the map production of the *Casa de la Contratación*, which was founded in Seville in 1503 as a powerful government agency to organize the Spanish expeditions to the New World. Most important to this was the official Royal pattern chart, the "*Padrón Real*", which

was made (and always renewed) by official cartographers like the Portuguese-born mapmaker Diogo Ribeiro, who worked since 1519 for the Spanish kingdom – and acted together with other cartographers as mediators in the structures of global power.

From Ribeiro we know two large *mappae mundi* from 1529, which are today preserved in the Vatican Library and in the "Herzogin-Anna-Amalia-Bibliothek" in Weimar, Germany. If we compare these unique and huge cartographic objects with other manuscript maps attributed to Ribeiro (so-called "*Castiglione map*" of 1525; "*Carta Universal*" of 1527 and two other fragments), we see a close analogy in their style ("Ribeiro type").

But why were these innovative maps drawn and how did they come to Italy and Germany? What does they tell us about political power of that time? How are they connected to other contemporary scientific objects and why are they ground-breaking for Spanish cartography in the Renaissance? To respond to these questions an overview of the historical background will be given, which includes a new analyses of the maps iconography, with the help of heraldic figures. Moreover, it will be demonstrated that these maps are probably directly connected with German trading houses of the Fugger and the Welser, who established their global network in the 16th Century in Iberia and South America. Furthermore, these charts of the 1520's were made for concrete powerful reasons (the contemporary dispute about the Spice Islands between the Spanish and the Portuguese kingdom) – by cartographers who had the power to change the views of the world while producing maps.

Keywords: Casa de la Contratación, Diogo Ribeiro, Planispheres, Welser colony in Venezuela, German trade, Iberian cartography

Diogo Ribeiro as an instrument maker: reinterpreting the mappamundi of Weimar (1527 & 1529) (ID 328)

Samuel Gessner *(University of Lisbon, Lisbon, Portugal)*

The Portuguese king João III received a report sent from Coruña, Spain, on February 28, 1525. It informed him about the naval activities there and mentioned a certain Diogo Ribeiro making "naval charts, spheres, world maps, astrolabes and other things related to transatlantic navigation". Obviously such news on scientific activities and artifacts were most relevant during the power struggle between two crowns, the Spanish and the Portuguese, that ventured into the Atlantic world. By that time, Ribeiro, although of Portuguese birth, had already started a successful career as an official cosmographer to the Spanish king. While historiography has usually underlined Ribeiro's work as a cartographer, this paper in contrast will take seriously the mention of his making of spheres, astrolabes and "other things". The latter may refer to the metallic bilge pump, which Ribeiro is known for having invented around 1524. Focusing on Ribeiro's instruments allows to connect him to a tradition of 16th century mathematical instrument making and the scholarly interest in producing instrument treatises. In doing so, the cognitive use and status of the so-called "universal charts" or *mappamundi* will be reassessed, in particular the two maps in Weimar from 1527 and 1529, which are attributed to him. If they could not be used for navigation, what purpose did they serve and whom were they made for? By looking into these questions, the paper will contribute to inserting Ribeiro's activity in the variety of mathematical cultures – including the practical mathematics of instrument making – that characterized the sixteenth century development of science and technology.

Keywords: mathematical instruments, Diogo Ribeiro, Herzogin-Anna-Amalia-Bibliothek, Weimar, universal charts, cosmography, craft tradition, status of mathematics

Historiographic controversies on Diogo Ribeiro's life and work (ID 330)

João Carlos Garcia *(University of Porto, Porto, Portugal)*

During the second quarter of the 19th century a new stage of European colonialism was discussed and implemented mainly in the Northern and Western parts of the African continent. In international law "Colonial rights" and priority of discoveries were based on historical documents and among them maps played a major role. Experts on cartography were often consulted by politicians, military and diplomats when they needed decide in international negotiations about the control and occupation of large overseas territories. Academic reports and memoires analysing old maps were presented during international meetings and appeared on scientific reviews expressing national interests. This happened after the unification of the German Empire and during the "Scramble for Africa". The same scenario repeated itself between the two World Wars and also in the 60's during the collapse of colonial empires. Again erudite controversies took place between politicians and savants.

A good example of this connection between Science and Power, between Cartography and Colonialism, is the life and work of Diogo Ribeiro, a Portuguese cartographer who worked to the Spanish Crown during the first half of the 16th century. His world maps (now in the Libraries of Modena, Weimar and the Vatican), depicting the configuration of oceans and continents after Magellan-Elcano's circumnavigation (1519–1522) were used to discuss global geostrategy and the Portuguese and Spanish hemispheres according to the Tordesillas Treaty. The maps were not only used in its time but also in the 19th and 20th centuries for colonial discussions in concrete political contexts.

Well-known names of the European Science as Humboldt, Santarém, Navarrete, Kretschmer, Harrisse, Nordenskiöld, Almagià or Cortesão, representing different countries and different scientific schools, were some of the historians of Cartography who studied these historical cartographic documents, analysing sources, authors, dates, editions or toponymy. Their findings would be extensively published in books and magazines and presented at international conferences. This communication intends to follow the historiographic controversies among theses scholars about Ribeiro's maps while taking into account the close relationship with the evolution of the geographical thought as well as with Political and Diplomatic History.

Keywords: Historiographical controversies, Diogo Ribeiro, Colonial rights, History of Cartography, Iberian Peninsula, Diplomacy

Royal Power and the Cartography of France (ID 475)

Suzanne Débarbat *(Observatoire de Paris, Paris, France)*

The apparition of the 1665 comet made Louis the 14th interested in astronomy; he was twenty-seven years old and in full power since 1661. The 1635 lunar eclipse had reduced, by one third, the length of the Mediterranean Sea and, with Galileo's discovery of four Jupiter satellites, their eclipses could also provide longitude determinations. Several French scientists (*savans*) attempted to predict their occurrences but had to wait for Cassini's predictions (1668) to be sent to Auzout, a member of the *Académie Royale des Sciences,* created by Louis XIV in 1666 a few months before his *Observatoire Royal*. Another member, Huygens, had written (1666–1667): *Aviser aux moiens de faire les cartes geographiques avec plus d'exactitude que jusqu'icy*, while Picard, another one, was measuring a meridian arc. *Savans proposent, le roi dispose* and royal orders were sent through Colbert, Louis XIV's important minister. Realization would come, from technical improvements: refractors on sectors in angular measurements for astronomy and geodesy, filar micrometers, pendulum clocks for longitude determinations. The orders: *…que l'on trauaillat a faire des Cartes Geographiques de la France plus exactes que celles qui ont esté faictes jusqu'icy, et que la Compagnie…* Up to Louis XIV's death (1715), things would go rather slowly, the shape of the Earth being under discussion. After Louis XV's orders to Cassini's grandson, in 1747, *savans* employed the same equipment, but better made and more precise. The mapping of France was made under his guidance with many collaborators; the Kingdom

was covered by triangles, France being divided into smaller rectangular maps. When Cassini III died, in 1784, the map was not yet complete; it was given to his son, Cassini IV, to complete the project in 1790. Three king's orders and four astronomers of the same name had, in the end, succeeded in producing the very first map, at national level, based on scientific measurements.

Keywords: Royal power, refractor, pendulum clock, cartography, longitude, mapping

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Symposium 321: The Acknowledged Ambassadors: Scientists' role in international relations during the Cold War

Organizers: ***Doubravka Olšáková*** *(Academy of Sciences of the Czech Republic, Prague, Czech Republic),* ***Simone Turchetti*** *(University of Manchester, Manchester, UK)*

One distinctive aspect of the 20th century was the growth of a global community of scientific experts and its influence on national, state, and international affairs. On the one hand, scientists were entrusted to administer state relations, while on the other hand, new global initiatives on both sides of the Iron Curtain facilitated the circulation of knowledge, thus highlighting the prominent role of scientists as new communication channels of the Cold War. Especially during the second half of the century, scientists came to occupy prominent spaces in public affairs and international relations – as demonstrated by the bourgeoning field of 'science diplomacy'.

New post-war world order reframed traditional schemes of international cooperation in science and the bipolar system transformed international organisations such as UNESCO, ICSU, and others into "battlefields" of the Cold War. Entrance of the USSR to the international arena and the 'spirit of Geneva' redefined the traditional understanding of the role of scientists in international diplomacy. The position of scientists was delicate: they were supposed to actively promote international cooperation in a world of isolation and sanctions. Sensitive knowledge, so crucial to innovative scientific work, became a key element of diplomatic manoeuvres. Scientific patronage and sponsorship became 'diplomacy by other means' and international science agenda was shaped by political and ideological priorities whose aim was, depending on the international situation, either to pave the way for or to hamper international bi- and multilateral cooperation.

Several works have presented a new phenomenology of particular cases. While this phenomenology clearly shows how scientists were empowered in the international arena and could thus "speak" for their governments/blocs/ruling ideology, the historical determinants of this phenomenon have yet to be fully scrutinized.

In particular the proposed panel aims to address following questions: Was it an "impasse" of traditional forms of diplomacy-making, for instance during the Cold War, that catered for the entrance of the scientist in the administration of international affairs? Was it the need to secure new means of global governance required "experts" to play a new role side-by-side with the traditional diplomatic figures given the complexity of legislating and policing global matters? Was it global trade or global governance that stirred forward the use of scientists in international affairs? Was it the practical utility of science or its underlying ideology that catered for strengthening international relations with the assistance of scientific experts? Was it the scientists' intervention in the administration of secret state affairs that legitimated their presence in diplomacy matters or vice-versa?

This panel aims to provide a contextual and analytical framework for understanding the Cold War science diplomacy by promoting a discussion on these questions through the analysis and comparison of different historical cases.

Keywords: Science Diplomacy, Cold War, Communism, Global Institutions, Circulation of Knowledge, Nuclear Research, Environment, Health Policy, International Programmes, International Relations

Scientists as instruments of state power in international collaboration (ID 325)

John Krige *(Georgia Institute of Technology, Atlanta, USA)*

International collaboration in fields of sensitive knowledge is authorized by governments but implemented by scientists. These scientists are expected to translate the foreign policy requirements of the regime they represent into practice by selectively sharing information with foreign colleagues. This paper will explore the strategies deployed in face-to-face encounters between nuclear weapons scientists who seek to satisfy both the restrictions imposed by their governments and the escalating demands for information by their foreign partners. A survey of the role of Siegfried Hecker, Director of Los Alamos Weapons Laboratory from 1986 to 1997, who has had extensive contacts with Russian scientists and visited the North Korean weapons complex seven times to date, will be used to illustrate the argument. Hecker maintained transnational links with colleagues abroad at times of deep tension between their respective government. His travels were sanctioned by the US national security state since they served to gather valuable 'informal intelligence' on the level of nuclear programs in 'closed' societies. However, he did not hesitate to condemn policies that violated his conviction that international scientific contact was imperative. He publicly condemned the assassination of Iranian nuclear scientists even though the US was vociferously opposed to the Iranian enrichment effort. He described his visits to North Korea as giving their scientists 'hope' that relations between the two countries would improve. Overall Hecker actively promotes international collaboration even as his government officially promotes isolation and sanctions. Individual scientific ambassadors like Hecker, while bound by their official briefs, do not adhere slavishly to them. They also seek to transform official policy in highly contested areas towards increased scientific, technological and political collaboration.

Keywords: Science Diplomacy, Cold War, Nuclear Weapons, Los Alamos, USSR, North Korea, Iran, International Collaboration

The patronage of science as "backchannel" diplomacy?: The case of NATO, 1950–1980 (ID 327)

Simone Turchetti *(University of Manchester, Manchester, UK)*

In recent and less recent years a number of historians have explored the history of Cold War scientific patronage to explain its significance. While their work has been fruitful, one chief shortcoming has been that their reflections have firmly used patronage as an explanatory device to chart the advancement of certain disciplines and reflect for instance on their "distortion" (Paul Forman) or –internationally- on the "co-production" of scientific knowledge (John Krige).

This paper, based on the analysis of the role of NATO as a scientific patron, suggests that in exploring the determinants of international science, we might have overlooked the ambitions of using sponsorship as "diplomacy by other means". By examining the NATO case, I aim to show that in some cases *what* disciplines or areas ought to be funded (and co-produced) was far less important that *how* the funding could help smoothening bilateral or multilateral relations in critical moments in which traditional diplomacy had failed or was about to fail. The NATO case is particularly importance since the alliance was seen in Europe as an emanation of US imperialism; an element that corroded political synergies. I thus contend that the offer of assistance to science programs in Europe was a way for US diplomats to by-pass and avoid contentious political issues and persuade allies through the offer of funds for research. This paper, based on the study of NATO archive materials, argues for understanding patronage as a form of "backchannel diplomacy" and for re-thinking about science administrators working at NATO as cleverly disguised diplomats.

Keywords: Science Diplomacy, Cold War, NATO, International Science, International Programmes, International Relations, Research Funding

The Socialist Lobby?: Socialist Countries and the Soviet Union in the ICSU and the UNESCO (1945–1972) (ID 329)

Doubravka Olšáková *(Academy of Sciences of the Czech Republic, Prague, Czech Republic)*

Post-war international science was affected by the Cold War since its very beginning. The Soviet Union pushed all countries which were part of its sphere of influence to withdraw from all international organizations, such as WHO, ICSU, and UNESCO. The reason is not obvious but the short absence (1953–1954) of countries which had participated in the international science agenda in the interwar period, such as Czechoslovakia or Poland, affected the post-war continuity and their isolation reinforced the impact of Sovietisation on East European scientific communities.

After Stalin's death in 1953, Geneva conference(s) in 1955, and especially after the entrance of the USSR into the highest circles of international science diplomacy in 1958–1959, international collaboration across the Iron Curtain became a key element of Soviet international science policy. Sovietisation was replaced by international cooperation and small East European scientific communities played an important role as a lobby which promoted Soviet interests on the international scene. The International Geophysical Year (1957–1958) could be seen as a transitory project between the period of Sovietisation and international cooperation under Soviet control. Programmes which were launched later – such as the International Biological Programme (1964–1974) and International Hydrological Decade (1965–1974) – demonstrate the mechanisms of a new type of international cooperation in the Cold War, where lobbying became an integral part of international science policy. The Soviets, as we will show, coordinated socialist countries and their voting in the ICSU or the UNESCO with great care. The proposed paper analyses the process of establishing the international science agenda of the Socialist bloc and pushing it through in the international bodies. Special attention will be paid to the main actors of the science management of socialist science on the international level, namely V. A. Kovda, leader of the first UNESCO Natural Sciences Department (1958–1965), Ivan Málek (1967–1973), the vice-president of the IUBS, and Kazimierz Petrusewicz, member of the executive committee of the IBP. Relation between the UNESCO agenda and the COMECON agenda will be mentioned as well.

Keywords: Science Diplomacy, Cold War, Global Institutions, UNESCO, ICSU, COMECON, International Programmes, Eastern Europe, Communism

From Nuclear Test Ban Negotiations to the Club of Rome and the First World Climate Conference: Soviet Geophysicist Yevgenii Fedorov on the Stage of Science Diplomacy (ID 331)

Julia Lajus *(National Research University Higher School of Economics, Saint Petersburg, Russian Federation)*

The paper analyses different roles Soviet scientists played on a stage of science diplomacy during the Cold War on the example of Evgenii Fedorov's – leading Soviet geophysicist and polar explorer, who by the 1970s became a high-level official in the governance of the Soviet science as a Head of Hydrometeorological Committee and a full member of the Academy of Sciences. Fedorov got large experience of representing the USSR in leading international organizations such as World Meteorological Organization (WMO) being its vice-president in the 1960s. In 1956 Fedorov's began to work in the atomic project where he studied dispersion of radiation in the atmosphere after the bomb explosions. For that research he organized an Institute of Applied Geophysics in the closed nuclear town of Obninsk. From this time Fedorov's life-span involvement into diplomatic negotiations around nuclear disarmament began: he participated at numerous UN forums and bilateral Soviet-American détente meetings, including ones on the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques to be approved by UN in 1976.

Fedorov was predisposed by the end of the 1960s to become 'a globalist' -- here I use Edwards's analysis of meteorology as 'infrastructural globalism'. He took part in the developing satellite network for weather monitoring, a programme supervised by ICSU. At the same time he became one of the

very few Soviet members of the Club of Rome and also served as a vice-president of World Peace Council. On the peak of his career Fedorov headed the Soviet delegation to the First World Climate Conference in Geneva (1979) and then on the name of the Soviet Union proposed at the UN Assembly the resolution on historical responsibility of states on nature conservation.

Fedorov built his understandings of relations between the humankind and nature on perception of contemporary ecological thinking and its reconceptualization on the base of his expert knowledge of global planetary processes including climate change. His book "Ecological crisis and social progress" (1977) is based on some knowledge of contemporary Western scholarship, attention to the ecological problems in the developing countries and faith in a crucial role of science, technology and involvement of scientists in the leading international organizations to cope with the 'crisis'. However, stressing the necessity of approaches from social sciences for solving the global environmental problems, he fully based his understanding of social problems of contemporary humankind on dogmatic Marxist ideas.

In this paper I would like to address several questions: What are the roots of the situation when natural scientist addressed social, economic, political problems on the international stage which lied far beyond his own expertise? What individual strategy and circumstances of scientific career led Fedorov become a trumpet of Soviet environmental thoughts? What comparisons could be made of Fedorov's behavior and concepts with other contemporary science diplomats, especially authors of the reports to the Club of Rome and American environmentalist Barry Commoner?

Keywords: Science Diplomacy, Cold War, Evgenii Fedorov, USSR, Hydrometeorology, Club of Rome, World Climate Conference, Environmental History, Communism, Ecological Crisis

US Science Attaches in Paris & London: Science & Politics in the early 1950s (ID 333)

Pnina Geraldine Abir-Am *(Brandeis University, Waltham, Massachusetts, USA),* ***Genevieve Benezra*** *(France)*

During the early 1950s, H. T. Clarke, Chairman of the Department of Biochemistry at Columbia University and the biophysicist Jeffreys Wyman of Harvard University were among the first scientists to serve in the newly created positions of US science attaches in Europe. The talk compares their approaches to their new assignments in London and Paris, respectively; their prior experiences with Europe in the inter-war era; and their roles in facilitating transatlantic contacts between European and American scientists at a time European scientists were denied visas to the US and American scientists' passports were revoked; (e.g. Linus Pauling's case in 1952 in which protests by European scientists and the advice of US science attaches led the US restore Pauling's travel to Europe) The roles of these science attaches in an emerging network of bioscience statesmen who shaped post-WW2 science as a force for detente will also be discussed, including their support of J. T. Edsall's manifesto of moral leadership "Government and Scientific Freedom" in a time of "no peace and no war" (1955) and their impact on the creation of new international organizations such as EMBO. The talk concludes with a discussion of the historicity of the early 1950s in affording science a key role in international diplomacy.

Keywords: Science Diplomacy, Cold War, Science Attaches, US, France, United Kingdom, Europe, Détente, EMBO, Biosciences

The Commitment for Soviet Dissidence as a Counter-Power During the Cold War? The Case of French Mathematicians (ID 337)

Sophie Cœuré *(Paris Diderot University, Paris, France)*

In comparison to other scientists (physicians, biologists, space researchers), the mathematicians were probably the less openly embedded in the Cold War contest, at least on the Western side. Based on my previous methodological and empirical researches about East-West cultural circulations and on new archival findings, this proposal aims to challenge the image of mathematics as an apolitical, pure and universal science, very widespread in France in contrast to the image of Soviet use of science for applied and political goals. By studying the case of the French *Comité des Mathématiciens*, which supported Soviet dissidents during the 60s and 70s, my paper attempts to determine how this commitment challenged the realist agenda of the French diplomacy. Did these mathematicians – Laurent Schwartz, Pierre Broué, Henri Cartan, etc. – who were mainly ultra-left wings activists, view themselves as a blip in the machinery of scientific cooperation? Was this "counter-power" purely political, or was it also based on a shared approach of mathematical research that could be illustrated by the clandestine seminars held in Moscow and St Petersburg? What were their relationships with concerned official authorities? Did they really stay aside from the administration of state affairs and from official cooperation with the USSR and if so, how did they interact with the actors of official cooperation? The French case will be replaced in both its national "milieu" (French Academy of Sciences, Universities, Professional associations, political parties) and in a transnational context (Helsinki committees, Committee of Concerned Scientists, International Mathematical Union, etc.)

Keywords: Science Diplomacy, Cold War, France, USSR, Mathematical Sciences, Comité des Mathématiciens, Circulation of Knowledge, Dissidence, International Mathematical Union, International Cooperation

Environmental researches and US-USSR rapprochement during the 1970s (ID 339)

Nicolai Dronin *(Moscow State University, Moscow, Russian Federation)*

At the May 1972 summit in Moscow Leonid Brezhnev and Richard Nixon signed agreements to establish the technological, commercial, and diplomatic framework for the policy of *détente*, including the creation of a Joint Committee on Environment Protection. Some forty cooperative scientific projects were established. Joint teams of scientists investigated seismic activity beneath the Nurek Reservoir in the Tadzhik SSR. Three clusters of earthquakes were found, one directly beneath the reservoir. In 1976 Soviet and US scientists analyzed precursor radon anomalies recorded during the May 1976 earthquake in the Gazli area of Uzbekistan. In June 1976 experts met in Leningrad to discuss the growing concern that manmade pollutants can alter the national condition of the stratosphere and thus produce adverse changes of the earth's climate. "A highly successful" exhibit –seminar Clean Air-76 was held in Moscow during February 1976. In November 1976, both sides signed a Convention concerning the conservation of migratory birds and their environment. For the first time, both sides exchanged delegations of experts to study the planning and construction of pipelines in the permafrost areas of Alaska and Siberia as well as related measures to minimize environmental damage to northern ecosystems. The scientists met annually under these bilateral agreements until the Soviet invasion of Afghanistan in 1979. The relationship revived in 1984, and two years later officials from both sides agreed to broaden cooperation on environmental issues over the following five years. Extraordinary event was establishment by two countries of International Institute of Applied System Analysis (IIASA) in Vienna in 1972. The institute was designed to develop the joint scientific cooperation of two superpowers apart military and cosmic spheres and environmental modeling was found to be good solution. The idea of the institute was belonged to the President Johnson who made first proposal as early as in 1968.

Keywords: Science Diplomacy, Cold War, Environmental Sciences, US, USSR, Joint Committee on Environment Protection, Détente, Seismology, International Relations

The "underground" International Geophysical Year: How American geophysicists used overt diplomacy and covert scientific intelligence-gathering during the early Cold War (ID 342)

Ronald E. Doel *(Florida State University, Tallahassee, USA)*

During the early Cold War, U.S. earth scientists during the Cold War were especially keen to maintain relations with their colleagues overseas, particularly after Dwight D. Eisenhower won the presidency in 1952. They were aware of the immense value of geophysics to emerging weapons systems and national security, and were actively crafting the third polar year, dubbed the International Geophysical Year. But Eisenhower's conservative Secretary of State, John Foster Dulles, backed plans to largely restrict international scientific activities to individuals in Western Bloc nations. Attempts to maintain contacts across the East-West divide took several intriguing forms. Leading geophysicists sought to underscore the importance of employing scientific attaches in European embassies to promote scientific diplomacy (aware that the Central Intelligence Agency saw such contacts as valuable for its mission as well). At the university level, individual researchers sought to maintain networks of international research projects (both within the IGY context and beyond it); like diplomats, they wrote out extensive "trip reports" after foreign visits to aid the state to appreciate foreign developments. One end result: gatherings such as congresses of the International Union of Geodesy and Geophysics became both venues for international diplomacy and intense sites for scientific intelligence-gathering. Eisenhower's increasingly favorable views towards these efforts reflected the vision of his final science advisor, George Kistiakowsky, that scientists provided a particularly promising means of promoting democratization in Eastern Europe.

Keywords: Science Diplomacy, Cold War, International Programmes, International Geophysical Year, International Union of Geodesy and Geophysics, Earth Science, US, Scientific Attaches, John Foster Dulles, Eastern Europe

The Joint Institute for Nuclear Research and Soviet Science Diplomacy in the Early Cold War (ID 343)

Karl Hall *(Central European University, Budapest, Hungary)*

Shortly after war's end a Soviet scientist toured German institutions and reported, "Russia emerged victorious from the war thanks to the courage and heroism of its people and the high level of its science and technology. All of this forces the Germans to take an interest in the Russian people and its science, which has succeeded in smashing German militarism and showing the superiority of our system of labor organization and government." That early confidence gave way after 1949 to more complex diplomatic challenges on two fronts, as the Soviet Union sought to project an image of peaceful atomic capabilities in the West with the help of politically reliable physicists (Geneva 1955), while also cultivating scientific ties between the Soviet Academy of Sciences and the scientific institutions of the newly socialist countries of East Central Europe. The responses of Czech, Polish, and Hungarian scientists were by no means uniform, and even in cases of strong bilateral interest there were many obstacles to collaboration. As Hungarian biochemist Bruno Straub put it, "we need less parading around and more profound acquaintance." The Joint Institute for Nuclear Research in Dubna eventually became the highest profile scientific collaboration in the Warsaw Pact, and the story of its formation in the wake of these halting international initiatives will conclude this brief narrative of early Soviet science diplomacy during the Cold War.

Keywords: Science Diplomacy, Cold War, Nuclear Research, USSR, Dubna, The Joint Institute for Nuclear Research, Warsaw Pact, International Collaboration, Eastern Europe

Uranium Surveillance, Uranium Diplomacy: Geology and Geopolitics in Morocco and Beyond (ID 345)

Matthew Adamson *(McDaniel College – Budapest Campus, Budapest, Hungary)*

During the Cold War, uranium immediately came to prominence as a key strategic material. Its potential as a focus not only for innovative scientific work but also key diplomatic maneuvers is apparent in the work of Jonathan Helmreich and Gabrielle Hecht. This paper provides new evidence for uranium's diplomatic importance by examining a little-known secret collaboration between France and the US in the 1950s to hunt for uranium in the protectorate of Morocco. The prospection program allowed mediation on multiple fronts, including the acknowledgement of a changing nuclear global order, as well as agreement over Morocco, a strategically important territory. What to outside observers might have appeared a scramble to find uranium deposits in Morocco's soils and sands was actually a means of agreeing to France's hegemony over the disputed territory, regardless of what the US said publicly. But with the arrival of Moroccan independence, the collaboration changed, becoming an effort to deny uranium to any unwanted geopolitical rivals. The French came away with a keen appreciation for the diplomatic influence of their uranium experts, witness their extensive travels around the world in the following decade, while to this day the geopolitical significance of attracting foreign uranium prospectors to one's own territory is not lost on the Kingdom of Morocco.

Keywords: Science Diplomacy, Cold War, Nuclear Research, Uranium, France, US, Morocco, International Collaboration

Fleming, Florey and Chain and East-West Circulation of Knowledge on Penicillin (ID 347)

Daniele Cozzoli *(Universitat Pompeu Fabra, Barcelona, Spain)*

This paper explores the notion of scientists as experts and ambassadors in the early Cold War years by focusing on the different roles played by Alexander Fleming, Howard Florey and Ernst Boris Chain, the three British Nobel Prize winners of 1945, in the circulation of knowledge on antibiotics between Eastern Europe, Britain and the USA between 1944 and 1950. Penicillin was a multifaceted object, being at the same time a life-saving drug, an industrial product, an instrument of propaganda and a defensive weapon. As early as 1944, the Soviets tried to acquire knowledge and know-how on penicillin large-scale production from the British and the Americans. The Foreign Office aimed to slow down antibiotics production in USSR, whereas Washington also wanted to protect the interests of its industry.

In this paper, it is explained how the projects of the three scientists were shaped by the Cold War dynamics above outlined. Fleming became the main promoter of the new drug as a powerful instrument of propaganda, but his strict scientific contribution was limited. Florey tried to balance the defence of British strategic interests with his humanitarian mission as physician. Chain promoted technology transfer to USSR and to Czechoslovakia. Nevertheless, he aimed at constructing an integrated research and production antibiotics centre in Britain. This paper also compares the three British biomedical investigators role with that of the Soviet microbiologists, Nikolai Borodin, a microbiologist who collaborated with Florey and fled to the UK, and Zinaida Ermol'eva, the heroin of Soviet penicillin.

Keywords: Science Diplomacy, Cold War, Circulation of Knowledge, Antibiotics, Alexander Fleming, Howard Florey, Ernst Boris Chain, Penicillin, USSR, Eastern Europe

Symposium 336: Power and display: Museums, science and politics in Southern Europe (1918–1939)

Organizers: ***Elena Canadelli*** *(University of Padova, Padova, Italy),* ***Jaume Sastre-Juan*** *(Universidade de Lisboa, Lisbon, Portugal)*

The display of science and technology is never politically neutral. Museums of natural history, world's fairs, industrial museums, ethnographic and anthropological exhibitions, or science centers have all been studied as spaces in which power relations have been constructed and negotiated. During the last decades, both museum studies and the history of science and technology have addressed the politics of display in terms of the production and reproduction of ideologies having to do, among other issues, with national and professional identities, gender, colonialism, class struggle, and ideas about nature and religion.

The political unrest of the turbulent interwar years was reflected in the creation or remodelation of many national museums of science and technology and in the reconfiguration of the display of science and technology around new exhibition techniques. There is ample scholarship on the politics of display in Central Europe and the United States. However, the picture is still far from complete: more national case-studies including other regions which have been less studied need to be taken into account if we are to build a truly global picture. One of these regions is Southern Europe.

This panel will explore the intersections between political power and representations of science and technology through display during the interwar period in Southern Europe. It will address questions such as the following ones: How was national identity negotiated through displays in museums and international exhibitions? What were the narratives beyond the exhibits? How were imperial ideologies and identities constructed in spaces such as gardens and horticultural exhibitions? How did the fascist regimes use science and technology displays for achieving political goals? In what ways was prehistoric cave art mobilised in support for specific political projects? What was the relationship between exhibition practices and medical knowledge? What was the political context for the first musealization of the history of science? How was the intense social conflict reflected in the display of science and technology?

Keywords: Southern Europe, Politics of Display, Science and Technology Museums, Fascism, Colonialism, World's Fairs, International Exhibitions

The Italian Genius on Display: The First National Exhibition of History of Science (Florence, 1929) (ID 338)

Francesco Barreca *(Museo Galileo, Florence, Italy)*

The First National Exhibition of History of Science, held in Florence from May 8 to November 10, 1929, was in many ways a unique event. The result of the steadfast efforts of Andrea Corsini, Piero Ginori Conti, and Antonio Garbasso, it marked the culmination of two decades' work for the protection of the historical heritage of science, and provided an initial census of Italian historical scientific collections.

Yet if the Exhibition succeeded in pointing out the importance of historical scientific collections, it was mainly because its organisers managed to make its aims consistent, at least *prima facie*, with those of the Fascist regime. Fascism had come to power in 1922 posing as the defender of the fatherland and since then had been constantly trying to secure its popular consensus by integrating that image into a comprehensive narrative within which the celebration of the "Italian genius" retained a preeminent position. Institutions and intellectuals were urged to "retrace the footprints of the Italian genius," and the regime was always willing to support initiatives that could be exploited to spread the myth of national rebirth. In this ideological panorama saturated with ultranationalistic rhetoric, history of science was held up as the instrument for uncloaking the "looters" who had "seized" the Italian scientific glories throughout the centuries.

From this perspective, the Florentine exhibition could serve as a telling case study for approaching the complex relationships between the Fascist regime cultural policy and the musealization of history of science.

Keywords: First National Exhibition of History of Science, Politics of Display

Politics of Display in Portuguese Science and Technology Museums under the Fascist Regime (ID 341)

Ana Delicado *(University of Lisbon, Lisboa, Portugal)*

The short-lived progressive Portuguese first republic ended abruptly in 1926, giving way to a fascist regime that would last almost forty years. Former policies aimed at promoting education and scientific development, including museums, took a sharp U-turn. Expulsion of professors and other restrictions placed on universities caused a significant regression for science, perpetuating a backwardness that has been labelled as the Portuguese being "stepchildren of Galileo".

Conversely, scientific museums experienced a significant growth in this period. Serving as propaganda machines, they helped disseminate the ideological values of the new regime. Maritime, archaeologic and ethnographic museums sprung up throughout the country, celebrating the heritage and achievements of appropriate groups (the sea-faring discoverers and inventors, the roman and medieval builders, the folklore of the humble populace, the racial superiority of Europeans), while omitting less savoury aspects (slavery, the Muslim legacy, social inequality in traditional societies, colonialism). At the same time, university museums languished in obscurity, dragged down by lack of funds and of ties to the community. And since Portugal bypassed the Second World War, these policies of display lasted well beyond the inter-war period.

This paper will discuss the institutions and persons behind the creation and development of scientific museums in the 1920s and 1930s in Portugal, as well as their contents and the discourses around them.

Keywords: Portuguese Science and Technology Museums, Politics of Display, Fascism

Science, Fascism and Foreign Policy: the exhibition 'Scienza Universale' at the 1942 World Fair in Rome (ID 416)

Geert Somsen *(Columbia University, New York, USA)*

Science has often been upheld as a model for international relations – even, despite various challenges, during the interwar period. Most of the time, such political uses of science's alleged universality are associated with liberal or leftist orientations. But these have never held a monopoly. In fact, also conservatives or even the extreme right have occasionally projected images of universal science as a guide to international politics. One great illustration of this was the exhibition 'Scienza Universale' that the Italian fascist government planned as part of its 1942 World Fair in Rome. In the end this event did not take place. But preparations were far advanced when the plans were interrupted, and from their traces we can reconstruct a picture of what the various parties involved wanted to achieve with this large public display of universal science.

In my presentation I will review the various aims of this exhibit. I will look at the various groups involved in its preparation and their sometimes clashing interests. And I will trace how the exhibition's message changed as the world that it sought to reflect and speak to drastically altered its shape with Hitler's conquests of 1938–40. If science was a guide to international relations, it needed to point in quite new directions.

Keywords: Fascism, Foreign Policy, Exhibition "Scienza Universale", Rome, 1942 World's Fair, Politics of Display, International Relations

Between Technology and Arts: Exhibiting European Prehistoric Cave-art in the Interwar Period (ID 349)

José Lanzarote-Guiral *(Aix-Marseille University, Marseille, France)*

Prehistoric archaeology was created in the mid 19th century as discipline focused on the study of material evidence of remote societies that aimed at fostering a positivist reading of human history in which the idea of universal progress became central. However, the recognition of cave art painting at the turn of the century opened the path for new approaches in which the "artistic" and intellectual capacities of prehistoric humanity could be also studied. In the first decades of the 20th century, the study of prehistoric cave art became the spearhead of the discipline, and moreover, it also became a powerful tool for national identity building, particularly in the case of Spain. Focusing on the exhibitions in which prehistoric cave art was displayed (by means of reproductions), in France, Spain and Portugal, this presentation aims to reflect on the ways prehistoric cave art was mobilised in support of political or social projects in the Interwar period.

Keywords: Prehistoric Cave-Art, Politics of Display

A Museum Under the Bombs: The Failed Technical Museum of Catalonia (1937) (ID 352)

Jaume Sastre-Juan *(Universidade de Lisboa, Lisboa, Portugal),* ***Jaume Valentines-Álvarez*** *(Universidade NOVA de Lisboa, Lisboa, Portugal)*

In June 1937, in the midst of the Spanish Civil War, while the Fascist aviation was bombing Barcelona, a proposal for building a national museum of technology was officially approved by the Catalan government.

The first national museums of science and technology can be traced back to the mid-nineteenth century, and even before, but most of them were created, re-inaugurated or renovated during the interwar years. By the end of the 1930s, many cities had seen the creation of such a museum: Munich, Vienna, Prague, Stockholm, Budapest, Oslo, New York, Philadelphia, Chicago, Moscow or Tokyo. Barcelona did not materialize the proposals that were put forward during this socially and politically turbulent period.

Taking into account the international context, this paper will reconstruct the elusive circumstances of this failed attempt in the light of the 1930s debates for creating an industrial museum in Barcelona. It will explore the relationships between politics and technological display by focusing on the technocratic and nationalistic ideologies within the Catalan engineering community.

Keywords: Technical Museum of Catalonia, Spanish Civil War, Technocracy, Nationalism, Politics of Display

Milan versus Rome: The Struggle for the Italian National Museum of Science and Technology in the 1930s (ID 340)

Elena Canadelli *(University of Padova, Padova, Italy)*

The 1° January 1928 Mussolini addressed a message to the new president of the National Research Council Guglielmo Marconi, asking him to establish new "living" museums of science and technology. At the time Italy didn't host neither a national museum of science nor a national museum of natural history. During the Fascist regime the debate on scientific museology increased, as shown by the case of Florence National Exhibition of History of Science (1929). Beyond the national rhetoric and the politics of autarchy, important cultural issues were at stake, such as the protection of the Italian scientific heritage, the dissemination of science and technology, the goals achieved by the Italian science.

Taking into account the lively international context, this paper will consider the attempts to create an Italian national museum of science during the 1930s. The front was multifaceted. Someone worked for the capital Rome, where a Universal Exhibition was scheduled to open in 1942, someone for Milan, where the industrialist and engineer Guido Ucelli was planning to found a national museum of arts and industry. While the Exhibition in Rome was cancelled due to the Second War World, in 1953 Ucelli succeeded in opening the National Museum of Science and Technology "Leonardo da Vinci" in Milan. Different models of displaying and communicating science to the public were at stake in relation with different political and cultural goals. The paper will focus on the debates among different scientific and political communities for creating the Italian national museum, looking at different European models such as the Deutsches Museum in Münich or the Palais de la découverte in Paris.

Keywords: Italian National Museum of Science and Technology, Politics of Display

Gardens and Horticultural Exhibitions Conveying the Idea of Empire (ID 346)

Ana Duarte Rodrigues *(Universidade de Lisboa, Lisboa, Portugal)*

I offer a first insight on horticultural exhibitions held in Lisbon, Portugal, and tropical gardens shaped in the beginning of the twentieth-century as places for experiment and display of exotics from all parts of the world, but especially from the Portuguese colònies.

The main point of reference for this study is the rich body of knowledge provided by the Tropical Garden in Belém, Lisbon, and the Tapada da Ajuda's exhibitions. Which were the species cultivated there; How were they displayed; What was the goal behind exotics' study; Who visited these gardens and exhibitions; Who were the main actors; What was the network established with similar international exhibits, are some of the questions posed.

The two case-studies proposed for this conference embody three main interrelated ideas: the study of botanic species from Portuguese colonies; the study to take advantage in colonial agriculture; and the display of exotics to the European public. Stemming from the development of horticulture as science since the nineteenth-century, I argue that although their heterogeneous circumstances these case-studies of botanic display convey the idea of the Portuguese Empire between wars that will culminate in the Portuguese World Exhibition (1940) which colonial section was held at the Tropical Garden.

Keywords: Lisbon Tropical Gardens, Politics of Display

Museological Pathology in Interwar Barcelona or the End of Museum Medicine (ID 412)

Alfons Zarzoso *(Museu d'Història de la Medicina de Catalunya, Barcelona, Spain)*

Morphological sciences flourished in the 1880s after the short period in which Santiago Ramon y Cajal led the chair of histology at the medical faculty of the University of Barcelona. Once he left to Madrid, professors that ran the chair of histology kept a low profile, without teaching innovation or research. The arrival of Angel Ferrer Cajigal to Barcelona in 1923 introduced a shift in the chair. This professor organized a discipline from a museological conception of pathology and by strengthening a strong relationship with the medical clinic and he surrounded himself with a diverse array of people that resulted in a true research school.

In this paper we take under consideration the workplaces of histology and pathology at the Faculty of Medicine and the Clinic Hospital for just over a decade. Links in those spaces contributed decisively to the formation of a discipline: the hospital ward, the dissecting room, the histopathology laboratory, a classroom and the museum. The architecture of the morphological sciences designed by Ferrer Cajigal

allows to know the museological sense of that discipline: work practices, preparation of objects, classification of materials and their use in different media, ranging from medical records to class notes, and from research articles in magazines –which were published in the journal created in the department- to original books and translations. So we are interested here in the study of the objects and the forms of visual representation that constituted the material culture of pathology.

The outbreak of the Spanish Civil War in 1936 meant the end of this initiative and we can say that it also resulted in the end of museum medicine. Ferrer Cajigal left Barcelona to Burgos in 1936, where he found an untimely death by disease. Post-war pathology transformed the understanding and teaching of that discipline. While some of his disciples consolidated a position linked to the academy, spaces and materials of that museological pathology were transformed and eventually suppressed in the late 1940s. Some of the material survived in the vault of the medical faculty and in the 1980s they became part of the collection of the Museum of the History of Medicine of Catalonia. It's through these remains that we can try to understand the rise and fall of museological pathology as a discipline and museum medicine as a way of knowing.

Keywords: museum medicine, museological sciences, Barcelona, material culture of medicine, history of medicine, history of science, régimes of exhibition

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Symposium 348: History of Science – Inspired Theatre: The Social Power of Recent Plays

Organizers: ***Robert Marc Friedman*** *(University of Oslo, Oslo, Norway),* ***Pnina G. Abir-Am*** *(Brandeis University, Waltham, MA, USA)*

This session examines the theatrical turn in the history of science by exploring different perspectives on several recent plays. In the last two decades historians of science have increasingly become involved with the dramatization of key events in the history of science as playwrights, advisers to PBS and other TV series, and cultural critics of history of science related plays. **Robert Marc Friedman** will share his experience as a playwright who focuses on the scientific, moral, and cultural dilemmas of leading physicists such as Einstein, Meitner, and Planck, and whose plays *Remembering Miss Meitner*, *Amundsen vs Nansen*, and *Transcendence: Einstein, Kafka and Planck vs Time, Space and Conventions* have been staged professionally in several countries and have received critical acclaim. While based on recent historical scholarship they challenge established legendary 'history' which has resulted in controversy. By providing an arena for discussion and debate such plays help history of science penetrate scientists' self-understanding and heroic narratives. **Pnina G. Abir-Am** will share her critique of several plays on the discovery of DNA structure, while further elaborating on a potentially synergetic relationship between historians of science, playwrights, and the audience in undermining the received views on scientific credit and gender bias in this and other discoveries. **Bruce Coughran** will discuss two theater companies (The Catalyst Collaborative, Cambridge, MA an Indra's Net Theater in Berkeley, CA) which focus exclusively on science related plays, as well as the role of the Sloan Foundation in stimulating this new genre. He brings into perspective the more general developments of science and history of science since 'Copenhagen' and 'Proof', which are widely seen as door-openers for other playwrights to bring plays about science into mainstream theatres. **Eva-Sabine Zehelein** will speak on the discussions between historians of science and Michael Frayn with regard to 'Copenhagen'.

Keywords: science-theatre, dramatization of history of science, 'Copenhagen', 'Photograph 51', 'Transcendence'

History of Science on Stage: Beyond Hyperbole and Academic Appropriations (ID 353)

Robert Marc Friedman *(University of Oslo, Oslo, Norway)*

Science on stage is thriving. So too are the claims as to its significance. Proclamations such as "bridging the two cultures" and a "mutual embrace of science and art" carry much cultural-political clout, but what are the realities in practice? What is actually being communicated about science and its history? Academic theatre- and performance-studies scholars have their own disciplinary agendas when assessing the recent upswing in science-related theatrical events. These tend to differ from those of professional theatre producers, historians of science, and the varied theatre publics.

The increasingly popular collaborations between scientists and theatre artists may well yield exciting performative events, but the frequent focus on de-contextualized scientific knowledge is problematic. Staged science needs as well to embrace the sciences as evolving social-cognitive enterprises embedded in society. What stories we tell of the past can help shape the science of the future. History breaks the illusion of naturalness or inevitability of the way things are today. In particular I choose to focus on the values underpinning and morality in science; these have of course changed over time and local context.

By writing stage-worthy plays – naturalistic and experimental – that draw upon historical research I have reached and engaged a wide-range of audiences in ways inconceivable through academic or even popular writing. I found, unexpectedly, that whereas scientists all too often tend to ignore professional scholarship in history of science, especially if it disturbs self-understanding and legend, they react and respond to staged-adaptations of our disciplinary insights. In the challenge of empowering professional

history of science to have an impact in broader discourses and understanding of science, a successful play offers extraordinary opportunities. I will discuss my experiences with three of my plays: *Remembering Miss Meitner*, *Amundsen vs Nansen*, and *Transcendence: Einstein, Kafka and Planck vs Time, Space and Conventions*.

Keywords: science-theatre, dramatizing history of science, Einstein, Planck, Meitner, Amundsen, Nansen

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The Power of Dramatization: Recent DNA Plays on Scientific Credit and Gender Bias (ID 357)

Pnina Abir-Am *(Brandeis University, Waltham, USA)*

Focusing on several recent DNA plays but especially on "Photo 51", (http://hssonline.org/wp-content/uploads/2014/04/July2012Newsletter.pdf) arguably the most successful of several plays on the discovery of DNA structure staged in the last decade or so in major US cities, the talk examines a surprising synergy between playwrights and historians of science around their parallel questionings of the historiographical status-quo endorsed by the scientific community. On the one hand, by dramatizing controversial aspects of the history of scientific discovery, most notably the misallocation of scientific credit and gender bias in the discovery of DNA structure, the playwrights enable the audience to develop a more critical understanding of the human passions in science and indirectly pressure the scientific community to modify its self-serving but outdated consensus. On the other hand, by researching new archival sources, historians of science highlight the limitations of dramatization efforts, which are often based on outdated research in the history of science. But historians of science also benefit from the public reception of plays, by being inspired to further clarify issues of character, motivation, culture, and ethics, or issues that may get obscured by their primary quest for the historical authenticity of scientific discovery. The talk concludes with an argument in favor of greater collaboration between dramatists and historians of science so as to sooner share with the public plays that are both dramatically appealing and historically grounded in new research.

Keywords: DNA, scientific credit, gender bias, historiography, dramatization, controvery, Photo 51

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Science in the Theater: A new way of examining the History of Science (ID 358)

Bruce Coughran *(Indra's Net Theatre, Berkeley, CA., USA)*

Although science has appeared in plays for centuries, starting around the turn of the 21st century, a new trend in the theater has emerged. A number of plays have been written that attempt to internalize the actual scientific subjects they explore, and give the audience a new understanding of the actual science involved, as well as an understanding of the world of science and scientists, in a depth that is possible with the theatrical form, and appeals to audiences and funders.

Many cite Michael Frayn's 1998 play Copenhagen as the beginning of this trend (Shepherd-Barr,2006). The play revolves around the 1941 meeting between Neils Bohr and Werner Heisenberg in occupied Copenhagen, and not only sparked an interest in Science in the Theater because of its effective use of science (in this case the Uncertainty Principle), but also led to a reexamination of the central meeting itself, resulting in academic articles and meetings examining the historical events portrayed in the play.

Since the success of Copenhagen (and also David Auburn's Proof, about the same time), there has been a marked increase in the number of plays written about Science. This is partly due to the investment of the Sloan Foundation in over 200 play commissions and over 60 productions to date. Despite this increase in numbers, few plays over the next decade approached the effectiveness or success of Copenhagen or Proof.

So what makes the best of these plays work? Is this a new and effective use of theater? In what ways are these plays more effective than other portrayals of the history of science (books, lectures, film, etc)? The successful plays, especially Copenhagen, have clearly inspired a new generation of playwrights and theater companies.

Newer plays are continuing this exploration, and with some success. Tom Stoppard's The Hard Problem (2015), and many others continue to delve into scientific subjects. Some scientists and historians of science have even written their own plays. And several young playwrights (e.g. San Francisco-based Lauren Gunderson) have even made science plays the focus of their body of work. At least two theater companies (The Catalyst Collaborative, Cambridge, MA an Indra's Net Theater in Berkeley, CA) focus exclusively on science plays.

So Science Theater needs to be recognized as a significant movement in the current theatre literature, and one that deserves some attention from historians of science. The theater may in fact be uniquely well suited to explore the history of science. Theatre audiences, facing an increasingly challenging and science-based world, may indeed be drawn to well-written plays that explore deep issues in science and the history of science. As younger playwrights search for a voice, they may find a rich ground in the exploration of Science and the History of Science, as well as support for their work in foundations such as the Sloan Foundation. Historians of Science should look at how that work can best serve the public understanding of science.

Keywords: Science-in-the-Theater, Sloan Foundation, Public Understanding of Science, Copenhagen, Plays, Theatre

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Three Drafts, Five Versions, one Moment: Power of Memory and Narrative in/for Copenhagen (ID 517)

Eva-Sabine Zehelein *(University of Regensburg, Regensburg, Germany)*

Michael Frayn's *Copenhagen* is considered by many the most successful science play to date and it has triggered a lot of critical attention, first and foremost from historians of science, but also from scientists and some theater/performance studies scholars or literary critics. Much of the debate about *Copenhagen* has been concerned either with the significance of the uncertainty principle for/in the play (is it "science-in-theatre"?) or with the question how "correct" or "factually precise" Frayn has (re)presented not only the historical moment but also its participants – the physicist Niels Bohr (Denmark) and his wife Margrethe with their visitor, physicist Werner Heisenberg (Germany) (is it history of science on stage?). However, one might well argue that the play is at least as concerned with a different topic: the nature of history writing, the way eye witnesses attempt to synchronize their idiosyncratic memories by retelling their versions of events in order to reconstruct the past. This contribution will illustrate how Frayn brings to the stage this powerful process in which "the past becomes the present inside your head" (6). It will also move center stage an often neglected yet crucial character – Margrethe Bohr who triple-functions a mistress of ceremonies, moral conscience and Greek Chorus – "I'm watching every step."

Keywords: Frayn, Michael, Copenhagen, science theater, Heisenberg, Bohr, physics

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Symposium 355: Re-contextualising Urban History of Medicine. Cities, Power relations and Networks of Urban centers of Medicine, 1848–1955'

Organizers: ***Birgit Nemec*** *(University of Heidelberg, Heidelberg, Germany),* ***Petr Svobodný*** *(Charles University, Prague, Czech Republic),* ***Natalia Aleksiun*** *(Touro College, New York, USA)*
Chair: ***Brigitte Lhoff*** *(Medical University of Vienna, Vienna, Austria)*

The history of medicine has long been studied and told as a history of successful schools and of productive intellectual urban milieus. In the case of Vienna, the so called second Vienna Medical School is known for the emergence of a prominent Medical Faculty in the mid 19th century which became one of the leading departments in the German speaking lands. It is certainly true, that the faculty's success among students and researchers from all over the world had to do with local resources and a creative atmosphere of Vienna as a vibrant modern metropolis. However, we still know very little about social structures and networks as well as power relations that connected Vienna to other centers of medical knowledge and training which shaped research, teaching and clinical practices. This observation is certainly also true for other university cities with medical faculties: Prague, Bratislava, and Warsaw as well as other medical schools in East Central Europe. Education, Research, social and professional networking, religion, and migration are transnational phenomena that shape the scientific, political and cultural context of a city. As a consequence of this, how do we need to re-contextualize urban history of medicine of old and 'new' centers of university medicine, of bigger and smaller cities, especially in periods of upheaval, of fascism, occupation, or nation building?

Our session will explore the ways in which precise structures and networks have been sources of power and power relations, in the sense that they shaped both, medical practices in a city, that for a time period acted as a center of medicine, and in its transnational networks. By analyzing case studies in different medical fields our panel addresses not only questions of mobility and exchange processes of knowledge, objects and people, as well as questions of transformation of political and philosophical concepts 'between' centers of medicine, but the co-construction of artistic and medical spheres and commemoration practices.

We intend to analyze the influence of scientific, political-economic, legal, societal and cultural developments on the structures of and networks of medicine in different cities in Central Eastern Europe. In the case studies we are particularly keen to examine:

- What effects did power and power relations have on these developments and how did they shape national and international medical research, carrers and personal biographies?
- To what extent did transnational developments shape the cities' image as centres of medicine?
- Which national and international networks and cooperations were built up and how powerful were they in shaping medical practices in the single cities, in Central Eastern Europe, and beyond?
- What do we learn about the interplay between old and 'new' centers of university medicine following political changes in 1918 and 1945, like Brno and Bratislava in the case of former Czechoslovakia after 1918 or Olomouc and Martin after 1945?
- What role did material and visual cultures of medicine play in shaping the 'medical' iconography of a city? – and was there a reciprocity between iconography, institutional socio-historical contexts and (local and transnational) identity building?

Keywords: Medicine, Central East Europe, Networks, Power Relations, Urban History of Medicine, Historiography, Identity, Exchange Processes, Commemoration, Material Cultures of Medicine

Austrian Nobel Laureates in Medicine in context of social networks: Education, Research and Mobility between Vienna, Prague and Budapest (ID 405)

Daniela Angetter *(Austrian Academy of Science, Vienna, Austria)*

Researching medical knowledge and its applications to the organisms of all beings are undoubtedly one of the greatest achievements that have ever been done in the history of mankind. In his over 1000 years old history Austria has brought up many world-renowned medical professionals, who have made important contributions by their discoveries for the benefit of mankind. For many Austrian Nobel Prize winners in Medicine Vienna was initially the center of education and the center of scientific research, but their roots were partly in Hungary or Prague as the biographies of Robert Bárány or Carl Ferdinand Cori and Gerty Theresa Cori point out. Especially the biographies of all Austrian Nobel Prize winners in medicine show how important worldwide contacts and connections to colleagues and research institutions – for example in Germany, Sweden or in the United States – have been, to realize those investigations, which were the basis of the Nobel Prize. The biographies of the Austrian Nobel Prize winners in Medicine clearly document that the way to success was not always easy often influenced by politically difficult times as well as by financial problems. But international network supported especially those Austrian Nobel Laureates in Medicine, who were expelled from Austria because of their Jewish origin in 1938.

Keywords: Austrian Nobel Prize winners in medicine, Biographies, Milestones of Viennese Medicine, forced emigration, international connection

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Vienna 1867–1941: Destination of Migration and Origin of Medical Refugees (ID 410)

Ilse Reiter-Zatloukal *(Vienna University, Vienna, Austria),* ***Barbara Sauer*** *(Vienna University, Vienna, Austria)*

Since the 1862/1867 Austrian constitution granted the freedom of migration Vienna saw an enormous demographic boom. The newly arrived hoped for an economic and social advancement, thus many of them studied medicine or law, the majority of them Jewish. This led to discussions about a "numerous clauses" for Jewish students and various antisemitic outrages, especially after World War I, namely against those coming from eastern Europe, the so called "Ostjuden".

Consequently migration from Vienna, which had started as early as the Zionist project had come into being, accelerated in the interwar years. During the Austrofascist years antisemitism still was not the official politics of the regime, but many MDs left the country because they could not achieve jobs or after having lost their contracts for "political" or (hidden) racists reasons. Now they migrated to a number of different countries, for example USSR, Spain, USA, GB and Southeast-Asia.

After the "Anschluss" (annexation) 1938 the conditions changed: Antisemitism was no longer hidden, the complete medical profession was to be "purged" from politically not trustworthy as well as non-aryan persons. The majority of those regarded to be Jewish under the Nuremberg laws left the country in the following years. Emigration was legally possible only until 1941.

The talk focusses on the legal framework for these migrations as well as on origin and target of the persons afflicted.

Keywords: Austrian MDs, 1867–1941, antisemitism, migration to and from Vienna

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Scholars' Monuments as Evidences of Power Relations in Medicine (ID 415)

Julia Rüdiger *(University of Vienna, Vienna, Austria)*

The functions of scholars' monuments are usually twofold: beyond ensuring *memoria* for its sitters, they also convey the sitters' virtues and values on the institution they are affiliated with. By representing their outstanding members, the donating institutions use the scholars' reputations for the creation of their own institutional identities. However, different socio-cultural, political, or historical contexts demand different kinds of identification or legitimation. Taking several monuments of outstanding physicians of the Habsburg Empire, e.g. Theodor Billroth and Ignaz Philipp Semmelweis, this presentation will demonstrate the reciprocity that exists between the institutional socio-historical context and the iconography chosen for the monument. Leading to the insight that medical portraiture serves not only as a memorial to its sitters but it often pursues (political) ambitions beyond that. The comparison of these monuments in different urban centers, like Budapest, Vienna, Prague, or Heidelberg, will display the different approaches, claims, requirements, and demands of Central-European medical institutions. In the period between the ending 19th century and the mid of 20th century the monuments for Semmelweis as well as those for Billroth show remarkable differences in style and iconography. These differences in representation reveal the power and influence of social, political, and scholarly networks in this realm.

Keywords: Networks in Medicine, Monuments, Billroth, Semmelweis, History of Medicine, Power relations, Central Europe

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Born in Jihlava, raised and worked in Vienna, died in Moskow. The visual world of the anatomist Julius Tandler (1869–1936) and the material power relations and international networks of the so called 'closed' welfare system of Red Vienna (ID 413)

Birgit Nemec *(University of Heidelberg, Heidelberg, Germany)*

In this paper I examine anatomical imaging in the interwar period as a transnational practice. I will focus on the visual world of Julius Tandler, a famous anatomist and left wing politician, who paved the development of Vienna's welfare, is known in Austria till today for his merits in the Vienna relief system, focusing especially on child and youth care, councelling of pregnants and mothers, the development of hospitals and public baths and the fight against alcoholism. Tandler was born in Jihlava (former

Moravia) as a child of an impoverish Jewish merchant family. In the search for a better future the family moved to Vienna, where Tandler made an impressive career. As full professor of anatomy (from 1910) he was received as one of the most prominent Jewish scientist in Europe and through his influential positions in municipal administration he was the focal point in the fight against anti-Semitic attacks on students and discrimination of university personel. Tandler was politically active for the socialdemocratic party. He was in 1917 involved in the newly founded imperial ministry of public welfare, then national undersecretary of public health in the new government and municipal council for health and welfare and from 1919 subsecretary of state and head of the ministry of health in so called *Red Vienna* – a positions that allowed him to shape reforms that affected the health and wellbeing of families and youth in a capital city the had been devastated by war. Parallel to his career as a health politician becoming more international, among other he was in the scientific board of the Hygiene Section of the League of Nations, Tandler step by step left Vienna. When the Austro-Fascist regime rose to power in 1934 and set an end to Tandler's 'closed reform program', he pulled up stakes and died soon after in his Moscow exile.

In my analysis I focus on *Tandler's textbook for systematic anatomy*, edited between 1919 and 1929, that was in the centre of a societal reform movement that connected Vienna to other medical centers in central and eastern Europe. I consider Tandler's atlas together with other objects of anatomical depiction as both scientific and political projects, as tools in the production of powerful networks of exchange, linked to distinct transnational notions of health, subjectivity and society. I will compare the case of Tandler's project to other imaging practices of the 1920s and 30s which allows us to take a closer look at how urban structures, local milieus and their international networks influenced anatomical imaging – and vice versa. Tandler's left-wing anatomy of the *New Man* is a project that roots anatomy – and thus the human, the citizen – in the contexts of the clinic, of international health administration, of hygiene fairs, the socialist *Weltbürger* and the visuality of artistic avantgardes. Tandler's visual world, I argue, allows us to re-contextualise urban history of medicine as it shows how both local cultures of medical centers and international networks of power shaped scientific practice in late European Modernity.

Keywords: anatomy, urban history, visualisations, modernity, politics, health politician, socialdemocratic reform program, Red Vienna, migration, Anti-Semitism

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Post-war Psychiatry in Vienna, 1945–1955. Science, Power and Transformation between War and Republic (ID 420)

Thomas Mayer *(Department of Contemporary History, Univ. of Vienna, Vienna, Austria),* ***Katja Geiger*** *(Department of Contemporary History, Univ. of Vienna, Vienna, Austria)*

After World War II psychiatry in Vienna had to face political change, dealing with economic as well as psychological problems of a post war society. Our paper focusses on this period and asks which shifts occurred in the Viennese psychiatry on the level of staffing, epistemology and therapy. A special interest lays on the question to which extent the Viennese psychiatry dealt with its Nazi past. Which psychiatrists stayed in their jobs, which lost their employment, which regained academic positions after a few years? And what impact did leaving or continuance of medical clinical personnel have on the use or denial of psychiatric therapies?

A useful example to think about these questions is the head of the university hospital of psychiatry, Hans Hoff. As one of few medical scientists who re-migrated to Austria after forced to leave the country in 1938, he seemed to be an ideal candidate to introduce new, progressive thoughts and methods in

the clinical practice at the university hospital of psychiatry in Vienna. Indeed, when the Vienna clinic is compared with other Austrian clinics it is striking that Nazi physicians almost got no chance during the Hoff era. At his time, Hoff was perceived a reformer for e.g. establishing new departments within the clinic. This architectural design corresponded to a methodological extension of therapeutic concepts, his "Multi-faktorieller Ansatz" (multifactorial approach), where different therapeutic concepts were applied to patients. While up to today this approach is perceived as progressive, established but rather outdated therapies, e.g. the malaria therapy of general paralyses, persisted due to the conservation of the tradition of the Vienna medical school. We claim that Hoff's interest in preserving the memory of Nobel Prize winner Julius Wagner-Jauregg was a strategic motive to strengthen the Vienna school of psychiatry as well as it delayed the introduction of new methods like the drug treatment during the 1950s.

Keywords: History of Medicine, History of Science, History of Psychiatry, Vienna, Austria, Hans Hoff, shock treatment, malaria therapy, Julius Wagner-Jauregg

Professors of Medicine between Prague, Brno, and Bratislava, 1918–1953 (ID 419)

Petr Svobodný *(Charles University, Prague, Czech Republic)*

The status, influence, and importance of a university in the surrounding environment (town, region, country, scientific community) is determined not only by its activities in the two main areas for which it was established, i.e., science and teaching, but also its social functions. All these three areas then to some extent interact with the political situation, which is given by the time and place one speaks of. In the 20th century, the impact of changing political (i.e., power-driven) situation on the university topography and 'hierarchy' of Central Europe – as defined either by the borders of the Former Austro-Hungarian Monarchy or more broadly, i.e. including Germany – has been especially radical.

Medical faculties of Czechoslovak universities during the interwar period (1918–1938), their predecessors before 1918, and their fortunes during the Second World War (1939–1945) and shortly afterwards (1945–1953) offer a most interesting material for the study of various aspects of relations between knowledge and power. My contribution focuses on the following, mutually interconnected levels:

1. Political/administrative power/influence: the establishment of new institutions, radical transformation of existing ones, and extinction (temporary, partial, permanent) of institutions in connection with shifting state borders and state forms as well as changes in ruling regimes (Brno, Bratislava 1919; Bratislava–Brno–Prague 1938; Prague 1939, 1945; Prague 1953).
2. Institutional power/influence: transfer of models, structures, and norms (Praha>Brno, Bratislava 1919, analogy with the relation Vienna>Prague prior to 1918; traditional faculties>specialised faculties and institutes of the Academy of Sciences, founded in 1953, where the issue of 'Soviet models' is especially relevant).
3. The power/influence of prominent personalities, scientific schools and traditions: transfer of models, experiences, usually driven by the relation centre>periphery (Vienna>Prague>Brno, Bratislava) but sometimes also working in the opposite relation; personalities/scientific disciplines between a university and an academy of science.

This contribution offers an overview of the basic structural changes, i.e., mainly the discontinuous development of institutions (universities in Prague, Brno, and Bratislava; the Czechoslovak Academy of Sciences) against the background of radical changes in state forms within which they functioned (Austro-Hungarian Monarchy, Czechoslovak Republic, Czecho–Slovakia, Protectorate of Bohemia and Moravia, Slovakia, Czechoslovakia after 1945 and 1948) and several case (biographical) studies (physiology, paediatric medicine), which should help us better understand the relation between all of the abovementioned aspects of development.

Keywords: universities, medicine, state forms, regimes, 20th century, physiology, paediatrics, biographies, Czechoslovakia

Between Power Relations and Powerlessness: Warsaw Medical Circles and Antisemitism (ID 414)

Natalia Aleksiun *(Touro College, New York, USA)*

In 1937, Poland's Association of Physicians – one of the two main medical umbrella organizations in the Second Polish Republic – passed the so-called Aryan paragraph, limiting membership only to medical professionals born of Christian parents. This resolution was prone to have significant effect on the profession. According to 1931 data, Jews comprised approximately 46 percent of the total number of physicians in Poland. Segregation of physicians based on their ethnicity and religion followed an anti-Semitic campaign that played out on the pages of professional journals, in the meetings of physicians and at medical departments. Ostensibly, it was grounded in a concern for national interests: allowing Gentile Poles greater access to profitable professions. It also pointed to the blurred boundaries between racial and religious categories that permeated the discussion since the early 1920s.

While tackling an intense involvement of Polish Jews with medicine, my paper focuses on Warsaw where Jewish physicians constituted 66.3 percent of all medical professionals. Despite their prominence, Jewish physicians practiced to some extent on the peripheries of the medical network. They were limited to private practice or worked at Jewish medical institutions. Not a single Jew was offered a teaching position at the medical department of Warsaw University. Moreover, Numerus clausus made access to medical department increasingly difficult while some members of the faculty such as Prof. Edward Loth openly expressed anti-Semitic views. The language of the discussions at faculty meetings, in petitions submitted by medical students and articles published by right-wing journals drew on what Helmut Walser Smith called the "anti-Semitic imagination", which relied on latent tropes going beyond – or in fact against – the program of emancipation of the Jews as equal citizens. This paper strives to map out the ways Jewish physicians in Warsaw engaged in the discourse about their professional role and the reality of marginalization accompanied by calls for of exclusion of Jewish physician in Poland. What role did the department of medicine and Jewish hospitals in Warsaw play in creating alternative networks for medical professionals? Last but not least, what role was played by medical journals such as Warszawskie Czasopismo Lekarskie (Warsaw Medical Journal) which promoted an integrated vision of medical care and medical profession? Such was a message of eulogies for prominent Polish Jewish physicians: Samuel Goldflam (1852–1932) or Maksymilian Flaum (1864–1933). Last but not least, these journals insisted on surveying the situation of Jewish hospitals alongside the municipal and other private medical institutions as part of broad vision for systemic reform and improving health care in the country.

Keywords: Warsaw University, Medical department, anti-Semitism, race, ethnicity, anatomy, network, Polish-Jewish relations, Second Polish Republic

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Symposium 364: Inequality in Early Modern Philosophy and Science: The Impact of Social Order on Learned Identity and Knowledge Production

Organizer: ***Verena Lehmbrock*** *(University of Wuppertal, Wuppertal, Germany)*

Social differentiations by rank ("estate"), religion, gender or "complexion" were basic elements of early modern European thought and lived reality. The paradigm of ranks (*Stände*) continued to structure thought and practices well into the enlightenment era, while privilege-bound legal, political and ownership structures prevailed until 1789 in France and even longer in other parts of Europe.

This panel traces some of the ways in which forms of social inequality that were specific to early modern European societies pervaded and shaped learned knowledge production and identity.

Topics include bordercrossing figures like the philosophical peasant (D. Phillips) as well as the polemical uses and pervasive effects of social order in learned discourse about true knowledge (V. Lehmbrock). By looking at the ways in which male and female, white and black scholars during the 17th and beginning 18th centuries built on ideas about the heroism of the mind we will shed light on the dynamics between rejection, inclusion, and appropriation of low status knowledges (M. Mommertz). We look at Health officers serving in the French campaigns in Egypt and Saint-Domingue around 1800 and how their theoretical work was combined with attempts at appropriating and re-framing non-European knowledge as a precondition for establishing colonial rule (R. Zaugg).

Keywords: Learned identity, philosophy and sciences, historical epistemology, social order, colonial knowledge production, artisanal and craft knowledge, agricultural improvement, heroism, social differentiation, rank paradigm

Learned Knowledge and Agricultural Skill: Transatlantic Perspectives during the Enlightenment (ID 614)

Denise Phillips *(University of Tennessee, Knoxville, TN, USA)*

Agricultural improvement was a central cause of the Enlightenment, and in enlightened attempts to improve farming, a perennial question was how to best transmit farming knowledge. This issue was central to early discussions of the relevance of the sciences to farming. What role, in particular, did the written word have to play in spreading agricultural enlightenment?

My paper will look at eighteenth-century answers to this question through the lens of the popular figure of Kleinjogg, a Swiss farmer who became famous in the 1760s for his agricultural acumen. I will examine images of Kleinjogg across several different political and cultural settings to ascertain the varying roles assigned to learnedness and literacy in each case. The Swiss reformers who first promoted Kleinjogg as a model cast him as a child of Nature, someone whose opinions had been formed entirely through experience, without consultation with books. In Swiss images of Kleinjogg, his supposed lack of interest in books represented a division of labor; he was depicted as an appropriate rural partner for the learned efforts of the Swiss urban elite. In the American and British receptions of this figure, however, Kleinjogg's reported rejection of book learning became a problem to be explained away. For the British-American radical Benjamin Vaughan, for example, Kleinjogg's lack of interest in formal learning was unquestionably a flaw. These varied receptions make visible the ways in which political and social commitments shaped epistemic assumptions in the nascent agricultural sciences.

Keywords: Agriculture, Switzerland, US, Enlightenment

The Making of Colonial Medical Knowledge during the French Wars: Military Physicians in Egypt and the Caribbean (1798–1803) (ID 615)

Roberto Zaugg *(Université de Lausanne, Lausanne, Switzerland)*

Focusing on the medical studies of the Neapolitan physician Antonio Savaresi (1773–1830) and other health officers serving in the French campaigns in Egypt (1798–1801) and Saint-Domingue (1801–1803), the paper examines the production of scientific knowledge in contexts marked by strongly asymmetric power relations, arguing that that the wars of the Revolutionary and Napoleonic period constituted a crucial moment in the emergence of modern colonial medicine. Largely unprepared to face diseases such as ophtalmia, the plague and yellow fever – whose pathogenic causes were still ignored by medical science – military physicians, surgeons and pharmacists struggled to find solutions to epidemic phenomena. They largely failed to contain the latter: pathogenic factors were at least as important in determining the defeats of the French troops as the military action of their Ottoman, Mamluk, British and Afro-Caribbean enemies. However, the knowledge and organizational experience accumulated by a new generation of health officers provided a basis for the institutionalized development of nineteenth-century colonial medicine. In many senses, this period constituted a transitional phase. While debates on aetiology and therapy were largely framed by neo-Hippocratic miasma theory, anti-contagionism and (to a lesser extent) Brunonian doctrine, at the same time a modern understanding of medicine and hygiene as tools of colonial government and as ideological components of the mission civilisatrice took shape. And while relations to colonial subjects were accompanied by a self-proclaimed racial superiority, daily interactions with local actors often involved cross-cultural exchanges in the realm of (phyto-)therapeutic practices. Theoretical eclecticism, as well as a tendency to appropriate and re-frame non-European knowledge, thus emerged as central features of this pre-pathogenic medicine: a tropical medicine ante litteram whose development was substantially catalyzed by the need to enable European troops to conduct military operations overseas and to establish a politically effective and economically profitable rule over colonial societies.

Keywords: Colonialism, Revolutionary and Napoleonic Wars, Medicine, Cross-cultural Knowledge Transfer, Racism, Plague, Ophtalmia, Yellow Fever, Medical Topographies, Brunonian System

Artisanal versus Craft Knowledge. How did Premodern Social Order Map onto Epistemology in German Agricultural Reform and Science (18th and early 19th Centuries)? (ID 369)

Verena Lehmbrock *(Wuppertal University, Wuppertal, Germany)*

According to German agricultural reformers, artisanal (*kunstmäßig*) knowledge of the land was cultivated and developed by practitioners who were not only skilled in agriculture but were acquainted with systematic knowledge from outside their craft as well. Figures like the "learned farmer" or the "theoretical-practical farmer" represented a hybrid of knowing and of practice, achieved by fusing the fields of academe and of economic production. Craft knowledge (*handwerksmäßig*), by contrast, was defined as an entirely unlearned, mechanical way of knowing (or rather non-knowing) that was associated with the peasantry.

My paper will argue that the distinction between artisanal and craft should not be regarded as a mere terminological oddity of the time. It was rather underscored by a powerful interpretive model. This model not only bore a social function appealing to estate identity and contemporary structures of social inequality, but also had a strong polemical potential that was frequently used by protagonists to strengthen their own knowledge claims and to challenge the claims of others. Changing attitudes towards the artisanal-craft-distinction and to its semantic construction can be related to social change on a broader level. Thus, the general historiographical claim of this paper is that conceptual histories are a useful and insightful tool in the social and cultural history of knowledge.

Keywords: Conceptual History, Artisanal and craft knowledge, Agricultural improvement, Agricultural science, Learned identity

Symposium 367: Sciences and Universities in the context of political regime changes

Organizer: ***Mitchell G. Ash*** *(University of Vienna, Vienna, Austria)*

In recent years, scholarship has become increasingly open to interpretations of relations between science and politics that emphasize their actual interactions, rather than assuming on normative grounds that their histories are – or should be – separate from one another. Potentially productive locations for more detailed examinations of such interactions are periods in which fundamental regime changes occur – for example from monarchies to republics, from democracies to dictatorships, or from dictatorships to democracies. In such cases it seems justified to ask whether the institutional or ideological conditions for conducting scientific or scholarly research – even definitions of science and scholarship as such – changed along with the political regime, and whether and under what conditions it was possible to renegotiate relations of sciences and politics, or sciences and the state in the course of such radical political changes.

After brief introductory remarks by the chair, the proposed symposium will present a series of case studies that consider such questions in greater detail. The case studies address a wide variety of regime changes in different time periods, ranging from an overview of scientific changes during the French Revolution of 1789 and transformations of the University of Innsbruck during the Napoleonic Wars, to examinations of the social sciences in Poland after 1918, a prosopographical study of the expulsion of life scientists from the German University in Prague on racist and political grounds after 1938/39, the transition from the Kaiser-Wilhelm Society under Nazism to the Max-Planck-Society in post-war West Germany, the impact of American efforts to transform the social sciences in West Germany after 1945, and a re-examination of the interactions of science, policy and politics after the fall of Communism, focusing on the case of German unification. Whereas some papers will focus on universities or non-university research institutions, others will consider specific scientific disciplines. The symposium will conclude with a brief summary and commentary from the session organizer, followed by general discussion.

Keywords: Science and Politics, Regime changes, Science policy, French Revolution, Napoleonic Wars, Social sciences, National socialism, German unification

The French Revolution and Science: A Time of Reinvention (ID 372)

Bruno Belhoste *(University of Paris 1, Paris, France)*

The French Revolution was a major period of change: the old regime collapsed, new political forces took power, civil war broke out and France was involved in a long European war which only ended with the fall of Napoleon in 1815.

At the end of Eighteenth century Science was at its peak in France. Savants and scholars enjoyed the protection of the King and the support of public opinion, and developed with great success all fields of knowledge. However, when the Revolution began in 1789, most of them viewed the new political regime favorably; it was a time of reinvention. During the following years they took a major part in the transformation of France and the renovation of all its institutions. Destruction prevailed during the first years: universities collapsed and the Academy of Science closed down, but after 1794 came a time of reconstruction, with the creation of many new scientific institutions. In the end, everything had changed, but science was still very high in its status and achievements.

In this presentation, I will recall the events and describe how the sciences were involved. This will be an opportunity to think again about what it means for men of science to take part in politically troubled times, and to have to reinvente themselves to survive and flourish again.

Sciences and Universities in Politically Unstable Times. The University of Innsbruck during the Napoleonic Era (ID 375)

Christof Aichner *(University of Innsbruck, Innsbruck, Austria)*

This paper addresses the history of the University of Innsbruck, founded in 1669, during the period of the Napoleonic wars. After the Peace of Pressburg (1805) Bavaria gained French-occupied Tyrol, which had been held by the house of Habsburg since 1363. The University of Innsbruck was then part of the Bavarian university system until 1814, with a short interruption during the Tyrolean Rebellion in 1809/10. While the Bavarian accession meant the integration into a foreign country with a new political system that was influenced by France, the short interruption in 1809/10 was dominated by the rigid regime of Andreas Hofer, leader of the Tyrolean Rebellion, who dismissed some professors and installed restrictive control of the university by the Catholic Church.

Focusing on this period allows investigating two political regime changes and their influences on the university and the scientific environment in Tyrol during a brief period. These changes had impact at an organisational level, specifically with respect to the position of the university within the Bavarian university system, and also on a scientific level. A further objective of the paper is to contrast the predominant historiography on the university in this period with archival sources from the University Archive and other archives, which allow for the first time a comprehensive view of the impact of these regime changes. Until now the short period under Bavarian rule has been interpreted in historiography and popular memory mostly as a period of stagnation for the university, and this assessment has changed only slowly during the last decades.

Keywords: Austria Universities, History of Universities, regime change

Useful Knowledge in a Nation State: Research Institutes and Political Transformations in Poland 1918–1939 (ID 377)

Olga Linkiewicz *(Polish Academy of Sciences, Warsaw, Poland)*

At the Paris Peace Conference in 1919, Poland was widely represented by professors: scientific experts on geography, politics and diplomacy, history, law, and economics. Social sciences and social scientists were conspicuously absent from the makeup of the Polish delegation. Yet, the position of social sciences in the emergent state was about to change. The minority rights treaty, which was signed at the conference, marked a turning point in the history of social scientific expertise in Poland. It was the "minority question" and ethnic issues, I argue, that gave ethnography and sociology a greater place in the politics of interwar Poland, remaining the driving force behind the relation between academia and the state.

Drawing on the case of the state-run research institutes in interwar Poland, this paper explores the uses of social sciences in a nation state. In the 1920s and 1930s, social scientists in Poland planned and conducted empirical research focused on the multi-ethnic territories that were subject to international territorial disputes – Upper Silesia, Pomerania, and the eastern borderlands (Kresy). Think tanks, such as the Baltic Institute in Toruń or the West-Slavic Institute in Poznań – modelled after those in the United States and Western Europe – became the major institutional framework of the state-science collaboration. My paper traces the role of academics in applying knowledge for the raison d'état both in the democratic nation state, which emerged after the First World War, and the increasingly authoritarian regime after Józef Piłsudski's coup d'état of May 1926.

Expelled Science. Dismissals of Life Scientists from the German University in Prague 1938/1939: A Prosopographic Evaluation (ID 379)

Michal Šimůnek *(Czech Academy of Sciences, Prague, Czech Republic)*

One of the subgroups of the victims of the Nazi regime in Bohemia and Moravia consists of scholars and professional scientists who established their careers during several decades of progress of modern science and technology and progressive emancipation of the Jewish population in the Habsburg monarchy from 1848 till 1918 and in inter-war Czechoslovakia. Due to the generally prevailing political and social conditions, as well as the specifics of the establishment of a scientific infrastructure in Bohemia, Moravia, and Austria, these scientists and scholars belonged both to the Czech and the German linguistic, cultural and intellectual communities, albeit in different numbers. Their professional careers, and eventually their lives, were violently interrupted in consequence of the political changes in 1938, and even more so by the occupation of the rest of Bohemia and Moravia by Nazi Germany in March 1939, and the subsequent establishment of the so-called Protectorate of Bohemia and Moravia and its integration into the Nazi Greater German Reich. Based on extensive archival research it is now possible to present a prosopographic evaluation of information pertaining to the origins, career, circumstances of death, and emigration of those scientists, who were affiliated with research in life sciences at the German University (Deutsche Universität) in Prague prior to 1938 and dismissed in 1938/1939.

Differential Psychology Under the Franco Regime (ID 319)

Annette Mülberger *(Universitat Autònoma de Barcelona, Barcelona, Spain)*

The paper focuses on differential psychology, a kind of psychology which played an important role during the first years of the Franco Regime in Spain. At that time it already counted with a long tradition, as scholars had tried to identify and study human differences for centuries. During the first half of the 20th century modern techniques such as psychotechniques and psychometrics proved especially instrumental for such an endeavour. Referring to the political background of democracy and meritocracy, some historians have already pointed out the strong relation between psychological testing (or IQ psychology) and state management, united by the aim of ordering and classifying citizen. Others have shown how differential psychology became a useful tool in war time and under dictatorial regimes.

In this research I will deal with a type of psychology pursued by researchers in Madrid and Barcelona in the 1940s and 1950s. The period following the Civil War meant years of penury, hardship, economical autarchy, military terror and censorship. The universities degenerated, the former scientific institutions were closed and many of the leading psychologists were dead or in exile. While the Second World War found its end, Spain was slowly recovering. With the gradual loosening of the regime, new possibilities for the re-introduction of a science (such as psychology) into the academic system appeared. It was a period in which the Spanish Government sought for an alliance with the Catholic Church and, especially with the Jesuit Company. Under these circumstances the Jesuit priest F. M. Palmés (1879–1963) was able to return from his exile, develop his 'moral psychotechniques', and become one of the most relevant figures in the field. During the same years also a group of psychologists in Madrid, with J. Zaragüeta (1883–1974) and J. Germain (1897–1986) as leading figures, were actively promoting differential psychology in Madrid. In my paper I will show that while these Spanish psycholgists lived in a country dominated by the Catholicism and a restrictive regime, which had declared neothomism as the official doctrine in education, they developed several strategies to make differential psychology compatible with the exigencies of a dogma based on the idea of a unified, substantial human soul.

Keywords: history of human sciences, history of psychology, psychological methods, totalitarian regime, Francoism, psychological tests, Spain, psychometry, Catholicism

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Mathematics in a new political environment – Changes and attempted change in Vienna 1938–1945 (ID 381)

Robert Frühstückl *(University of Vienna, Vienna, Austria)*

The Nazi seizure of power in Austria in 1938 led to a profound reorganisation and restructuring of the Austrian universities, radically changing their institutional setting as well as their personnel constellation. This historical development inevitably raises the question of how these changes affected the sciences themselves – if they did at all. In this talk I want to shed some light on this question by looking at the example of the mathematics department at the University of Vienna in the period from 1938 to 1945.

I propose to show that in this particular case scientific change came in two separate phases, which can be distinguished by their respective driving forces but also by their particular success rate. The first one was that of the forced emigration and expulsion of ethnically Jewish and politically undesirable scientists and the subsequent appointment of new professorial chairholders under the new political guidelines. In this first phase we are dealing with scientific changes that were promoted and executed solely by the Nazi regime and its academic collaborators. The second phase, however, or so I will argue, was in fact promoted by the mathematicians themselves. As I will show, in Vienna there were attempts to establish and intensify specific research fields in response to the new political conditions. It is interesting to note, however, that in the end these attempts turned out to be unsuccessful. On the contrary, the example of applied mathematics in Vienna seems to support the view that the traditional form of scientific research as institutionalised in universities was unable to satisfy the Nazi regime's specific demands for scientific research. I therefore describe the second phase as one of attempted change.

Jewish Refugees and the Diffusion of Italian Mathematics in Argentina (1938–1948) (ID 519)

Erika Luciano *(University of Turin, Turin, Italy)*

The promulgation of racial laws in 1938 had a shattering impact on the Italian scientific community. In Turin, dozen of scholars at the Faculty of Sciences and at the Polytechnic University were expelled. To these we have to add many teachers of mathematics, physics and natural sciences in middle and high schools (Emilio Artom, Vittorina Segre, Annetta Segre, Ugo Levi, ...) who were relieved out of their roles. Among the mathematicians, Alessandro Terracini, Beppo Levi, Guido Fubini, Gino Fano, Bonaparte Colombo and Beniamino Segre emigrated to Argentina, USA, Switzerland and Great Britain. All those scholars had completed their training in Turin and had worked in the context of the two research 'schools' directed by Segre and Peano, benefiting from the influence of both these masters. During their exile the refugees – and in particular Terracini and Levi in Argentina – devoted themselves

in a priority and systematic way to the vulgarization and the diffusion of the best Italian 'traditions' in mathematics, to the scientific organization and to the enhancement of science in their host universities.

In this talk, in light of archival sources, we aim at:

- illustrating how and to what extent the research and the teaching of mathematics in the Universities of Turin, Tucumán and Rosario changed, as a consequence of the exile of some Jewish mathematicians;
- examining the *Lectures* in mathematical logic, algebraic geometry, epistemology and methodology delivered by Levi (1939–1962) and Terracini (1939–1948), and the articles dedicated to Italian mathematics and mathematicians appeared in the three journals founded and edited by Levi and Terracini: *Publicaciones del Instituto de matematicas de la Facultad de ciencias matematicas de la Universidad nacional del litoral*, *Revista matematica y fisica teorica de l'Universidad nacional de Tucuman* and *Mathematicae Notae*;
- investigating, through these various channels, how Terracini and Levi promoted in Argentina the work and the thought of the 'schools' of Peano and of Segre, how they characterized the identities and cultural roots of these teams, and what legacy their experiences of acculturation had on the local scientific life.

Keywords: Racial laws, Emigration, Circulation of Mathematics, Fascist era

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Transforming the Kaiser Wilhelm Gesellschaft into the Max Planck Gesellschaft: Continuities, discontinuites and the interdependcies of science and politics after the defeat of the Nazi regime (ID 385)

Florian Schmaltz *(Max-Planck-Institute for History of Science, Berlin, Germany)*

The military defeat of Nazi Germany by the Allied powers in May 1945 brought with it a political regime change of epochal significance. This paper will analyze and contextualize how the entanglement of science and power and the power of science historically developed in the the Kaiser Wilhelm Gesellschaft (KWG) – Germany's largest non-university academic organization with more than 40 research institutes – and the recontextualization of this organization in West Germany after 1945.

The KWG had become an integral part of the National Socialist science system after 1933 with various personal and institutional entanglements with the elites of ministries, industry and the military, and had contributed to political aims of the regime: the legitimation and implementation of Anti-Semitic and folkish-racial policies from persecution to mass destruction, aggressive territorial expansion and the technological needs of the war effort.

After Germany's military defeat, Allied plans to dissolve the KWG were put aside rather quickly, resulting in the foundation of the Max Planck Gesellschaft in 1946 (bi-zonal) and 1948 (tri-zonal). Several aspects of this complex process will be discussed here:

1) strategies and measures of the central administration of the KWG to prepare for a post-war perspective;

2) prohibition of military-related research, control of research institutions and programs, knowledge transfer to Allied countries, and the systematic exploitation of results of German war related research though Allied intelligence;

3) the objectives of Allied occupation policy (de-militarization, de-Nazification, democratization) and its impacts on science policy, specifically at MPG institutes;

4) The transformations of scientific institutions, research programs and practises in the advent of the Cold War era, opening new spaces to maneuvre for German science policy makers.

Gisela Konopka: An Émigré's Contribution to the Reconstruction of German Applied Social Sciences after World War Two Barbara Louis, Vienna (ID 383)

Barbara Louis *(University of Vienna, Vienna, Austria)*

The rise to power of the National Socialists in 1933 resulted in World War II, which disrupted German society, displacing a large number of scientists, intellectuals, and political and social activists. After the Nazis were defeated and German reconstruction was underway, several of these former refugees returned, oftentimes only temporarily, to play a part in the reconstruction of their former home country.

This paper explores the role of Gisela Konopka, who had escaped Nazis persecution and became a professor of social work at the University of Minnesota. She was one of several former refugees sent to Germany by the American government to assist the Germans in rebuilding welfare services, bringing the German social work profession up to date with current standards, and ultimately contributing to the democratization of German society. Starting in the early 1950s, Konopka repeatedly returned to West Germany as a specialist of the U.S. State Department's International Educational Exchange Service, striving to rebuild German social work on a solid philosophical and social scientific foundation and to infuse it with strong democratic principles.

Using a variety of sources, including Konopka's personal and professional correspondence, government reports, manuscripts, and other publications, this paper examines the complex entanglements of politics and the applied social sciences in post-war Germany, as it addresses Konopka's struggles with the U.S. State Department over defining the scope and content of her mission, as well as the decisions she had to make in her day-to-day work, both of which ultimately shaped the development of German applied social sciences in the decades after World War II.

"As in the West, so also on Earth"? Transformations in the Sciences, Politics and Policy after the Fall of Communism: The Case of German Unification (ID 386)

Mitchell G. Ash *(University of Vienna, Vienna, Austria)*

The case of German unification after the fall of the Berlin wall in 1989 presents an unusual opportunity to examine interactions of science and politics in the context of regime change. The quotation in the title by Dieter Simon, then head of the Science Council (Wissenschaftsrat) of the Federal Republic of Germany, is a sarcastic reference to the Biblical phrase „As in heaven, so also on Earth", and alludes to the widespread claim, made at the time and often repeated since, that German unification meant little more than the destruction of East German scientific institutions and the absorption of a limited

number of scholars and scientists into the expanded West German system. More than twenty-five years later, perhaps it is time to present a somewhat more differentiated picture.

In this paper, the transformation is described as a process in three stages: (1) initial attempts to cope with the collapse of the East German regime while retaining two states; (2) the move toward unification beginning in the spring of 1990 and ending with the Unification Treaty in October; (3) the scientific and political evaluation of Academy of Sciences institutes and higher education disciplines and personnel, and the creation of new research institutions in a time of financial and political turmoil. In summary, the paper argues: that the „West-Germanification" of research structures in the East was assisted by East German officials, had unexpected feedback effects on the science system and produced innovations at the margins; that at the level of professorial appointments, complete „West-Germanification" occurred only in the small group of humanistic disciplines that were agreed to be ideologically suspect; while in the natural, medical and technical sciences more complex alterations in institutional arrangements and scientific practices took place.

Keywords: Science policy, German unification

Symposium 374: Historical-Epistemological Prospects on Science as Power

Organizers: ***Sascha Freyberg*** *(Max Planck Institute for the History of Science, Berlin, Germany),*
Pietro Daniel Omodeo *(Max Planck Institute for the History of Science, Berlin, Germany)*
Chair: ***Sascha Freyberg*** *(Max Planck Institute for the History of Science, Berlin, Germany)*

The growing interest in the close connection between science and society/science and power casts doubt on reductionist epistemologies (very much in vogue from the 1950s onwards), and calls for a wider conception of science. This is where historical investigation and the theoretical reflection can converge and reinforce each other. In this session we assess the ways in which considerations on power challenge established views on science in history and force us to revise established epistemological outlooks.

Recent developments in the history and philosophy of science seek for a richer understanding of science capable of encompassing its cultural and political dimensions. This is not only due to (inter-) disciplinary reasons pertaining to methodology of inquiry. Rather, political motivations have come to the fore—questions pertaining to the role of science in society, to scientists' public responsibility, the global impact of human activity and technology on the terrestrial systems, the agendas underlying scientific and academic discourses, and so on.

However, the meaning of this turn for Science Studies in general and Historical Epistemology in particular is still waiting for a clarification. If the different strains of Historical Epistemology and culturalist historiography can be seen as a critique of reductionist treatments of science (Feest & Sturm 2011), the different historiographical methods and their consequences have to be discussed.

Keywords: Meta-Science, Historiography and Philosophy of Science, Concept of Science, Science and Society, Political Epistemology, Historical Epistemology, Methodology

Narratives of Superiority in the Historiography of Pre-modern Science (ID 408)

Sonja Brentjes *(Max Planck Institute for the History of Science, Berlin, Germany)*

This paper discusses the political background of narratives on pre-modern science from the viewpoint of a global history of cross-cultural exchanges. Twentieth-century historians of science throughout the Cold War have generally been trapped in an approach that can be aptly depicted as teleological, linear, mono-cultural and static. Some examples will be presented, discussed and critically assessed. Whereas Eurocentric mainstream narratives have often established themself at the level of commonsense, alternative approaches proved not less monolithic and static, as is the case with recent 'Islamocentric' historiography. It will be argued that such mono-cultural approaches are not apt to account for the history of knowledge. Intellectual history has rather to be seen as a cross-cultural process. What's more, the one-sidedness of the aforementioned 'narratives of superiority' is not only misled from a methodological viewpoint but also is affected by ideological shortcomings that have to be understood in political terms. Such a criticism of implicit and explicit politico-cultural agendas underlying historiography is aimed to foster a dynamic and non-linear model. Such a change of perspective would make justice to the participation of many different cultures in the production, transfer and advance of science. The presentation will include a discussion of some instances of historical inquiry developed from such point of view. Such cases will show the fruitfulness of an approach devoted to the study of the in history of knowledge as the field of cross-cultural exchanges.

Epistemological and Political Configurations of the Sciences of Man The Society of the Observers of Man (France, 1799–1830) – Methodological Reflections (ID 406)

Martin Herrnstadt *(Goethe University Frankfurt, Frankfurt/M., Germany),* ***Laurens Schlicht*** *(Goethe University Frankfurt, Frankfurt/M., Germany)*

From 1799 to 1804 the *Société des observateurs de l'homme* (Society of the Observers of Man, SOH) tried to create a universal science of man, that, in the eyes of the actors, should encompass physical, moral and intellectual aspects of man. Up to now existent research concerning the SOH concentrated on its intellectual heritage and sociological configuration, thereby claiming, that the SOH was rooted in the French science of ideas – the so called *Idéologie* – and mainly indebted to sensualist philosophy. While this perspective on the SOH and more generally the sciences of man around 1800 is essentially adequate, it is too little known about the concrete practices of the sciences of man and their political functionality. Our research project thus raised the question, in what ways these interrelated epistemological and political aspects of the sciences of man could be analyzed symmetrically.

Inspired by Hans-Jörg Rheinberger's analysis of experimental systems we therefore proposed a methodological framework to study what we call "epistemical and political configurations". Our way of analyzing these configurations assumes that much can be learned by appreciating their situatedness in local epistemical and political contexts. Thus we proposed to start the analysis with the identification of central *epistemic* and *political terms* and of their connectedness to specific epistemic and political practices. By differentiating several of these practices connected to epistemic and political terms it was possible to discern different epistemologies and *politics* – the totality of explanations of epistemical or political terms. In our contribution we want to clarify this approach of historical epistemology further and show on the basis of examples from our research how it can be useful for analyzing past procedures of knowledge production in their entanglement with the political realm.

Keywords: Human sciences, history of the Société des observateurs de l'homme, Methodology, Political and Historical Epistemology

Cultural Hegemony, Historical Epistemology and the Concept of Science (ID 409)

Pietro Daniel Omodeo *(Max Planck Institute for the History of Science, Berlin, Germany)*

This paper addresses the ideological embedment of 20th-century history and philosophy of science as emerged and was discussed from the threshold of the Cold War onwards. In particular, it departs from the analyses on this issue carried out in the 1930s by the Italian intellectual Gramsci in his *Prison Notebooks*. On those pages, he critically discussed the views presented by Bukharin in his popular introduction to *Historical Materialism* and in his epoch-making talk at the *International Congress of History of Science and Technology* (London, 1931). Although the question about the ideological embedment of science and natural conceptions had already been raised in the 19th century—for instance by Engels in *Anti-Dühring* and *Dialektik der Natur*—nonetheless it is only in the 1930s that the focus of ideology criticism shifted from epistemology to historiography. Bucharin's provocation produced a debate echoed by other Marxist intellectuals such as G. Lukács and A. Gramsci. It moreover influenced the most important developments of the history of science after WWII: an ideological bifurcation that is clearly documented, in the 1940s, by the theoretical opposition between Koyré's intellectual historiography and Zilsel's materialist approach to early modern science, and by the later clash between "internalist" and "externalist" historians of science. Still, a reflection on the political-cultural embedment of the history of science has often been overshadowed by claims about the objectivity and neutrality of science and its historiography. Thus, the seminal discussions of the 1930s remain one of the most lucid moments of reflection about the role of science and history of science as cultural phenomena shaped by political struggles. In particular, Gramsci's views on culture, ideology and the intellectuals are crucial in the assessment of the interrelations between science, history and cultural hegemony. His criticism of science as cultural hegemony can also be extended to post-WWII hegemonic approaches

to the very concept of science (along the lines indicated by Koyré/Popper/Kuhn) as embedded in the values and political oppositions of the Cold War.

As I will argue on the basis of several cases, neo-Gramscian historical epistemology permits us to examine and assess the many ways in which hegemonic values and science have been continuously intertwined in the concepts of science brought forward either by historians or by philosophers of science up to the most recent merging of the fields as Science Studies.

The use of historical theater play in science education (In memoriam Arthur Stinner) (ID 435)

Juergen Teichmann *(Ludwig-Maximilians-University and Deutsches Museum, Munich, Germany)*

There are several ways to use science history in University or school education. Theater play is an until now relatively unusual kind of making history of science alive for students. Since 1999 Arthur Stinner and me developed some examples which we tested at conferences, teacher and student seminars and in public performances, for example the "Age of the Earth's debate", "Count Rumford", "Galileo, Kepler and Cardinal Bellarmin", "Einstein and Newton". (Complete texts are available from the homepage arthurstinner.com, which is still existing.) Of course such reconstructions of history have to be effectively based on relevant historical secondary literature and sources. But theater plays gain their influence from dramatic effects, especially by factual or personal conflicts, controversies, contradictions in specific historical developments. That means – for a theater play of 1 to 2 hours – the historical material has to be concentrated and translated in personal actions and direct speech. And within this time an arc of suspense has to be erected.

Students get by such a play an immediate living introduction to specific research processes, to their role in society, to the power of science as a medium of rational beliefs, but also to its weakness because bound to the events and preconditions of its time. By being themselves actors in such a play they can "actively" participate at history.

The problem of such historical reconstructions of course is much larger than at reconstructing single elements like experiments, decisions or used prior knowledge of scientists in specific situations. Theatre plays are in danger to come too close to a novelistic compaction of otherwise complex historic processes – intensified by the use of direct speech and the contraction of events, which happened at different locations and different points in time.

It is then necessary to combine those performances with further study of good secondary and primary literature to bring any deeper understanding of history.

Keywords: theater play, science education, reconstruction of history

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Machines as metaphors: a 'big picture' of the history of modern science (ID 521)

Frans van Lunteren *(Vrije Universiteit Amsterdam, Amsterdam, the Netherlands)*

Over the last few decades there have been several calls for a 'big picture' of the history of science. There is a general need for a concise overview of the rise of modern science, with a clear structure allowing for a rough division in periods. Here I would like to propose such a scheme, one that is both elementary and comprehensive. It takes its cue from Norton Wise's work on 'mediating machines'.[1] It focuses on four machines, which mediated between science and society during successive periods of time: the clock, the balance, the steam engine and the computer.

Following an extended developmental phase each of these machines came to play a highly visible role in Western societies, both socially and economically. Each of these machines, moreover, was used as a powerful resource for the understanding of both inorganic and organic nature. More specifically, their metaphorical use helped to construe and refine some key concepts that would play a prominent role in such understanding. Finally, in a refined form, each of these machines would eventually make its entry in scientific research. This remarkable pattern repeated itself every hundred years or so, thereby presenting us with a convenient scheme that can serve as a backbone for the rise of modern science during the last four centuries.

A scheme such as this cannot be all inclusive. Grand narratives inevitably involve selectivity in terms of the facts they marshal. This scheme tends to privilege natural philosophy, physics and physiology and to highlight ontologies at the expense of method and practice. It remains to be seen whether such missing elements can be included in the scheme in a natural way.

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Keywords: Big picture, modern science, machines, metaphor, society, energy, information

Sharing Knowledge, Challenging Power? (ID 576)

David Steinman *(University of Toronto, Toronto, Canada),* ***Dolores Steinman*** *(University of Toronto, Toronto, Canada)*

"Knowledge is power and it can command obedience. A man of knowledge during his lifetime can make people obey and follow him and he is praised and venerated after his death. Remember that knowledge is a ruler and wealth is its subject."

— Imam Ali, Nahj Al-Balagha, Saying 146

Power, as "the ability or right to control people or things", will be addressed in our paper, specifically referring to mastering medical-imaging technology and establishing the ranks in the communication between patient and health-care provider.

The meaning we chose to associate with "knowledge" refers particularly to the education in science, more pointedly the way the information imbedded or accompanying medical images can be shared with the lay public.

Over the centuries, production of (scientific) knowledge as well as imparting it, were the fief of the few. Starting with the moment it became a field of research and not "merely" a collection of cures and remedies, the importance of information sharing became more acute. A healer or a witch doctor would protect his or her knowledge, setting him or her apart from the congregation to which they belonged. They were authoritative, respected and revered, even. All this as a result of the knowledge they had and the power that came with it: the power to heal or to let die.

The skill set required to operate and the "smoke and mirrors" of technology give power to the educated, the specialists.

Within the span of a century, from the initial X-ray to today's myriad of computer-mediated/generated medical images, there is a great shift in style and attitude.

The dynamics of knowledge-based power became less dramatic with time, and one would expect that – with the popularization of (medical) science and, lately, with the plethora of medical images freely flowing on the internet, as well as the easy access to information – the public would be more knowledgeable. In fact, what is so often noticed, is a misinformation and misinterpretation of the data, be it personal one (patient) or research (public at large).

The research conducted in our laboratory aims at bridging the patient-collected data with the physician, the technologist, while also addressing the demand to respect the patient's needs. Images are part of the public domain, but their meaning remains, sometimes obscure or obscured.

An elite of the technologically-knowledgeable feel responsible and empowered and fighting the tide of "common knowledge" as spread by the easy-access internet sites. Their attempt at stopping the "democratization of information" is made with the overt intent of avoiding misunderstandings and misconceptions but, at the same time, lead to a lessened input of the patient regarding decisions concerning the course of treatment and the potential outcome.

Over the last couple of decades, a shift in attitudes as well as in the use of data provided by the medical images occurred: the familiarization of public at large paralleled by the health-care provider interaction with both the novel technologies, as well as with the new public awareness.

We consider and would like to discuss the hypothesis that making the scientific communication clear and concise for the benefit of the public is both difficult as well as potentially misleading, thus adding to complexity of the task.

Keywords: medical imaging, patients, healthcare, technology, democratization

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Symposium 380: Circulation of mathematics, sciences and techniques between continents, 19th–20th centuries

Organizers: ***Yolima Alvarez Polo*** *(Francisco José de Caldas District University, Bogotá, Colombia),* ***Norbert Verdier*** *(University Paris-Sud, University Paris Saclay, Paris, France)*

Since 2002, a lot of "new" studies by historians of science allow us to understand aspects of the circulation of mathematics, structures and actors between 1800 and 1945. For instance, in the book *Mathematics Unbound: The evolution of an International Mathematical Research Community, 1800–1945* we can find a lot of information (eighteen chapters written by twenty authors) about circulation between United States and Europe (especially England, France, Germany, Italy & Spain), whereas three chapters deal with cases about China (The Emergence of a Modern Mathematical Community in China by Joseph W. Dauben and Yibao Xu) and Japan (The Emergence of the Japanese Mathematical Community (1855–1945) by Chikara Sasaki). However, Africa and the Middle East (for instance, Turkey) are not treated at all.

The ESHS Conference in Prague offers the possibility to present and discuss recent perspectives and methodological issues concerning the circulation of mathematics, sciences and techniques around the world.

It is well known that, mainly as a consequence of wars, professors had to leave their place of origin. Students also had to change country in order to find a better education or better conditions to work. The analysis of particular cases provides elements for a general outline. We are also interested in studying mutual exchanges between research centers located in different continents. We would like to point out some characteristics of specific schools and contrast their goals and visions. Our symposium considers cases that present some aspects of circulations in mathematics between Africa, America, Asia, Australia and Europe.

Keywords: Mathematics, Sciences, Techniques, 19th–20th Centuries, Africa, America, Asia, Australia, Europe

John Horvath and the beginning of modern mathematics in Colombia (ID 430)

Asdrubal Moreno Mosquera *(Universidad Distrital Francisco José de Caldas, Bogota, Colombia),* ***Yolima Alvarez Polo*** *(Universidad Distrital Francisco José de Caldas, Bogota, Colombia)*

The aim of this proposal is to study the influence of John Horvath in the incipient mathematical Colombian community in the middle of the 20th century. John Horvath (1924–2015) was born in Budapest where he studied under the great Hungarian mathematicians L. Fejer and F. Riesz. In 1947 he received his doctoral degree from the University of Budapest and later he held a position at CNRS in Paris. In 1950 he was contracted by the Universidad de los Andes in Bogotá to lead the newly created mathematics department. He stayed in charge until 1957 when he moved to Maryland. Horvath contributed to the formation of the first Colombian professionals in mathematics. In 1955 he promoted the creation of the Colombian Society of Mathematics, and he also founded the Journal of Elementary Mathematics, now *Revista Colombiana de Matematicas*. Along his distinguished career Horvath interacted with renowned mathematicians as Jean Dieudonné, and Laurent Schwartz. In 1952 Horvath invited Marc Krasner and Jean Dieudonné to give several conferences in Bogotá. Later he invited Laurent Schwartz who gave several courses in the National University of Colombia in Bogotá. We can say that the influence of Professor Horvath in the mathematical Colombian context allowed modern mathematics to begin in Colombia.

Keywords: John Horvath, Colombia, Modern Mathematics in Colombia, Colombian Society of Mathematics

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Connections between France and Colombia. The case of Aimé Bergeron (ID 431)

Yolima Alvarez Polo *(Universidad Distrital Francisco José de Caldas, Bogota, Colombia),* ***Asdrúbal Moreno*** *(Universidad Distrital Francisco José de Caldas, Bogota, Colombia)*

In 1848, the Colejio Militar was created in Bogotá-Colombia under the government of the president Tomás Cipriano de Mosquera. The Colejio offered studies in Civil and Military Engineering inspired by the model of the Ecole Polytechnique of Paris-France. Curriculum guidelines, teaching methodologies and French texts and handbooks were imported. Foreign professors were hired as part of an ambitious project of Colombian Government to promote sciences in our country. Among them we find the French J.P. Aimé Bergeron.

Who was Bergeron? We do not have any biographical data. We know that he graduated from the University of Montpellier. He wrote in 1844 "Sur la résistance des solides élastiques" and "Sur la rotation de la terre" and after that he was working as a teacher at the Colejio Militar in Bogota-Colombia.

He taught mathematics and astronomy. He published "Lecciones de Matemáticas Parte Primera: Aritmética" (1848) and there is an evidence that he taught differential calculus in 1851. At the National Library of Colombia we found a manuscript of the course notes taken by his student, Sixto J. Barriga.

The aim of this proposal is to present this particular case as an example of the crossing of cultural and political boundaries.

Keywords: Colombia, 19th Century, Engineering, Mathematics, Bergeron, Military College

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From the Western method to New Method – Government and the identity of European mathematics in China (ID 541)

Miao Tian *(Institute for the history of Natural Science, CAS, Beijing, China)*

From the 17th century, European science and technology were systematically introduced into China by Jesuit missionaries. At the start of this process, methods from Europe were commonly regarded as "Western methods". Chinese scholars usually evaluated these methods based on their effectiveness and knowledge criteria within the Chinese cultural context. However, from the second half of the 17th century to the middle of the 18th century, European methods were generally mentioned in official publications as "new methods" or "nowadays methods", in contract to "ancient methods" developed in China. This meant that at least some of this European knowledge was accepted by the Chinese government as a part of Chinese knowledge. During the same period, Chinese scholars were still working very hard on comparisons of knowledge from the Chinese and European traditions, and most of them involved themselves in the debate concerning the advantages and disadvantages of the methods and knowledge from these two cultural traditions. In this paper, based on source materials and focusing on mathematical knowledge, I will first present the process of the transfer of the identity of European knowledge from the 17th to the 19th centuries in China, and second discuss the role the Chinese government played in this process and the reasons behind it.

Keywords: European method, New method, Chinese method, Chinese government, Transmission of European mathematical science in China

The sources of general topology from the policy of authors and journals to geopolitical powers (ID 549)

Marie Větrovcová *(Charles University in Prague & Academy of Science of the Czech Republic, Prague, Czech Republic)*

The paper discusses the silent streams of birth and the natural alliances between mathematical cultures (before 1938) and the impact of the great geopolitical power struggle on the formation of general topology (after 1945). It focuses on the journals, authors and references associated with topics featured within this new discipline (closeness, continuum, neighborhood, convergence etc.).

The beginnings of general topology were restricted to newly-formed national journals: Scandinavian *Acta Mathematica* (Poincaré 1882(1), Cantor 1883(2), Volterra 1889(12)) and Italian *Memoire della R.Accad.Sci.Bologna* (Arzelà 1895(5)). In the "continuum" period of 1903–1906, topology became established as a new discipline through texts in reputable scientific journals: the British journal *Proc.London Math.Soc.* (Young 1902–1903(35)), the French journal *C.R. Acad.Sci.* (Hadamard 1903(136), Lindelöf 1903(137)) and the journal *J.Math.Pures Appl.* (Zoretti 1905(6)(1)). In 1906, articles on functional analysis by Fréchet and by Hilbert appeared in *Rend.Circ.Matem.Palermo* (22)(1) and *Götting.Nach.,* respectively.

The key period was the 1920s, when general topology entered Central European journals and when two silent alliances were formed: the Polish-French and the German-Soviet. The Lvov-Warszaw school, writing on properties of finite-dimensional space and continuum, published in the new Polish journal *Fundamenta Mathematicae* (1920–1922), referencing French topologists. In *Bull.Intern.Acad.Pol.Sci.* (1923), the Moscow school referred to compact spaces, mentioning the Göttingen school. However, the top mathematics journal in Central Europe was the German *Mathematische Annalen* (Leipzig), edited by Klein, Hilbert and Einstein. Its volume featuring Hilbert's famous "Die logischen Grundlagen der Mathematik" appeared (1923)(88), and it also included Tietze's paper on general topology based on the new concept of neighborhood. Alexandrov's and Urysohn's contributions on metrization of compact/normal space (*Math.Ann.* 1924–1925) and Tichonov's articles (*Math.Ann.* 1926, 1930) linked the Soviet results to those of the German mathematicians (Hilbert, Hausdorff, Carathéodory).

Interestingly, it was Czechoslovakia that became "an isle of democracy" of Central Europe during the 1930s when Germany was ruled by the Nazis. The Brno topological circle came up with completely new ideas at that time, which were published in *Ann. of Math* (1937), and, mainly, in Czech in *Čas.pěst.mat.fys.* (1938) and *Spisy Masarykovy university* (1938). Čech, Pospíšil (and Novák) followed Tichonov (USSR) and M. Stone (USA) with respect to infinite cardinality of space.

During the Cold War, mathematics was caught in the geopolitical struggle between the USA and the USSR. After 1945, the top mathematical journals were American *Annals of Mathematics* and *Proceedings of AMS* with articles by European exiles and Americans on the application of topology in functional analysis (Lefschetz, Morse, Heins, A.H.Stone, Eberlein, Bochner), on the connections between algebra and topology (McKinsey, Tarski, Mayer, Bing) or on set theory (Dieudonné, Zorn, Hewitt, M.Stone), while papers written by Eastern-European mathematicians (Tichonov, Smirnov, Shanin, Banach, Sobolev, Krylov, Shmulyan) were mainly published in the Soviet journal *Uspekhi Mat. Nauk*.

By 1950, general topology had become a well-defined discipline. The formative role of author preferences, schools and journal policies yielded to the new driving force shaping the developments in this field in what had become a separated world was political power.

Keywords: history of 20th century mathematics, general topology, mathematical journals, politics of science, journals policy

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SESSIONS

Session 1: Perspectives on Politics, Power and Knowledge from Russian and Soviet History

Chair: ***Suzanne Débarbat*** *(Observatoire de Paris, Paris, France)*

The Power of Translation: Technical Translation and Early Russian Enlightenment (ID 596)

Maria Avxentevskaya *(Freie Universität Berlin, Berlin, Germany)*

Russian Enlightenment was in many ways inspired by West European cultural values, including the development of natural studies and technology. Peter I, Russian sovereign in 1692–1725, in one of his speeches expressed the view that the first and initial "throne of sciences" was Greece, from where, through Italy, knowledge could spread across Europe, and only "the negligence of forefathers" prevented sciences from flourishing in Russia. Peter I believed that knowledge "spreads and circulate like blood in a body," and not only he provided state support but also participated in the practical organization and estimation of translation works, particularly in the field of military technology. In his famous "Ordinance to Zotov on avoiding future mistakes" (1709), Peter mentions a book on fortification, which he read in a Russian translation and found that "the talks" were translated very intelligently, but the actual matter of "how to do fortification" was not delivered understandably. The tsar insisted that in the future, instead of maintaining the order of words, the translation should deliver the understanding of "how to do things," for which training in languages and "the arts" need to complement each other. At the time, the difficulties in finding the right language for translating technical descriptions was mainly caused by the ubiquitous use of outdated Church Slavonic as the language of state management, which was not capable of live development. Therefore, Peter I believed his authorized unprecedented translation projects to be the foundational efforts in enabling not only new technical but also political reality. Even the Academy of Sciences in St Petersburg was established with the purpose "to teach languages, as well as other sciences and arts, and to translate books," (*Decree on Establishing the Academy of Sciences*, 1724). Peter's Ordinances and Decrees defined not only the values of technical translation, but also the values of performing any operations of state management and exercising of state politics, and one of the functions of technical translation consisted in modernization of the state government. In my paper, I will argue that technical translation worked not only for transforming what was coined as "the order of things" by Michel Foucault, but also for delivering the performative knowing of how to manage the new technocracy of a state in the process of rapid modernization, which remains relevant in the contemporary cultures of knowledge. My paper will address questions on how these specific technical translation practices in early Russian Enlightenment facilitated the remarkable transformation in the exercising of state power, what challenges it created, and what negative impact it may have had on the specific development of Russian humanism.

Keywords: Technology, Translation, Performativity, Enlightenment, Russia, Government

How to outwit the regime: Physical anthropology in the 19th century Russia (ID 599)

Galina Krivosheina *(Institute for History of Science and Technology, Moscow, Russian Federation)*

Physical anthropology as a scientific discipline concerned with biological aspects of human beings and strongly associated with Darwin's theory of evolution emerged in the second half of the 19th century. During that period the first professional associations, periodicals, and chairs in anthropology were established in Europe. Similar processes developed in Russian science. Even though Russian authorities considered new anthropological ideas politically unreliable and ideologically harmful, in 1864 the first anthropological association was founded in Russia by the effort of professor of zoology of Moscow University Anatolii Bogdanov (1834–1896) and his Society of Friends of Natural Science (since 1867 – Society of Friends of Natural Science, Anthropology and Ethnography – OLEAE). Surprisingly enough

this happened in traditional and loyal Moscow but not in westernized St. Petersburg, where main national scientific institutions of the period, including Academy of Science, resided (Russian anthropological Society in St. Petersburg was founded only in the late 1880s). Later Bogdanov managed to establish a chair in anthropology in Moscow University (1876) and to organize Ethnographic (1867) and Anthropologic (1879) exhibitions in Moscow. He was a unique and considerably underestimated figure in the history of the 19th century Russian science. According to Dmitrii Anuchin, "if Bogdanov starts something he will achieve his aim and do what would be unthinkable to any other". The present paper deals with the analysis of his administrative and scientific decisions, and his tactics, which helped him to overcome political and ideological obstacles, to establish anthropological community in Russia and to make the word anthropology well-known to Russian public.

Keywords: physical anthropology, science in Russia, Anatolii Bogdanov, Society of Friends of Natural Sciences, history of anthropology

"General Biology", the textbook by Yu. Polyansky. The return of science to secondary school. (ID 585)

Anna Samokish *(Saint-Petersburg branch of the Institute for the history of science and technology, Saint-Petersburg, Russian Federation)*

New economic conditions and education reform carried out in Russia, caused the appearance of a lot new textbooks. Modern science teacher can choose any but not all of them will be really scientific. But there is a textbook which has become a benchmark and was published dozens of times. Some sections of it can be considered out of date but it was the first textbook on general biology in the Soviet Union based on scientific principles.

In the middle of 1965 the Academy of Pedagogical Sciences held a meeting to develop urgent measures to remedy the catastrophic situation of the teaching biology in secondary school. The tradition of natural science teaching inherent in the innovative schools of the early twentieth century has been lost. Creating the highly applied school subject like agronomy made teachers forget about science for many years. It was decided not to teach this subject in school during the year and in the meantime prepare a new curriculum and textbooks. The work was headed by famous protozoologist and great popularizer of science Yu. Poliansky (1904–1993). In 1966, the book "General Biology" edited by Polyansky was published as a study guide. By 1971, the guide was modified into a complete textbook which could be used at schools.

The structure of the book is quite different to the traditional: the presentation is not from lower to higher structural levels, but on the contrary: beginning with the evolution (or rather, an overview of the historical development) to genetics and breeding. After nearly twenty-year break the new textbook gave the strict scientifically exposition of the principles of genetics and evolutionary theory. For the first time in Soviet school the basics of molecular biology and ecology were considered. In the chapter "Basics of Ecology", even before the famous French ecology textbook by F. Dre, the unusual order has been set in this discipline. It was extremely effective in relation to the didactic order of presentation – from environmental specimens (autecology) to the ecology of communities (synecology).

In the discussion of the textbook and the program of Ministry of Education of the USSR minister M. Prokofiev (scientist, biochemist) expressed the reasonable doubt in the ability of the bulk of school teachers to work in accordance with these materials. It was necessary not only to create a new textbook but also to explain a new scientific approach in the work to teachers. As a result, Yu. Polyansky was offered the position of chief editor of the journal "Biology at school". For 5 years of his editorship the magazine published a series of articles by leading scientists setting out the theoretical foundations of the different branches of modern biology.

The textbook by Polyansky and his activities for the dissemination of scientific knowledge brings science to the teaching process at secondary school, started a new era in the history of this subject. In addition,

this textbook demonstrates the importance of the participation of scientists, not only professional teachers, in the creation of school programs.

Keywords: general biology, natural science education, Yu. Polyansky, teaching natural science at secondary school

Session 2: The Power of Newton's Ideas and their Reception

Chair: ***Efthymios Nicolaidis*** *(National Hellenic Research Foundation, Athens, Greece)*

Prism Quality Not a Factor: Estimations and Replications of Newton's Optical Experiments (ID 556)

Yoshimi Takuwa *(Kobe University, Kobe, Japan)*

Isaac Newton's new optical theory overturned the modification theory of colours, which was dominant from the times of ancient Greece through the 17th century. In this traditional understanding, colours are generated when light rays are modified by an external cause such as the termination of light and shadow; thus, the colour of rays can be changed by refraction or another cause. However, if colour is a property of rays, as Newton explained, the colour of rays cannot be changed by refraction, provided that we can make homogeneous light.

When Newton published 'A New Theory about Light and Colours' in 1672, he did not reveal the technique by which he made homogeneous light. Consequently, scholars who denied his optical theory based on their experimental tests could not have known how to make homogeneous light. These scholars, including Anthony Lucas and Edme Mariotte, tested Newton's theory following the *experimentum crucis* presented in 'New Theory' and reported that they could change the colour of rays with refraction.

Newton likely did not initially reveal how he made homogeneous light because of the difficulties he encountered. This study describes the improvements Newton made to optical experiments to prove the immutability of homogeneous light and draws upon historical sources, estimations and replications of his experiments to demonstrate that his so-called *experimentum crucis* was imperfect. It was difficult to determine the accuracy of Newton's optical experiments because he did not always give detailed conditions of the experiments and also because 17th-century prisms were likely of low quality. Popular writers, such as Voltaire and Francesco Algarotti, claimed that those who denied Newton's optical theory had made use of 'bad' or 'defective' prisms. However, my estimations and replications show that, even if the *experimentum crucis* had been performed under optimal conditions, the experiment could not have proven the immutability of colours.

Keywords: Isaac Newton, optics, light, colours, the 17th century, the 18th century

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Law and order: God and the sovereignty of Newtonian methodology in Petrus van Musschenbroek's work (ID 484)

Pieter Present *(Vrije Universiteit Brussel, Brussels, Belgium)*

In this paper, I discuss Petrus van Musschenbroek's (1692–1761) defence of Newton's experimental philosophy, in relation to his views on natural laws and their dependence on the power and will of God. At the time van Musschenbroek started his academic career, several universities in the Dutch Republic had been plagued by intellectual and institutional struggles between Aristotelians and Cartesians, sometimes even resulting in physical violence (Ruestow 1973, 34–88). In contrast to these philosophies, van Musschenbroek presents experimental philosophy as a study "free from all disputations and controversies [*ab omni disputatione & controversia liber[a]*]" (van Musschenbroek 1723, 42). I show how for van Musschenbroek, the harmony in experimental philosophy is premised on the order in nature. Natural phenomena are governed by universal and unchanging laws instituted by God. Therefore, as a diligent study of natural phenomena, experimental philosophy cannot but produce agreement (van Musschenbroek 1723, 43–4). Divine law guarantees order in science. I then discuss the role of van Musschenbroek's voluntarism in his defence of the method of experimental philosophy. The order in the world is based on a free and arbitrary act of will by God, whose will and power are beyond our comprehension (van Musschenbroek 1723, 9). The sovereign and free will of God is used to ban a priori reasoning from philosophy and guarantee the sovereignty of the method of experimental philosophy. I conclude by situating van Musschenbroek's insistence on the stabilising nature of Newtonian experimental philosophy, and his invocation of natural law and God's sovereignty in the broader religious and political landscape of the Dutch Republic.

Keywords: Petrus van Musschenbroek, Newtonianism, Scientific method, God, Laws of nature, Voluntarism, Sovereignty

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Force of Nature, Power of State and Newton's Legacy (ID 498)

Dimitris Petakos *(National and Kapodistrian University of Athens, Athens, Greece)*

According to traditional historiography, Newtonian philosophy was a homogeneous and well-defined body of doctrines. However, this approach does not take into account the multiplicity of factors that contributed to the construction of Newtonian philosophy. Newtonian philosophy developed in a complex and multifaceted intellectual context, and this resulted in a number of ambiguities inherent in Newton's major works.

The socio-political and theological context of England during the second half of the seventeenth and the first half of the eighteenth centuries defined not only the conceptual framework of Newtonian philosophy but, also, the different *assimilations* of Newton's work. The complexity of historical context favored the development of multiple "Newtonianisms" in the intellectual landscape of England. These English "Newtonianisms", assimilated, reshaped and expressed the sociopolitical and theological context independently of Newton's intentions. As a result, each thinker elaborated a different approach to Nature, natural laws and the fundamental concepts of natural philosophy (universal attraction, absolute space etc.).

The aim of this paper is to highlight the *diversified assimilations* of Newtonian philosophy by Newtonian thinkers of the first half of the eighteenth century and to link them with the different perception of power by each historical actor. These *assimilations* reflected the public discourse and sociopolitical

conflicts concerning the boundaries between *freedom of will* and *social necessity*, *active participation* and *passive obedience*. The turbulence of the decades before and after the Glorious Revolution (1688) set the stage for the emergence of natural-philosophical and natural-theological concepts related to this discourse. The paper will focus on Newtonian natural philosophers and natural theologians, such as William Whiston, Samuel Clarke, John Toland, William Derham and Colin Maclaurin, and will try to show how the sociopolitical engagements and theological pursuits of each thinker resulted in a different Newtonian philosophy and, therefore, a different image of Nature.

Keywords: Newtonian Philosophy, Newtonianisms, Natural Theology, England, 18th Century, Active/Passsive Force, Diversified assimilation

How Lagrange Saved the Universe: The Forgotten Narrative on the Stability of the Solar System (ID 193)

Massimiliano Badino *(Universitat Autònoma de Barcelona – Massachusetts Institute of Technology, Cambridge, MA, USA)*

According to a deeply ingrained narrative, supported by astronomy textbooks, popular accounts, and some scholarly works, Newton's gravitation theory entailed very naturally the question whether the solar system would continue in its orderly periodic movements or would at some stage collapse. The narrative goes on that this fundamental question was eventually answered by Pierre Simon Laplace in the mid-1770 (or, alternatively, mid-1780) with the proof, now known to be partial, that the system is stable. The aim of this paper is to present a totally different perspective. First, I argue that, in the original Newtonian framework, the stability of the solar system was not an object of physical and mathematical inquiry. The cosmological question of stability only turns up within a larger theological and metaphysical discourse, which does not affect physical research. Rather, Newton and his followers were much more concerned with the study of specific planetary inequalities, most notably the motion of the Lunar apogee and the great anomaly of Jupiter and Saturn. After Euler's breakthrough in the late 1740s and the emergence of modern perturbation theory, these anomalies were attacked by new and more powerful analytical methods. The main protagonist of the vigorous development of perturbation theory was Joseph Louis Lagrange. Throughout the 1770s, Lagrange refined, extended, and generalized the techniques used in physical astronomy to a level never seen before. Thus, my second claim is that, by introducing new formidable mathematical practices (changes of variables, integrals of motion, perturbative function), Lagrange realized that perturbation theory could aspire to more than just solving localized problems. It was in the early 1780s that Lagrange, for the first time, clearly posed the problem of the stability of the solar system and provided a general solution. Laplace, who admittedly had also contributed to the development of perturbation theory in an important way, further improved Lagrange's methods and solved the long-standing mysteries of the Lunar motion and the great anomaly. In the first decades of the nineteenth century, Laplace's extremely influential *Mécanique Céleste* and the whole Laplacian school consolidated the narrative today still widely accepted.

Keywords: Physical Astronomy, Celestial Mechanics, Stability of the Solar System, Lagrange, Laplace

Session 3: The Cold War

Chair: ***Jakub Jareš*** *(Charles University, Prague, Czech Republic)*

Agents or actors? How Czech scientists helped shape UNRRA's penicillin plant program, 1944–49 (ID 469)

Slawomir Lotysz *(Polish Academy of Sciences, Warsaw, Poland)*

We tend to believe that international aid programs, whether for ad hoc relief or long term rehabilitation, are initiated and formulated by politicians, while scientists, engineers, doctors and relief workers only step in afterwards, to provide the aid. This is the message conveyed by the media, which usually presents, for example, a set-off program as being the result of political negotiations. In fact, the signing of agreements is the last stage of what often begins as a bottom-up initiative, devised by a visionary local expert, who understands both the problem and how it needs to be solved.

When, in early 1946, the United Nations Relief and Rehabilitation Administration (UNRRA) announced its new program of building penicillin factories in Czechoslovakia, Poland, Yugoslavia, Belarus and Ukraine, it had in fact been preceded by long negotiations that had been initiated by doctors who, as early as 1944, had understood both the significance of antibiotics and the fact that Eastern Europe's need for penicillin could not be solely dependent on supplies from relief organizations.

This paper aims to explain the role of Czech scientists in shaping UNRRA's penicillin plant program, from its inception to its finalization. It will argue that the Czech experts – a microbiologist, a chemist, and an engineer – played a crucial role in the collaborative effort to overcome the obstacles that slowed the program down under the East-West tensions on the eve of the Cold War. In the broader context, this analysis will contribute to a redefinition of the roles of the technical and scientific experts from the countries aided, from being passive takers to active agents of change, and their contribution to the circulation of knowledge. The paper mainly uses primary sources, and is partially comprised of the results of a larger, ongoing research project on penicillin production in Eastern Europe.

Keywords: health, international organizations, pharmaceuticals, medicine, post-war reconstruction, technology transfer

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The 1947 Commission médicale de défense contre la guerre moderne: post-war civilian contributions to NBC preparedness and response in France (ID 315)

Etienne Aucouturier *(French Ministry of Foreign Affairs/University of Ghana, Accra, Ghana)*

In the context following the end of the Second World War and the *Libération*, a high value was given to civilian input in military affairs in France. Many members of the most prestigious national academic institutions (including *Institut de France*, *Académie nationale de médecine*, *Collège de France*, *Ecole polytechnique*, *Institut Pasteur*, *Ecole vétérinaire d'Alfort*, *Institut du radium*, *Institut national d'hygiène*, *Institut du cancer*) were given the unprecedented opportunity to contribute to future military endeavours regarding biological, chemical and nuclear warfare, through a new pluralistic commission. This 1947 *Commission médicale de défense contre la guerre moderne* was a scientific commission, defining its agenda, under the supervision of the *Ministère des armées*. Its mission was to understand how to prevent and cure lesions or disorders caused by the then new atomic, chemical and biological weapons.

On the basis of first hand archival materials from *Institut Pasteur* and from the French Ministry of Defence, we shall focus on the achievements of the subcommissions dedicated to research on biological and chemical weapons, and will examine the extent to which the expected military and civilian outcomes of this explicitly dual research program, have been effective. Noting that the German military had discovered nerve gases through earlier research on insecticides, and that the English military had found remedies against arsenical and mercurial intoxications through earlier research on vesicants, the French military gave these subcommissions the mission to explore a wide range of chemical substances and biological agents, and their potential effects on human health, but also on crops or animals. These activities did to some extent contribute, on the civilian side, to improve public health (in particular vaccination) and agriculture (through the improvement of insecticides and herbicides).

Keywords: Commission médicale de défense contre la guerre moderne, biological warfare, chemical warfare, WMD, France

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Reproducing scientific elites 1958–1989: Scientific contests for Swedish youth during the Cold War. (ID 485)

Daniel Lövheim *(Stockholm University, Stockholm, Sweden)*

The production of future scientific elites in Sweden has during the second half of the 20th century taken place under a mixture of national images. The need for economic growth and global competition has intermingled with historically rooted identities of being a country of successful scientists and inventors. Often the main responsibility to foster the next distinguished generation has been placed upon the school system. But the production of scientific elites has also involved industry, media and private organizations. In the network of such actors, other platforms for shaping excellence have crystallized rather than class rooms and high school physics labs.

Many of these contexts for the forming of scientific elites are still unbroken territory in the academic fields of history of science and education. As part of a project idea this presentation seeks to focus on a number of co-operations between state, industry and media that resulted in the establishment of scientific youth contests for Swedish high school students during the Cold War. Even if the arrangements often were motivated by an overarching need to entice as many individuals as possible into scientific pursuits, it was evident that the structure of the competitions had developed in order to differentiate and to motivate an elite. They were designed to find and encourage the top, thin layer of Swedish youth that were the most talented and high achieving.

The competitions were developed in close relation to already existing ones on the international scene. Winners of the Swedish arrangements were invited to participate in the American Contest National Science Fair – International, others in the Science Olympiads developed in Eastern Europe. Consequently, Swedish secondary school pupils were taking part in similar events on both sides of the cold war.

From perspectives mainly rooted in the academic fields of history of science and history of education, the overarching purpose of the project is to study and analyze these contests in Sweden and their international equivalents during the period 1957–1989. The analysis will concern the role of these

contests as reproduction practices of scientific elites in the tension between democratic and meritocratic goals of education, between high school science and the scientific community, but also with regards to the shifting ideological contexts in which such a (re)production was given meaning.

Keywords: Scientific elites, Science competitions, History of science education, Cold War

Power Networks from the Evidence of IUPAC Conferences (ID 16)

Pierre Laszlo *(Ecole polytechnique, Palaiseau, France)*

Comparative analysis is among the tools of the historian. How does one pick the events for comparison? By first realizing the need for drastic selection, sometimes dictated by overabundant data — as with contemporary science. Second, by disparate probing, i.e., by comparing similar and apparently unrelated events. Third, and most important, by relying on one's intuition.

With as examples the Natural Products Chemistry conference held in Kyoto in 1964 and the Synthetic Organic Conference held in Helsinki in 1990 — in which I presented one of the plenary lectures — I shall sketch the lines of forces structuring these meetings. Areas of chemistry featured, invitations issued as lecturer or as a session chairman, countries of the invited, all merit careful analyses.

The 1964 natural products conference at Kyoto thus showed the scientific rise of Japan, American dominance led by universities of the Ivy League, continued excellence of Oxbridge in the UK. Another noteworthy feature was English as the compulsory lingua franca. The analyst also notes the instrumental revolution and lectures with single authors, typically men scientists with great power invested in them, who ruled university appointments and key journals.

My second case study postdates the end of the Cold War. It is thus not totally accidental if Finland hosted that international conference. Its aspects were, first and foremost, the emerging empire of the computer. Within synthetic organic chemistry, the Helsinki conference also included organometallic tools and stereochemical control. This last term, control, was a keyword during that conference.

I shall submit a comparative analysis of these two conferences, a quarter of a century apart, with apparently dramatically altered fields of forces in the interim.

My contribution will comment upon the power structure within global organic chemistry at those times, together with the question of whether it has remained intact since, or whether it has once again drastically changed.

Keywords: dominance, gender, Cold War, USA, Japan, Europe, rivalry

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Two Faces of Sovietology. The Cold War and the Troubled History of Soviet Studies in Finland and Switzerland (ID 611)

Timo Vilén *(University of Tampere, Tampere, Finland)*

While the involvement of American social and human scientists in a wide range of Cold War activities has long been an established part of the U.S. intellectual history, there has recently been an increasing interest in the relationship between the Cold War and social sciences. A case in point, discussed by David Engerman, is the rapid transformation of Soviet studies – a branch of area studies often unjustly portrayed as a mere tool of American Cold War policy – from a marginalized academic activity to a massive research enterprise with thousands of scholars specializing in Soviet or Slavic subjects and with several large Soviet and Eastern European area centres set up at many of the most prestigious American universities.

Drawing on information unearthed in the course of my research on the history of Russian studies, my paper discusses the uses of sovietology within the context of the Cold War and the complex interaction between Soviet specialists, their patrons and those in power. However, unlike most existing research on the history of Soviet studies, the paper will not deal with the American sovietology, but with sovietological research pursued in Finland and Switzerland from the mid-1960's to the mid-1970s. Knowledge and understanding are often described as one form of power, but just what kind of power was sovietology and how and for what purposes was that power used – and not used – in the above countries, both of which positioned themselves as neutrals in the Cold War conflict with, of course, varying emphases and freedom of manoeuvre vis-à-vis the great powers?

The paper highlights the diverse and varied nature of sovietology, while at the same time arguing that approaching the history of Soviet studies through the lens of neutral countries can offer fascinating perspectives on the relations between knowledge and politics.

The fate of S. I. Vavilov's report of 1949 on the philosophy of physics (ID 598)

Konstantin Tomilin *(S. I. Vavilov Institute for the History of Science and Technology, Moscow, Russian Federation)*

In 1949, the President of the USSR Academy of Sciences Sergey Ivanovich Vavilov prepared a report on the philosophy of physics, which had to become a keynote address at the All-Union meeting of physicists in 1949. This meeting was considered by the party ideologists as the transfer to physics of the "successful" (in their opinion) fight against idealistic theories in biology, carried out during the session on Agricultural Sciences in August 1948. When the idea of such a meeting appeared in November 1948, Vavilov felt the danger of destruction, under the guise of fighting against the idealism, of modern physical theories – the theory of relativity and quantum mechanics, like the destruction of genetics, and he managed to include physicists from the Academy of Sciences as participants of the meeting.

Participation of academic physicists radically overturned preparatory meetings at which all reports were preliminarily heard and discussed (12 reports and more than 50 presentations had been collected). Reading and discussion of the reports took place in the building of the USSR Ministry of Higher Education under the direction of A. V. Topchiev in the period from 20 December 1948 to 16 March 1949 (there were 42 such meetings). At the meetings physicists were invited, who presented their comments on the reports. Thus, V. L. Ginzburg participated 10 of those meetings, I.E. Tamm, M.A. Leontovich, E. M. Lifschits – 7 ones, V. A. Fock, G. S. Landsberg – 5, etc.; V. L. Ginsburg, I.E. Tamm and V.A. Fock prepared and made personal reports. More than 100 physicists participated in those meetings. Despite the long preparation, the meeting of physicists was cancelled.

Nevertheless, S. I. Vavilov read his report at another meeting – of the heads of departments of philosophy and Marxism-Leninism. In his report, Vavilov sought, at first, to divide the physics and philosophy, and secondly, to adapt the Marxist-Leninist philosophy to the achievements of modern physics (for example, it is used as a "law of dialectics" thesis "unity in opposites" (without the word "struggle"), which actually corresponds to the physical principle of complementarity), and, thirdly, pointed out the primacy of physicists over the philosophers on the question of the philosophy of physics.

Text of S. I. Vavilov report was criticized by party ideologists, but Vavilov did not want or did not manage to take them into account and read his report to the Party philosophers, July 14, 1949, apparently without any significant changes. In late July, intraparty authorities found the report as containing "serious errors" and it was not published. Moreover, it was decided not to publish any materials of this philosophical meeting. Fragments of Vavilov's report were later published with many omitions. In full it was published only in 2014.

Keywords: Soviet physics, All-Union meeting of physicists, ideology pressure, philosophy of physics, S. I. Vavilov

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Communist jubilees as a symphony of power and science (ID 612)

Ewelina Drzewiecka *(Bulgarian Academy of Sciences, Sofia, Bulgaria)*

The aim of the presentation is to show the dialectic relation between the power of various institutions and the science (i.e. humanities) in the context of the cultural memory. The focus is on the Cyrillo-Methodian jubilees in Bulgaria during the Communist period. The context is the process of inventing of the (Communist) tradition and functionalization of the national "grant narrative." The object of the analysis are various artistic and scientific texts written in the connection to the great historical anniversaries of 1963, 1969, 1983, and 1985.

How the Communist party (as a political institution) and the Bulgarian Academy of Science (as an academic institution) co-work in order to establish a new vision of society? How the scientific facts and interpretations give the reason for the power of authorities?

The research is part of a larger project entitled "The Culture of Jubilee. Usage of the Cyrillo-Methodian tradition in the Communist Period in Bulgaria" and conducted in the Cyrillo-Methodian Research Centre at the Bulgarian Academy of Sciences.

Session 4: The History of Mathematics: Concepts, Practices and Political Issues

Chairs: ***Maria Teresa Borgato*** *(University of Ferrara, Ferrara, Italy).* ***Annette B. Vogt*** *(Max Planck Institute for the History of Science, Berlin, Germany)*

Falling prey to the power of (mathematical) imagination: Bernard Nieuwentijt's (1654–1718) 'learned ignorance' as a cure for pansophia (ID 562)

Steffen Ducheyne *(Vrije Universiteit Brussel, Gent, Belgium)*

Baruch Spinoza's work caused outrage across the Dutch Republic, for it obliterated the carefully installed separation between philosophy and theology. It was especially the mathematical order in which the *Ethics* was composed that caused fierce opposition, for its mathematical appearance gave the impression that Spinoza's heretical teachings were established demonstratively.

In my presentation, I shall document how the Dutch physician, local politician, and amateur mathematician and experimenter Bernard Nieuwentijt, who endorsed the beliefs of the Dutch Reformed Church, attempted to methodologically counter the threats posed by Spinoza's programme. Nieuwentijt is a case in point of how an adherent of the Dutch Reformed Church tried to defend the authority of the Scriptures in times at which they came under attack by the new philosophy and the emerging sciences. Spinoza and his followers have fallen prey to the power of imagination, Nieuwentijt claimed, and in view of this mathematical imagination should be constrained by experience. The crux of his defence consisted in delineating a modest epistemology, a 'learned ignorance', that would cure the followers' of Spinoza of their pansophical aspirations, on the one hand, and remove the apparent conflict between the Bible and reason, on the other.

The natural-philosophical epistemology and methodology which Nieuwentijt spelled out in his *Gronden der zekerheid* (1720) empowered its followers to avoid the pitfalls of human imagination. Accordingly, for Nieuwentijt the ideas contained in *Gronden der zekerheid* functioned as a stabilizing force for natural-philosophical research so that conflicts – such as the controversies between the Voetians and the Cocceians and the scandalous intervention of Spinoza – could be avoided in the future and so that a pious and modest epistemic outlook could blossom. Ultimately, mixed mathematics could, according to Nieuwentijt, successfully counter the dangerous power of human imagination.

Keywords: Dutch Reformed Church, Bernard Nieuwentijt, Isaac Newton, Baruch Spinoza, pure versus mixed mathematics, 'learned ignorance', Gisbertus Voetius, Newtonianism, Gronden der zekerheid

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Nieuwentijt Bernard (1720), *Gronden van zekerheid, of de regte betoogwyse der wiskundigen so in het denkbeeldige, als in het zakelyke: Ter wederlegging van Spinosaas denkbeeldige* Samestel*; en ter aanleiding van eene sekere sakelyke wijsbegeerte*. Amsterdam: Joannes Pauli.

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Credit and intellectual ownership in the work of W. J. 's Gravesande (1688–1742) (ID 467)

Jip Van Besouw *(Vrije Universiteit Brussel, Brussels, Belgium)*

One of the most obvious forms of power in the history of science and technology has been that of intellectual ownership. Around the turn of the eighteenth century, patent law was in place in much of Europe. Intellectual ownership of abstract matters was a real issue too, as the mathematical world was divided over the infamous priority dispute about the calculus. At the same time, Royal Society experimenters such as Hooke and Desaguliers continuously had to defend their rights from the 'gentlemen fellows', who treated them as mere servants. Yet, one person, the Dutch physicist and philosopher Willem Jacob 's Gravesande, seems not to have been bothered by these issues, even though he was very much aware of contemporary disputes.

In this talk, I will examine his stance towards the issue and discuss some of its effects. As 's Gravesande explained in his immensely popular *Physices elementa mathematica*, he freely took from the work of others what he considered useful and encouraged others to do the same with what was his own: even crediting through references would be unnecessary. Together with his instrument maker Jan van Musschenbroek, 's Gravesande literally invented dozens of machines, but none were patented. Science, he argued, should be free and to the benefit of all mankind.

Although, partly because of this attitude, 's Gravesande played an enormous role in the spread of physical knowledge in the eighteenth century, I will show here that his way of doing things was not appreciated by all of his colleagues. While 's Gravesande was born into an upper class family, many of his fellow physicists and philosophers depended on intellectual credit for their living. I will use this tension to cast light on the creation of a public 'Enlightened' science in the rest of the eighteenth century.

Keywords: 's Gravesande, intellectual ownership, public science

No Safety in Numbers? Mathematical Skepticism in Cartesian Physics and Contemporary Environmental Modeling (ID 589)

Guilherme Sanches de Oliveira *(University of Cincinnati, Cincinnati, USA)*

In stark contrast with his earlier work, Descartes' mature physics seems to be purely qualitative: in later works like the *Principles of Philosophy* and *Le Monde*, Descartes forgoes the formal mathematical approach he had previously favored, and provides only pictorial and verbal descriptions of physical phenomena. Some commentators have interpreted this shift as revealing Descartes' disillusionment with mathematical physics. Yet, based on evidence from Descartes' correspondence with Mersenne, Garber (2000) argues that the shift was instead due to Descartes' twofold dissatisfaction with the specific mathematical tools available at the time and with Galileo's alternative paradigm. In this paper I contrast the "mathematical skepticism" found in Descartes' mature physics with contemporary discussions about the failures of mathematical modeling in environmental science. The use of mathematical equations and computer simulations to study a host of environmental phenomena has yielded results ranging from the underwhelming to the actually tragic, including the collapse of entire animal populations and preventable material loss to floods and coastal erosion. Some of these modeling failures have been interpreted as indicative of problems within the particular models in use, such as their inaccuracy and/or excessive simplicity; in other cases, however, the notable ineffectiveness of the models raises the question of whether mathematics is capable of capturing the phenomena at all. Drawing from "mathematical skepticism" in environmental science, I argue that recent debates mirror the clash between the Cartesian and the Galilean paradigms in seventeenth-century physics and can help illuminate Descartes' approach in his later work. In support of the idea that Descartes' mature physics was still thoroughly mathematical, I characterize his apparent skepticism as resulting from an

underlying representationalist bias, which, I propose, corresponds to doubts about deriving "strict predictions" from "quantitative mathematical models" while nonetheless still trusting the "broad predictions" generated from "qualitative mathematical models."

Keywords: skepticism, mathematics, physics, Descartes, Environmental Science, modeling, simulation, representation

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Philosophical and Mathematical Correspondence between Gottlob Frege and David Hilbert in the years 1895–1903. Some Uninvestigated Topics (ID 482)

Gabriela Besler *(University of Silesia, Katowice, Poland)*

Frege and Hilbert met in Lubeck in 1895, where Frege gave a lecture published then in 1897 as *Über die Begriffsschrift des Herrn Peano und meine eigene*. This event started their correspondence consisting of ten documents.

Six letters were written because of Frege's disagreement about the new concept of geometry presented in Hilbert's *Grundlagen der Geometrie* (1899). I present their discussion about the following topics:

1. Geometry based on spatial intuition (Frege) or geometry as an abstract system without interpretation (Hilbert).
2. Structure of the system of geometry and functions of its elements (axiom, definition, elucidation sentence, explanation).
3. Understanding of axioms and their function in mathematics: axioms express fundamental facts of intuition (Frege) or axioms as definitions of concepts (Hilbert).
4. Axioms independence and consistency: it cannot be demonstrated (Frege) or there is a method for proving it (Hilbert).
5. *To exist* as a second order predicate (Frege) or consistency as a criterion of existence and truth (Hilbert).

Hilbert did not change his geometry system after Frege's criticism and Frege did not accept the new understanding of geometry and axioms. However, this correspondence shows that Frege was treated by Hilbert as a respected mathematician.

Keywords: Gottlob Frege, David Hilbert, Foundations of geometry

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Nikodym and Wilkosz – two mathematicians who were inspiring Banach (ID 532)

Danuta Ciesielska *(Institute for the History of Science, Polish Academy of Sciences, Warsaw, Poland)*

A mathematician Hugo Steinhaus obtained PhD in 1911 in Göttingen under David Hilbert. He was spending some years of WWI in Kraków. In 1916 he was taking an evening walk in the Plant Garden, when he unexpectedly heard the words "Lebesgue integral". Steinhaus joined the conversation of two young people: Stefan Banach and Otton Nikodym. They told him that they often discussed mathematics and they were frequently joined in their debates by a third friend, Witold Wilkosz. The main target of the paper is to present the influence of these two mathematicians on Banach's interest in mathematics. Nikodym and Wilkosz were well educated mathematicians who were interested in the theory of real functions. From 1914 they were discussing their problems with Stefan Banach, a former student of Lvov Polytechnic, developing his knowledge of contemporary analysis. The paper is a result of the studies of their early published and unpublished results in mathematics (1918–1930) and some notes and memoires.

I will present a very short biography of Otton Nikodym (1887–1974), who is remembered mainly for the result known today as the Radon-Nikodym Theorem, and Witold Wilkosz (1891–1941), a mathematician and radio inventor from Kraków, who probably is best known as a classmate of Banach. Both scholars were invited speakers at the International Congresses of Mathematicians. Nikodym and Wilkosz were also experts in teaching of mathematics. Both were radio fans and experts, and last but not least, were of Czech origin!

Keywords: History of Polish mathematics, Witold Wilkosz, Otton M. Nikodym, Radon-Nikodym theorem, Van der Pol equation, Nikodym set, Nikodym–Grothendieck boundedness theorem, history of teaching in Poland, history of radio broadcasting in Poland

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Some remarks about history of the theory of differential objects in Krakow (ID 584)

Zdzisław Pogoda *(Jagiellonian University, Krakow, Poland)*

Modern differential geometry is a continuously developing branch of mathematics. Several results obtained here have many important applications in different areas of mathematics and physics. Pseudoriemannian spaces play significant role in general relativity theory, geometric models of the universe have basic meaning for modern cosmology. The theory of symplectic manifolds lead to the expression of classical mechanics in an elegant form. The surprising results about wild structures in four-dimensional space were obtained by Simon Donaldson with the use of the Yang-Mills theory. The equations of this theory may be clearly formulated in the language of geometric objects. There are many other spectacular examples of significant applications of differential geometry.

Polish Mathematical School was created after World War I, but its background may be found in the earlier period, i.e. in the end of the XIXth century and the very beginning of the XXth century in the

achievements obtained in two important historical Polish universities: in Lwów and, first of all, Kraków. However, Polish territory was there under the reign of other countries. Kraków and Lwów belonged to Austro-Hungarian Empire. Nevertheless, the scientists of the Jagiellonian University in Kraków made significant contribution to the development of mathematics in Polish area.

The areas of mathematics that are most frequently mentioned as those developed by the Poles in the interwar period are: topology, set theory, functional analysis, the theory of differential equations and mathematical analysis. Differential geometry is rather rarely pointed out, although also here the results obtained by Polish mathematicians are of fundamental importance. Topology and set theory were chosen by Zygmunt Janiszewski, as it was more probable to obtain quickly valuable results in new and rapidly developing branches of mathematics. The great progress in the research in another new mathematical area, i.e. functional analysis, was made in Lwów thanks to Steinhaus, Banach and their students and collaborators.

Differential geometry in its classical version, where mainly the theory of curves and surfaces were investigated, was a respectable branch of mathematics. However, it was not this direction of research which gave basis to its further development. Some results that were later included into differential geometry were first joined to the theory of differential equations or analysis. Although differential geometry was not included to the fundamental branches of Polish mathematical research, some of the first major results in differential geometry were obtained by Polish mathematicians. Here, first of all, the work of Kazimierz Żorawski must be recalled. Żorawski had a major influence to the development of mathematics in Kraków and at the Jagiellonian University. Many of his important results may be included to the theory of geometric objects. The theory of geometric objects later became a specialty of Kraków's centre, thanks to the work of Stanisław Gołąb and his students.

In the paper the history of the development of the theory of geometric objects in Kraków, the evolution of the concept of geometric objects (from classical to natural bundles) and the history of their applications in geometry and physics will be presented.

Keywords: differential geometry, geometric objects, natural bundles, Kraków geometry school

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Marxism and Mathematics. Paul Libois (1901–1991) and Intuitive Geometry in Belgium (ID 494)

Geert Vanpaemel *(KU Leuven, Leuven, Belgium),* ***Dirk De Bock*** *(KU Leuven, Leuven, Belgium)*

After World War II, a wave of educational reform was aimed at adapting the traditional schooling system to the demands of modern society, as it emerged from the atrocities of war and ideological conflict. This entailed also a view on the role of science and technology in the education of future citizens. Mathematics in particular was considered to be an essential element in the articulation of a new cultural discourse. Debates on the reform of mathematics therefore often reflected the values and ideologies of the various parties involved.

Intuitive geometry was proposed an alternative to Euclidean deductive geometry. Students would be trained in mathematical thinking through the observation and manipulation of real objects or real life events. It was believed that this approach would mimick the historical genesis of mathematical knowledge. At the same time, it responded to a dialectial epistemology in which industry and technology would be the source of all knowledge.

The central advocate of intuitive geometry in Belgium was the mathematics professor and Communist politician Paul Libois. In this paper we will chart the ideological elements in the debate on intuitive geometry by looking at the views expressed by Libois. Many of his arguments bear a clear parallel with his Marxism. The emphasis on the real world as the origin of abstract concepts, the equality among teachers and students in the learning process and the dialectical nature of the history of mathematics are but some of the elements which will be considered.

The paper will also situate the work of Libois and intuitive geometry into the wider framework of European reform movements for school mathematics, in particular with respect to the New Math reform of the 1960s.

Keywords: history of mathematics, education, Marxism, Belgium, New Math

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Power Evaluation – Several Applications of Game Theory in Political Sciences (ID 551)

Magdalena Hykšová *(Czech Technical University in Prague, Faculty of Transportation Sciences, Prague, Czech Republic)*

In the twentieth century, game theory experienced a stormy development: from marginal considerations on individual hazard games, a stand-alone mathematical discipline with many branches and interesting applications was gradually developed. Nowadays, it represents a key tool e.g. in economy, political science, computer science or evolutionary biology, and also a fruitful field for the selection of Nobel Laureates.

One of the earliest explicit applications of game theory to political science was introduced by L. Shapley and M. Shubik (1954), who presented a method for the a priori evaluation of the division of power among various bodies and members of a legislature or a committee system, based on the so-called Shapley value, one of the solution concepts for cooperative games introduced by Shapley one year earlier. Their "power index" of an individual member is defined in a way that takes into account the chance he has of being critical to the success of a winning coalition. Shapley and Shubik illustrated the application of their index on various examples, including United States Congress, United Nations Security Council or stock companies. For example, they show that due to veto power, a permanent member of the Security Council enjoys a better than 90 to 1 advantage over a voted member, or that the power of stockholders is not directly proportional to their holding, but is usually biased in favour of a large interest.

The paper will discuss the ideas of Shapley and Shubik and their followers (e.g., W. H. Riker (1951)) both from historical and contemporary perspectives. The method based on cooperative game theory

will be compared with other approaches, above all with the probabilistic measures of a priori power considered by L.S. Penrose (1946) and J.F. Banzhaf (1965), and the strategic power index introduced by B. Steunenberg, D. Schmidtchen and Chr. Koboldt (1999), which employs the tools of non-cooperative game theory and is based on the analysis comprising actor preferences, policy space, decision-making rules, as well as the strategic considerations of the players.

The relevance of various indices and their applications to present problems will also be discussed.

Keywords: Game theory, Power index, Shapley value, Shapley-Shubik index, Banzhaf index, Strategic power index

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Session 5: WW2

Chair: ***Helena Durnová*** *(Masaryk University, Brno, Czech Republic)*

Science, Politics and Military Effort: Chaim Weizmann's Chemical Research during the First and Second World Wars (ID 586)

Nurit Kirsh *(The Open University, Ra'anana, Israel)*

"My Zionist and scientific interests have been interwoven from my earliest years in an organic fashion," wrote Chaim Weizmann in 1949 in his autobiography, *Trial and Error.*

Weizmann is known as the chemist who in World War I discovered a method for producing acetone from corn through the use of microorganisms. He is also celebrated as a political leader who became the first president of Israel in 1948. Less known are his chemical projects designed during World War II that intended to advance the war efforts of the UK and the USA.

In my talk I will describe in brief Weizmann's scientific activities during the years 1939–1945: the catarole process that intended to produce reserves of toluene, the basis of TNT; the synthetic rubber project in the US; and efforts to create synthetic meat substitutes using plant waste and plasmolyzed yeast culture. I will examine to what extent these studies can be seen as a continuation of research done prior to 1918, and to what extent they reflect a change in direction. I aim to flesh out a more complete picture of Weizmann's research in chemistry and biochemistry by focusing on the chemical studies of Weizmann's earlier years of research that culminated in the discovery of industrial production of acetone, as well as by examining the less familiar years of his scientific activity – the 1930s and 1940s.

I will argue that prior to 1918 Weizmann perceived his scientific endeavors and political actions as two parallel vocations that only slightly and indirectly influenced each other (In fact, Weizmann assumed that his achievements in chemistry would provide financial security, thereby enabling him to invest his energy in the Zionist project). Only after 1935, when he was re-elected president of the Zionist Organization, and particularly during the years of the Second World War did Weizmann's scientific activity became inextricably linked to his political vision. In 1939 Weizmann offered his services to the British Ministry of supply; he was appointed an "honorary chemical adviser" and was given a small research laboratory across from Hyde Park. In April 1942 Weizmann arrived in the US, invited by the American government, where he stayed until July 1943, contributing to the synthetic rubber programme. Weizmann believed that after the war, UK and its allies would be the chief decision makers on the matter of the future of the Jews in Palestine. The chemical projects he initiated during WWII were designed to curry favour with the leaders of those countries. Weizmann's chemical projects were also oriented towards technological products that could ultimately serve the future nascent State of Israel.

Keywords: World War I, World War II, Military Effort, Chaim Weizmann, Science and Politics

World War II and the plasma fractionation program led by Edwin Cohn (1892–1953) (ID 10)

Elisa Campos *(Nova Medical Shcool, UNL, Lisboa, Portugal)*

For the first twenty years of his academic career at Harvard, Cohn's studies were primarily devoted to fundamental investigations of the physical chemistry of proteins, whose nature was poorly understood at the time. These studies would be of enormous practical importance as the USA prepared for World War II.

In 1940, The National Research Council recognized the need for providing material for blood transfusion for the war effort. It was the hope initially that bovine albumin could be used as 'plasma expander'

for the prevention of shock. With his vast experience with serum proteins, Cohn, in 1941, was enlisted to direct an effort for large scale purification of bovine albumin. He wisely also worked on the isolation of human albumin as well because bovine albumin was never proven safe for humans. This enterprise called into play Cohn's qualities as a leader and organizer who drew together a multidisciplinary team. In the course of this work, fractionation was designed to produce particular components for specific purposes: albumin for transfusion and shock treatment, fibrinogen and prothrombin for clotting problems; γ-globulins for certain diseases.

Reorientation of Cohn's group to the task of isolating a transfusion material gave the laboratory a new mission. Cohn's laboratory sophisticated instruments were used for establishing the standards of purity for serum albumin fraction along with other therapeutic fractions. This unusually effort in a university laboratory was already in full swing, allowing, in December 1941, the shipment of human serum albumin to treat several casualties of Pearl Harbor attack. Impressed, the Surgeon General of the Navy authorized contracts for the commercial use of human serum albumin early 1942. Cohn was the driving force behind the success of the albumin program, driven by the war emergency; close collaboration with the armed forces contributed enormously to the understanding of plasma proteins.

Keywords: Blood transfusion, blood fractionation, serum proteins, serum albumin, therapeutic fractions

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Mathematics during adversity: The turbulent career of Heinrich Löwig 1938–48 (ID 473)

Jan Kotůlek *(VSB-Technical University of Ostrava, Ostrava, Czech Republic),* ***Pavel Ludvík*** *(VSB-Technical University of Ostrava, Ostrava, Czech Republic),* ***Rolf Nossum*** *(University of Agder, Kristiansand, Norway)*

Heinrich Löwig started his mathematical career in 1927 by presenting his doctoral thesis *Über periodische Differenzengleichungen*, devoted to the study of functional equations, to the German University in Prague. Löwig was able to generalize and deepen the investigations of Émile Picard, and his effort in this area resulted in a series of scientific papers published in prominent mathematical journals. During the 1930s, he contributed significantly to the rapid development of functional analysis. Among the leading figures of this brand new field of mathematics were Stefan Banach, Felix Hausdorff, John von Neumann or Frigyes Riesz. Löwig studied and extended some of their results. His investigations were mainly concerned with infinite-dimensional complex Hilbert spaces, and Löwig clarified the concept of separability in this context. Also his works on several concepts of dimension were very well known at the time.

Habilitated for mathematics at the German University in Prague in 1935, Heinrich Löwig was however employed as a professor at a grammar school (*Realgymnasium*) in the small town of Nový Jičín, far from the main mathematical centres of the day.

Nový Jičín was ceded to Germany as part of the Munich Accord in 1938. Löwig, being half Jewish, lost his position and moved to Prague. His attempts to make a living as a *Privatdozent* were thwarted by the German University, and his subsequent attempts to re-establish himself in the UK were unsuccessful, despite positive testimonials obtained from von Neumann, Riesz and others. During the war, Löwig changed his field of study again as he turned his attention towards abstract algebra, especially Boolean rings and the rapidly developing field of lattice theory.

Surviving the war in various labour camps to which he was deported for being half Jewish in 1944, he was again ostracized after the war, being regarded as German by the Czech victors, German being his native language. His efforts to find an academic post in Czechoslovakia, Germany, and Britain were unsuccessful. With substantial support from John von Neumann, he became a professor at the University of Tasmania in 1948, later moving to the University of Alberta in Canada.

Making use of archival sources not available to previous investigators, we are now able to paint a more complete picture of the situation Löwig found himself in as war descended on Czechoslovakia, and later as he struggled to regain his professional footing in post-war continental Europe.

Keywords: history of mathematics, refugee mathematicians, emigration, scientific patronage

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Gleb Wataghin and his Brazilian pupils: Fascism, Second World War and international circulation of scientists (ID 432)

Luciana Vieira Souza da Silva *(University of São Paulo – Faculty of Education, São Paulo, Brazil)*

This talk explores political events regarding Brazil and Italy, from the perspective of circulation of scientists. In the year 1934, a group of Italian teachers was invited to teach at the University of São Paulo, Brazil. The Italian government was leaded by the Fascist National Party (Partito Nazionale Fascista) and one of its policies was the sending of intellectuals to foreign countries. Since 1931, all Italian teachers were obligated to be affiliated members of Fascist National Party, but a lot of them weren't ideologically affiliated. In the year 1942, during the Second World War, Brazil positioned itself in the United States of America's side (the Allied Powers: United States, Soviet Union and Great Britain) and consequently was against the Axis Countries (Italy, Germany and Japan), so almost all the Italian teachers that were working in Brazil were obligated to return to Italy. For instance, the physicist Gleb Wataghin, born in Russia but an Italian citizen, had problems to stay at the University of São Paulo, but after some negotiations he was authorized to stay. Thanks to the rapport between Brazil and United States after 1942 and the aid from scholarships from the Rockefeller Foundation and other agencies, Wataghin was able to send his pupils to other countries. The point of this talk is to explore the idea of science and politics as connected fields, studying both political events in the Gleb Wataghin's life: his relations with Fascist National Party when he was invited to go to Brazil and with the Rockefeller Foundation and American scientists during the Second World War, important events to introduce his group of young Brazilian scientists into an international network.

This study was supported by the grants 2012/24076-3 and 2015/20490-8, from the São Paulo Research Foundation (FAPESP).

Keywords: Gleb Wataghin, Physics in Brazil, Science in a war context, Circulation of scientists

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The influence of the Atomic Bomb project on physics and the political grand alliance (ID 458)

Joseph Kouneiher *(Univeristé de Nice Sophia-Antipolis/ESPE, Nice, France)*

The value of the atomic bomb as potential rather than an instrument of policy was reconized already during the Second World War. But many thought that its impact on diplomacy has to wait at least a demonstration of its power.

"The bomb as a me rely probable weapon had seemed a weak reed on which to rely, but the bomb as a colossal reality was very different." (Henry L. Stimson, the secretary of war, Memoirs)

Others contend that the drapping of not only bring a speedy conclusion to the war with Japan, but also that American leaders understood the potential diplomatic value of the bombs and viewed them as a lever against the Soviet Union. We can particularly stress the implications of Franklin D. Roosevelt's wartime atomic policy decisions. The President recognized the bomb both as a legitimate weapon of war against the Axis and as a possible diplomatic weapon against the Soviet Union.

On the other hand, the atomic project had a profound influence on the nature of physics thinkings, their modalities, secrecy, and most of all the idea of the separation of the theory from experimental work and from reality. On the experimental side, an essential impact to improve of the organisational system of scientific work and, more particularly, to encourage its collective forms.

Keywords: Atomic Bomb, Physics, Changing power, political decision, grand alliance power

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Session 6: Universities and their Political Environments

Chair: ***Ana Simões*** *(CIUHCT, Faculty of Sciences, University of Lisbon, Lisbon, Portugal)*

Universities for the Working Class: Creating New Spaces for Science and Technology in Lisbon (ID 515)

Maria Paula Diogo *(CIUHCT, Faculty of Sciences, NOVA University of Lisbon, Lisboa, Portugal),* ***Ana Simões*** *(CIUHCT, Faculty of Sciences, University of Lisbon, Lisboa, Portugal)*

In this paper we aim at exploring the way intellectuals, mainly scientists, engineers and physicians, staged their action as educators of the working class, in the context of the republican ideals.

In October 1910, Portugal shifted from a constitutional monarchy to ta republican regime, a political change that heralded a new vision for the country as a whole. The republican project was anchored in a new concept of citizenship, in which science and technique were key elements, and which entailed the construction of a "new man." In this context, formal education was deemed critical and a substantial programme of reforms was put forward, together with informal initiatives led by republican intellectuals that considered to be their mission to bring science and technology to the people, thus actively engaging in the creation of the new republican citizen.

A new dynamics of circulation and popularization of science and technology was born supported by an unusually strong relationship between the University of Lisbon and both the Free and the Popular Universities. This active network was not only an intellectual project, but expressed itself in the geography of Lisbon, moving experts from their usual intellectual havens of the faculties of sciences and of medicine to the working class neighbourhoods, and giving the city a new cultural and political identity based on the republican educational project.

Keywords: informal teaching, university outreaching, organic intellectuals

New directions at Mexican public universities regarding the national innovation system (ID 455)

Gonzalo Varela-Petito *(Universidad Autonoma Metropolitana – Xochimilco, Mexico City, Mexico)*

Public higher education in Mexico is in deep transformation since some decades ago. The collision between traditional academic organization and the pressures of modernization and globalization became evident. The Mexican university system is no more an elitist one, but it is neither an institution with a thorough satisfactory achievement of its principal goals at a time when the country is facing the challenge of knowledge society. The documents of educational planning insist on the excessive heterogeneity of this system. Changes produced a hybrid structure, combining features from a period of expansion with those from a period marked by the restrictions in economical and social policies since the nineties of the last century, and by the rise in competition at different economical and political levels, both nationally and internationally. At the same time, the aim to integrate Mexico to the knowledge society demands a massive increase in the educational standards. This is reflected on the governmental policies meant as incentives for higher education, because the improvement in life and work opportunities, driven by productivity rather than by the low cost of labor, require also an effective increase in the education rates of the population. But the answer to this challenges could not come only from above (i.e., government requirements) but instead, from new directions from the universities themselves, aiming to resolve a situation that historically speaking, has not changed but slowly from the end of the last century, when a collective research in which this author participated, mentioned as critical problems at the level of Mexico's graduate education: a) A lack of communication with the science and technology system; b) Programs with insufficient high quality human resources an some of them with limited teaching abilities; c) An inadequate supply of equipment and materials to conduct

research activities; d) Curricula often disconnected from long-term research and relevant information on the labor market requirements.

Keywords: universities, academic planning, Mexico's national innovation system

Democratization and professionalization of Dutch universities in the 1970s and 1980s: the case of the Vrije Universiteit Amsterdam (ID 569)

Abraham Christiaan Flipse *(Vrije Universiteit Amsterdam, Amsterdam, the Netherlands)*

In the early 1970s the universities in the Netherlands were reformed. The pressure to reform came both from the government and from students and staff within the universities themselves. The aim was to decrease the elite character of the universities and to respond to new social and political demands. At the same time the reform was meant to reduce the costs of science and to counter inefficiency and arbitrary spending. A new Act of University Governance of 1970 prescribed a radical democratic structure for all Dutch universities. However, a decade later science and university policy changed again, with increasing roles for market pressure and competition; the democratization of the university was reversed. The changes of both the 1970s and 1980s, resulted in professional management structures and an increase in bureaucracy (cf. Baneke 2014).

In my paper I will focus on the case of the Vrije Universiteit ('Free University') Amsterdam, a Protestant-Christian University, founded in 1880. Since its foundation, this university had been permitted more autonomy than the other Dutch universities, resulting, among other things, in a deviant governance structure. Although its identity had changed considerably – from a strictly Calvinist university in 1880 to an open, ecumenical Christian university in 1970 – it still had a distinctive Christian character in the early 1970s. However, from the 1970s this changed quickly. Both the processes of democratization and professionalization had such radical consequences that in the course of two decades, the university almost completely lost its distinctive character. This paper analyzes how the forces of university governance changed the identity of the Vrije Universiteit Amsterdam, and of Dutch universities in general.

Keywords: University history, Student movement, Christian university, democratization, professionalization, governance, science policy, the Netherlands, 1970s, 1980s

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Session 7: Women and Science in Different Political Environments

Chair: ***Olga Elina*** *(Institute for the History of Science and Technology, Russian Academy of Science, Moscow, Russian Federation)*

Early modern narrations concerning the roles of women to be involved in scientific experimental research (ID 536)

Yu Cheng Lin *(Ludwig Maximillian university of Munich, Munich, Germany)*

As history shows, early modern period was a wondrous epoch, where learned man dominated the scientific communities alongside with their (heroic) rational approach (**Easlea: 1980**). Nevertheless, it was also a conflicting period, filled with episodic events of revolutionalising the Aristotelian view of nature, into a Newtonian and Copernican view of nature.

My research should solely focus on the narrations of women, in particularly, comparing them with the written works of the learned men in the early modern period, especially relating the formulation of misogynic notions resulted by unintentional academic discourse, that deliberately creating a preferential male dominant research environment, to attain the agenda of advancing the rationality of mankind. The historiographical works relating to the subjugated gender of women, were often not only lacking the primary sources as reference from women's perspective, and also usually one –sided from male narrators solely. As consequence, an unfavourable condition that refraining the learned women from pursuing or establishing "scientific research" as a profession, or even hindered these learned women to enter professional body of intellectuals.

An such misogynic example, *Henry Oldenburg (1619–1677)**[1]*, a German natural philosopher, and his narrations concerning how women should not be involving in Royal Society In London, were been selected. In contrast to England on Continental Europe, I also draw narrations from *Gottfried Leibniz (1646–1716)*, showing his positive contribution towards The **Royal Prussian Academy of Sciences** (*German: Königlich-Preußische Akademie der Wissenschaften*) and **Acta Eruditorum** as public sphere to exchange genuine ideas. I will also be reviewing the narrations from *Gottfried Kirch (1639–1710)* and *Maria Winckelmann (1670–1720)**[2]* [3]. Whom were known as the pioneer of German astronomical researchers? And evaluate the general opinions on women from other practicing male peers. Lastly, propose some possible explanations to justify, what could be the difference between England and Continental Europe, verify Brian Easlea's assertion the misogynic notions in England indeed more detrimental for the women to pursue her scientific career.

By embarking on this research proposal, I seek to understand the Zeitgeist in the 17th male dominated scientific community. In addition, to explore the similarities and differences concerning the participation of learned women of the scientific community, through examining the contributing sources from Anglophone and German speaking collaborators. Hence, by locating the progenitors of misogynic ideas resulted by academic discourse, could provide a more plausible explanation, to account for the scarcity of learned women embarked scientific endeavour during this period.

Keywords: Science and Sexual Oppression, Seventeenth Century, Maria Winckelmann, Germany

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Fighting for Equality: Scientists and Suffragettes in World War One (ID 437)

Patricia Fara *(University of Cambridge, Cambridge, UK)*

During the summer of 1914, British suffragettes became increasingly militant and the nation's attitude towards the status of women was divided. Immediately war was declared in August, suffrage societies stopped fighting for the vote, but gained support by committing themselves to defending their country. In the absence of men, female scientists and doctors were temporarily able to take over powerful positions that had previously been denied them. Best known are the many thousands of women who operated the munitions factories that literally generated Britain's military power, but this paper focuses instead on a significant but neglected group: scientific women with a university education. At home, female scientists began running museums and lecturing students, as well as carrying out research into wartime essentials – explosives, poisonous gases, drugs, optical glass, coal. Although spurned by the War Office, all-women medical teams went abroad to save lives and introduce public health measures not only along the Western Front but also in Serbia, Greece and Russia. When the Women's Auxiliary Army Corps was set up in France, its commander was a London botany professor. By the end of the War, suffrage campaigners had secured the vote for many women over thirty. But although they had achieved political power, female scientists and doctors in positions of authority had little option but to resume their former subordinate positions. They had proved their capabilities, but were still not treated as professional equals.

Keywords: women, war, suffrage, universities, medical schools, twentieth century

Research of Lithuanian plant physiologists during the Cold War (ID 493)

Aurika Ričkienė *(Nature Research Centre, Vilnius, Lithuania),* ***Jadvyga Olechnovičienė*** *(Lithuanian Academy of Sciences, Vilnius, Lithuania)*

After WWII Lithuania became a part of the Soviet Union, which meant that all spheres of life in Lithuania were changed accordingly to the mode of the Soviet Union. In the first years after WWII the scientific research in Lithuania was planned by the Communist Party; it mostly aimed at solving country's economic problems.

Alfonsas Merkys was perspective graduate of Vilnius University. In 1953 he was sent to Moscow University, Department of Biology and Soil, for his doctoral studies. Merkys was offered to investigate the causes of cereals lodging and thus to solve food problems. In 1957, he obtained his PhD, which argued that cereals lodge for the main reason: plant reaction to gravity.

In 1957 the Soviet Union started its space programs. Merkys's field came under particular attention of the higher authorities of the Soviet Union because the Soviets were interested in developing agriculture in outer space. Under these circumstances, Merkys entered the Space research programs. From 1971 to 1990, his team performed experiments with plants in Soviet space shuttles and space stations. They found out that plants are able to transact full life cycle under microgravity conditions. In addition, Lithuanians investigated mechanism of plant hormone auxin action in plant during its growth, development and reaction to gravity and then, created analogues of physiological plant growth regulators and developed its application in agriculture.

Our presentation will explore how in spite of being under Soviet occupation, during the Cold War period Lithuanian plant physiologists achieved remarkable results and became well known scientists in the World. Together with the main topic we will briefly review the contribution of women to research in Merkys's laboratory[1], because female researchers were active scientific co-workers and did considerable work in the field however, their work is imperceptible and unexplored.

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Keywords: plant physiology, women, Lithuania

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Session 8: Power Issues in Science and the Theory of Science

Chair: ***Michal Kokowski*** *(Polish Academy of Sciences, Krakow-Warsaw, Poland)*

The structure of power in the scholar body of Mexican program of methodology of science (ID 595)

Luis Mauricio Rodríguez-Salazar *(National Polytechnic Institute, México, Mexico),* ***Carmen Patricia Rosas-Colín*** *(National Autonomous University of Mexico, México, Mexico),* ***Joel Ángel Bravo Anduaga*** *(Monterrey Institute of Technology and Higher Education, México, Mexico)*

The origin and development of disciplines, has much to do with the origin and development of academic communities in institutions, which encourage or impede the academic interest in all fields of knowledge. In this paper we present our epistemological reflection in the case of the institutionalization of the Master of Science program in Methodology of Science (MSMS) at the National Polytechnic Institute in Mexico. Thus, the proposal of Kleiche-Dray, Zubieta García & Rodríguez-Sala (2013) about Institutionalization of disciplines is the framework of our analysis about the day by day in academic bodies in which academic profiles is mixed with affective ties creating disputes between them. This creates political and administrative circumstances in the dynamics of the institutions, which take to a political-ademic debate. In this paper we propose that the political-ademic debate (Irure, T., 2002) in the program of methodology of science is due to the different conceptualization of the scholar body about methodology. The discussion its conceptualization research methods or methodology of science, in which the Latin triad *logos metha, odos* (λόγος μετά ὁδός) is involved (Rodríguez-Salazar & Rosas-Colín 2016).

This conceptual difference between research methods and methodology of science, is what has become a politics struggle in the scholar body, in which the majority of scholars, which has always been in favors teaching research methods, it is what has defined the policy in the structure of the curriculum of our MSMS program. This combination of policy and politics has permeated the path of the program that we discussed in this paper. Another problem that has prevailed is the absence of researchers with training and/or experience commensurate in methodology of science, in addition to the problem that has been teachers who are not active researchers in any field. Based on the above stated, we analysed the scholars of MSMS as actors in the structure of power in the political-academic debate from its origin throughout its 30 years of live, that we are developed in the recent years.

Keywords: methodology of science, political-ademic debate, scholar institution, scholars as structure of power, logos metha, odos, λόγος μετά ὁδός

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Influences and powers at play in experimental research (ID 587)

Isabel Serra *(University of Lisbon, Lisbon, Portugal)*

In science, the issue theory vs. experience has been contaminated by myths and ghosts influencing the social image of science at various levels of evaluation, particularly among decision-makers and power holders. The history and philosophy of science from Francis Bacon to the present time, allows detecting misconceptions and prejudices which over time affected thinking about science activities, such as the idea that there is a hierarchy between doing theory or experimentation.

In this communication we intend to illustrate, through examples from the history of science, some of the beliefs and myths constructed concerning the influence of the decision-making power over the development of scientific experiments. A nineteenth century case that we consider paradigmatic – the experiences with discharges in gases – will be treated in more detail.

There are a variety of different reasons that make the gas discharge a privileged object for analysis of the relationship between science and the powers that influence scientific research. First, understanding what happens in a discharge took several centuries to be achieved. Nevertheless, long before the understanding of theories involved, discharges were used in successful scientific experiments. In addition, its development has enabled major progress in research in micro-physics, and in the applications of science too. Finally, the uses of discharges for scientific purposes are also examples of competitiveness between countries both from the technological point of view and from the interpretation of the experiments.

In sum, the presentation will show how talking or writing about scientific experiments requires recognizing various fields undermined by the preconceived and contradictory ideas of the scientific environment and the general social and historical atmosphere.

Keywords: Experimentation vs Theory, Gas discharges, misconceptions and prejudices about science activities

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Negotiating Power in the Public Communication of Science (ID 560)

Mircea Sava *(University of Bucharest, Bucharest, Romania)*

The construction of the public status of science has always been a crucial ingredient in the complex network through which science asserts its power in society. The common scenario in this respect has traditionally been that a privileged social status for science is not only a source of credibility, but it also entails more straightforward advantages, such as power over resources and funding for the scientific endeavour. This paper aims to highlight the evolving ways in which the scientific community gradually understood communication as a main instrument for maintaining power, in the second half of the 20th century. From C. P. Snow's *two cultures* debate, to the Sokal Affair and the *science wars*, there has been a struggle over power that may be seen as a communication gap between science and society. The attempts to fill this gap eventually gave rise to the development of the Public Understanding of Science movement (PUS) in the 1980s and later to the more dialogical models of Public Engagement with Science and Technology (PEST) or Critical Understanding of Science in Public (CUSP), in the 1990s. Acknowledging the importance of communicating scientific research to the public was the key element which led to a revival of popular science at the end of the 20th century, for which the two-

way, symmetrical approach of communication was the main goal. The perspective of a popular message which is fully controlled by the scientist, programmed to the smallest details, gives way to a potentially contradictory way of reception. The public can compose its own meanings from the alternatives offered by popular science produced by professional science communicators. The positive attitude towards science and the recognition of its privileged social and epistemic position, which make up the intended message of the scientist, are equally preserved. Power is a product of meaning negotiation in the contemporary public communication of science.

Keywords: science communication, science and society, public understanding of science, two cultures, science wars

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On the meaning of Francis Bacon's supposed motto 'Science is power' and its relevance today. (ID 446)

Gustaaf Cornelis *(Vrije Universiteit Brussel, Brussel, Belgium)*

The adage 'Science is power' is generally attributed to the seventeenth century English philosopher Francis Bacon. However, nowhere in his writings can this phrase exactly be found. In his Meditationes Sacrae he did write 'ipsa scientia potestas est', but he indisputably talked there about God's wisdom and power — which clearly concerns an altogether complete different meaning than what is nowadays understood by the decontextualized saying 'science is power', understood by many as 'knowledge leads to submission'. In his Novum Organum Bacon wrote about the relation between science and nature. That relation is not straightforward at all, as if — simply put — scientific knowledge necessarily implies control over nature (or any part of it) let alone other people. For Bacon this complex relation regards the individual scientist, science, society and nature, and not a controlling relation between two individuals. In his fictional story Nova Atlantis it becomes clear what he meant. Following a strict scientific methodology, based on induction, through (repeated) experimentation and teamwork, scientists are able to discover the laws of nature. Experimentalists must obey nature, since only those phenomena can occur which are natural; i.e., only what is physically possible can be made explicit. This implies humility from the part of humans towards nature. The purpose of knowledge is "for the benefit and use of life […] not either […] for superiority to others, or for profit, or fame, or power, or any of these inferior things." For Bacon, man can gain power through knowledge, but power cannot be the reason to perform knowledge, nor does it concern the plain idea of dominance over nature or a fellow human being. In my presentation, I will not only analyse the Baconian meaning of the words in question (and set the record straight for that matter), but also look into the relevance the Baconian interpretation can have for the (different) ways we perform science today. During those 400 years motivations changed in directions opposite to the Baconian ideal. Nowadays, scientists are sloppy from time to time and some even commit fraud in order to strengthen their academic position. Not publication pressure but the academic culture and career stage lead to scientific misconduct and non-science. Can Bacon inspire us enough to change the academic culture once again and to perform science only to gain understanding for the benefit of all? Or are we merely interested in the subjugation of others (our fellow humans and academic peers) and the subjection of nature through science?

Keywords: Francis Bacon, Science ethics, Scientific integrity

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Session 9: Science, Politics, and Issues of Race and Ethnicity

Chair: ***Danielle Fauque*** *(Université Paris Sud, Orsay, France)*

American anti-Immigrationism in the Years of the post-Darwinian Debate (ID 555)

David Ceccarelli *(Università di Roma, Rome, Italy)*

Several scholars have emphasized the intermingling of scientific and extra-scientific discourses that featured the American debate on evolution between the nineteenth and the twentieth century. Further, it has been suggested that American naturalists often gave rise to a dialogue among scientific, meta-physical and social issues in their works. Yet the way such a dialogue occurred was as complex as the epistemological and theoretical framework of evolutionary biology in the years of the post-Darwinian debate. This proposal aims at analyzing the evolution of the anti-immigration issue in the American scientific discourse between the Post-Civil War Era and the first decades of the twentieth century. The topic will be framed by considering the transformation of the anti-immigration arguments along the works of two of the most prominent American evolutionists of their own generations: Edward Drinker Cope (1840–1897) and his pupil Henry Fairfield Osborn (1857–1935). Though being well-studied in literature, Cope's and Osborn's anti-immigration arguments will be critically rethought in consideration of the theoretical shifts between their interpretations of the causative factors of racial differences. In particular, the contribution will try to show that, though Osborn moved from Cope's pure morphological explanation of racial inferiority and reshaped his evolutionary view in the light of genetics, their anti-immigration arguments remained centered on the idea that the development of some human types occurs within internal constraints which undermine their adaptivity, intelligence and social value. By examining Cope's and Osborn's contributions in the American debate on immigration, and retracing their public activities as "conservative" scientists, this proposal will try to inquire the extent to which the defense of anti-immigration instances changed in structure as a consequence of the changing structure of the biological views.

Keywords: scientific racism, eugenics, immigration history, evolutionary theories, post-darwinian debate, Darwinism, Lamarckism, Edward Drinker Cope, Henry Fairfield Osborn, history of biology

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Trend Analysis about the Ethnobotany in a Certain Political Context (ID 548)

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The denationality and deregionlism are the main problems in the ethnobotanical research in China. Most of the researchers were agree that the process, in which the knowledge developed from regional practices to scientific standardization step by step, is reasonable and helpful to increase the scientific level of the ethnobotany. However, is ethnobotany without nationality and the regional characters still can be regarded as ethnobotany?

The ethnobotanists got the knowledge of the local plants with local cultural characters from the local people's words in the field research. But the relationship analysis between the local people and the plants are replaced by the scientific analysis of the chemical composition of the plants after the researchers went back their research lab. In the lab analysis process, the national cultural of the plants, the local people's living style, and social characters are all ignored. The life wisdom and experiences of local people are dissociated, and only the nutrition and the new resource's development and usage are being researched in the analysis process. Such researches are against the basic aim of trying to find and preserve regional plants out of the book knowledge, and also against the aim of trying to find the pluralism and cultural diversity of the knowledge. Furthermore, such research has also brought the problems of denationality and the infringement of the local people's rights and the benefits.

In this paper, the usage of the national power, the involvement of the government and the enterprises, the science and study system's running mechanism, and the effect of the scientists, scientific research institutions towards the research trend about the ethnobotany are studied when we put above problems are put into a certain political institution context. The Inner Mongolia ethnobotany research situation is chosen as a case to expand our analysis in this paper. This study has important theoretical and practical significance to the development of the ethnobotany and making better understanding towards the relationship between the science & the political institution and the power.

Keywords: Political Institution, Ethnobotany, Knowledge of the Plants, Nationality, Power

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Session 10: History of Medicine

Chair: ***Pradipto Roy*** *(NIMHANS (National Institute of Mental Health & Neurosciences), Inst. of National Importance, Bangalore, India)*

Subaltern Healing and Indigenous Agencies in Therapeutics: The Many Worlds of Pharmacy in Colonial South Asia (ID 580)

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This paper goes through the rhetoric of pharmacopoeias, medical manuals, vernacular treatises and drug committee reports in nineteenth and early twentieth century south Asia to explore the changing trajectory of codification of therapeutic knowledge in south Asia. The collective and cumulative efforts to assert identity through scientific enterprises was a key feature of nationalism in late nineteenth and early twentieth century south Asia, and this paper problematizes that scenario to unravel the complex power-dynamics towards making of a nation, its scientific community and their myriad approaches to science.

Formal exchanges between western and south Asian healing practices can approximately be dated to sixteenth century, with the arrival of Portuguese in India. By the end of seventeenth century, the fame of Indian medicine reached Europe, mainly through translation works of European physicians. The initial decades of British East India Company too witness considerable interest of its medical officers in indigenous medicines. This paper traces the chequered history of indigenous medicine throughout nineteenth century, and shows how by the end of the century, this plurality in indigenous medical markets, was being perceived with increasing suspicion by the colonial government. Being attached to several indigenous revivalist movements and local entrepreneurship, the Indian practitioners reacted to the colonial government's drug policies. The international exhibition of indigenous drugs, arranged by Indian practitioners in the 1880s, became a huge success. The first meeting of the Indian Medical Congress in 1894, was concluded with the set up of 'Central Indigenous Drug Committee', the enquiry of which led to publication of three reports for the period 1896–1916. Prompted by these, the Government had to set up the 'Drug Manufacture (Edward) Committee (1919–23)', 'Medical Organization (Fletcher) Committee 1928' and 'Drugs Inquiry (Chopra) Committee (1930–31)', none of which however, recognised the indigenous drugs beyond sympathy.

By the early twentieth century, the high milieu of nationalism and *Swadeshi* movement, got intertwined with entrepreneurship in indigenous drugs manufacture and marketing, and by attempting case studies against that backdrop, this paper challenges the insular local spatiality of the indigenous healing traditions. In conclusion, I emphasize the need to trace the horizontal connections in medical pluralism, research and entrepreneurship, against consumer medical market and socio-political backdrop, rather than inventing tropes and traditions of indigenous medicines.

Keywords: plural medicine, pharmacology, chemistry, clinical trial, heterotopia, medical education, indigenous medicine, bio-medicine, subaltern medicine, daktari

State of competition: conceptual shoehorning behind priority on calcitonin precursor biosynthesis (ID 421)

Enrique Wulff-Barreiro *(Consejo Superior de Investigaciones Científicas, Cádiz, Spain)*

The breath of Spanish exile was a central element in shaping research directions concerning endocrinology diffusion in Spain after 1939, which occurred differently from in Britain or Austria. The purpose of this communication is to exhibit a concrete case of a generation facing as an original aspiration to work simultaneously in science and politics, and the professional roles of biological researchers in the 1970s, under the historical parameters of molecular endocrinological research. The fact was that, at

that time in Spain, all research on the endocrine glands was directed to the service of clinical medicine, and that the development of the investigation worked in opposite direction to the firm beliefs of Juan Negrín. The real problem was not the sharing of information, or the control of scientific work, but the purely political problem of exile. Vain theories and even errors of the over-zealous clinicians slipped under the radar. At the core of these deficiencies was the abolishment of the political unity. That can only exist if the great scientists stand together. Without the generous solidarity and sense of universality (intentions of re-establishment of democracy in Spain) on the part of the Republican exile, the institutionalization of this specialty (endocrinology) followed a model which has been handed down in a limited quantity of printed materials. Because the pro-calcitonin literature on 1974–75 was concerned with the intellectual unity of an overarching co-authorship network during the "sixties" period of the Spanish biochemistry, it is discussed here that this discovery mobilized a research effort which was not duly recognized. The problems specified by the discovery of the precursor of calcitonin biosynthesis are very difficult to break away from the political moulds which faced the research in this field.

Keywords: Scientific priority, History of biochemistry, Calcitonin, Bibliometry

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The Science of "super-pleasure": Insatiability, Self-Stimulation, and the Post-war Brain (ID 7)

Otniel Dror *(The Hebrew University of Jerusalem, Jerusalem, Israel)*

"recently discovered is a region within [the hypothalamus]…which on stimulation gives rise to a strongly pleasurable sensation. …Evidently all the desirable things in life are desirable only insofar as they stimulate the pleasure center. To stimulate it directly makes all else unnecessary."

Isaac Asimov, 1965

In 1954, James Olds and Peter Milner discovered pleasure in the brain of a laboratory rat. Pleasure, which had been ostracized as a nameable experience by the behaviorist sciences and which had been de-ontologized during the early twentieth-century as merely *aponia*—as *only* an absence of pain, returned with a vengeance. The return of pleasure inaugurated a major transformation whose repercussions and off-shoots are very much still with us today, including the development of a neurophysiology of decision making, risk taking, addiction, affective neuroscience, and more.

In this presentation, I will focus on the first decade or decade and a half of the discovery of this new super-pleasure. This early period was characterized by multiple models and hypotheses, incongruent and conflicting terminologies and ideologies, and by an intensive empiricism. I will reconstruct the laboratory enactments and models that constituted this new pleasure as "supramaximal," instant, and insatiable. I will argue that "pure" "supramaximal" "super-pleasure" was the immediate product of experimental enactments. These enactments of the laboratory made pleasure and made it supramaximal. The laboratory construction of an instantaneously-produced insatiable self-perpetuating super-pleasure captured the imagination of contemporaries and of generations to come. I will briefly discuss the reactions of philosophers, legal scholars, psychologists, journalists, fiction writers, movie producers, investigators, and clinicians to the new discovery. One of the major preoccupations was where to position the newly discovered super-pleasure in the social and natural orders.

Keywords: History of Pleasure, History of the Brain, History of Emotions, Laboratory praxis, Recent Science

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The waste crisis in Campania, South Italy: a historical perspective on an epidemiological controversy (ID 436)

Roberto Cantoni *(Ecole des Ponts ParisTech, Paris, France)*

For eight years, between 2001 and 2009, the South Italian region of Campania and its state capital, Naples, have repeatedly hit the headlines of national and international newspapers and tabloids for one main reason: the waste disposal crises that on many occasions filled up the streets of the city with huge piles of garbage. During the most acute phase of the crisis, between 2004 and 2008, the media brought to light an extremely pronged network of subjects interacting in complex ways: national and local politicians, the Campanian mafia, entrepreneurs from North Italy, activists and groups of experts (engineers and epidemiologists). What soon emerged as the main bone of contention of the crisis regarded the health of Campanian citizens, particularly in relation to the presence on the territory of landfills and incinerators. What the risks for health and the environment actually were, whether the construction of incinerators would solve the problem of an excess of waste, and who was entitled to address and answer to this problems, resulted from an epidemiological debate that took place along the political and governance crisis. The debate mainly opposed a group of governmental epidemiologists, who considered the absence of any certain causal link between health and landfills as a proof of absence of any health effect, to another group of epidemiologists who, in the presence of a growing body of evidence of such causal link, tried to persuade the government of the need of specific programs to target the affected population. This paper investigates the complexity of the epidemiological debate, through an analysis of a debate that was mainly staged on the official review of the Italian Epidemiological Association, but which deeply involved a number of opinion-leading newspapers as well. In my analysis I stress the ambiguous nature of the construction of medical knowledge, and the ways in which scientific uncertainty regarding the existence of causal links between landfills and health was used in the production of knowledge and ignorance by different Italian medical agencies.

Keywords: waste management, Italy, epidemiology, agnotology

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Session 11: Power Issues in the History of Psychiatry and Psychology

Chair: ***Josef Řídký*** *(Charles University in Prague, Faculty of Arts, Prague, Czech Republic)*

The Privilege of Being Tested? Administering the Rorschach Inkblot Experiment Among Delinquent Girls, 1938–1949 (ID 335)

Saskia Bultman *(Radboud University Nijmegen, Nijmegen, the Netherlands)*

From 1938–1949, each pupil entering the Dutch State Reform School for Girls had to take the Rorschach inkblot test. At the time, the Rorschach was viewed as a "projective test": a test that supposedly uncovered what was hidden in the mind of the test subject. While the Rorschach has mainly been described as development within the history of psychology, recently, historians of science have examined it as a technique that produced new notions of self (Galison 2004, Lemov 2011). While informed by the "practice turn", these and related studies (Nelson 2011, Miller 2015) do not concentrate on the practices of testing, or the contents of the resulting test reports. This paper looks inside the dossiers of the pupils, therefore, to investigate how the Rorschach was administered, and what was written in pupils' Rorschach reports. Examining scientists' practices and rhetoric in conjunction reveals a striking disconnect between the two: while administering the Rorschach was a lengthy, complicated procedure, the psychologist's rhetoric barely leans on the testing practices at all. After examining this disjunction, the paper investigates a key feature of the reports' rhetoric: the enactment of the girls as individuals with inner depth. First, it shows that this notion, central to modern identity concepts, is fundamentally rhetorical in nature. Second, it explores the privileges and disadvantages this rhetoric brought with it. On the one hand, girls who were ascribed inner depth were viewed as complex and "re-educable". On the other, however, this rhetoric presupposed the expert's ability to see below the girls' surface and know what was best for them, thus guaranteeing the exercise of disciplinary power. Conversely, pupils who were thought to lack inner depth were viewed as hopeless, and could be transferred to stricter institutions. Through this approach, this paper thus explores how being tested had benefits *and* limitations.

Keywords: Rorschach, Projective testing, History of psychology, Self, Interiority, Discipline, Practices

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Developmental Psychology: Power Beneath Scientific Method (ID 591)

Josef Řídký *(Charles University in Prague, Faculty of Arts, Prague, Czech Republic)*

This paper focuses on Czechoslovak and Czech developmental psychology of the second half of the 20th century and its equivocal relationship to power. Although medical sciences such as developmental psychology are grounded on hard sciences such as, in this case, physiology, endocrinology or sexology, as well as on exact methods of observation, experimentation and statistic quantification, they can be, nevertheless, questioned for insufficient objectivity – at least in comparison to natural sciences – and criticised for unconscious adoption of period prejudices, whereas another time they can be seen as a mere instrument of propagation of prevailing opinions and beliefs, as recent researches suggest (see

Foucault 1961, Laqueur 1990, Burman 2008, Dorlin 2009). Based on this knowledge, this paper tries to answer the question "How does the developmental psychology rank here?"

This paper demonstrates how Czech(oslovak) developmental psychology was adopting values, attitudes and concepts of the era and how it was justifying them using hard science methods. Through examining major texts of the key figures of Czech(oslovak) developmental psychology (Příhoda, Vágnerová, Langmeier, Říčan) and with respect to neighbouring disciplines (such as gerontology or adolescent sexology), this paper exposes how diverse scientific notions can be used to prove culturally conditioned imaginations or even to disgrace ways of acting and thinking. Through the times, Czech(oslovak) developmental psychology was gradually adopting the latest scientific methods, e.g. principles of behaviourism, Darwinism, endocrinology, ontogenesis, psychology as well as of anthropological surveys, and it was integrating them into highly biased quasi-scientific conceptions. All this was done with the purpose of asserting rather stable ethically contingent persuasions. This paper traces how these methods were changing throughout the decades, so as to maintain hard sciences semblance despite the fact that unchanging major conclusions of the science resemble a product of a time rather than a coherent scientific thesis.

Keywords: developmental psychology, Czech science, Czechoslovak science, medical sciences, method, ideology

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Session 12: Perspectives on Politics, Power and Knowledge from Chinese History

Chairs: ***Jiří Hudeček*** *(International Sinological Centre, Prague, Czech Republic),* ***Václav Laifr*** *(Charles University, Prague, Czech Republic)*

The establishment of the first regime and a large-scale survey in early China (ID 509)

Fengxian Xu *(Institute for the History of Natural Science, Chinese Academy of Sciences, Beijing, China)*

According to various classical Chinese literatures, at the beginning of the Xia Dynasty, the earliest dynasty in Chinese history which began in the 21st century BCE, a large-scale survey was carried out and the distances of the earth were measured from east to west and from north to south. Many literatures mentioned the distances of "the earth". Another classic, Shangshu Yu gong, or the Chapter of the tribute of Yu in the Book of Documents, recorded that Da Yu (Yu the Great), the first king of the Xia, set up a system called wu fu, or five fu, which was a kind of tribute system stipulating local tributes according to their distances to the centre of the Xia. The distances of each fu to the centre of Xia were given. Comparing literature records and real distances on Eurasia continent and the control area of Yu the Great, this paper concluded that the distances of the "earth" recorded in literatures conform well to the real east-west and north-south distances on the Eurasia continent taking the capital of Xia as the centre of the measurement, and the distance from the east edge to the west edge of the outmost fu conform to the real control area of King Yu.

It was a hard task to carry out such a large-scale measurement. It happened just on the turning point from prehistory to the establishment of the first regime in China. Archaeological findings show that just at this time large walled-cities, palaces, and even a grand astronomical observatory were built. To know "the range of the whole world" was not only an ideological need, but also a necessity of cultural development. The measuring scheme of east-west and north-south was based on the earlier astronomical observations and the cosmology which endowed special meanings to the four cardinal directions. In ancient Chinese literatures "the four seas" were often used to describe the whole world, which was the reflection of this early survey.

Keywords: early China, Xia Dynasty, first regime, large-scale survey

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The Transition under Emperor's Enthusiasm: The Sinicization of Tapestry in Song Dynasty (ID 324)

Wei Chen *(Institute for the History of natural sciences, Chinese Academy of Science, Beijing, China)*

Tapestry in which weft yarns are typically discontinuous is a form of textile art deriving from east Mediterranean since about 3000 years ago, within the technological tradition of usage of vertical loom. The wool tapestry textiles have been found in northwest border of ancient Chinese cultural zone such as Lop Nor, Altay and Tuyuhun which dates between the second millennium BCE to the sixth century

CE. The silk tapestry textiles discovered in Dunhuang which can date back to seventh to tenth century CE were mostly used as sutra streamer or belt of Buddhist scripture roll.

The author uses the term "sinicization" to refer to the process that tapestry was integrated into Chinese weaving tradition. It consists of several aspects. Firstly, the tapestry textiles were manufactured in traditional areas of Chinese culture such as Yellow river basin and by Chinese weavers. Secondly, the tapestry was seemed as an important component in traditional Chinese weaving systems, even was viewed as original instead of exotic technique. Thirdly, the tapestry textiles presented the traditional Chinese style patterns. With these standards, it was the *Jin* made on pattern looms can be considered as of first important form in Chinese weaving tradition.

The sinicization of tapestry was not accomplished until the last years of North Song Dynasty (960–1127 CE). Base on the surviving silk tapestry textiles and the perspective of art history, this paper argues that "sinicization" had close contact with the aesthetic trend led by the literary pursuits emperor, Huizong (reign in 1102–1125 CE). Huizong appreciated the extremely sophisticated style of painting, which adapted the artistic expression of silk tapestry. At that time, The artisans of tapestry often kept company with the court painters who served in "Han Lin imperial painting house" established by emperor. On the part of material cultural, the painting in court mainly drew on plain weaving silk (*juan*), so the carrier of painting and tapestry weaving were same and some patterning skills were universal. All in all, the tapestry obtained lofty position besides using in ostentatious dress among weaving forms in Song Dynasty, was a process of connection with Chinese elite and art tradition.

Keywords: tapestry, north song dynasty, sinicization, Huizong Emperor, Zhu Kerou, the painting of flower and bird

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Measuring the Heaven and Earth: Antoine Thomas (1644–1709) and His Scientific Activity in China Revisited (ID 542)

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In the past two decades, scholars paid great attention to scientific activities at the Kangxi court. In introducing European science into China, the Jesuits played a crucial role. In 1995, I pointed out that Antoine Thomas (1644–1709) was the first European Jesuit who introduced algebra (Jiegenfang 借根方) into the imperial court. Later, after having compared Chinese mathematical work Suanfa zuanyao zonggang 算法纂要总纲with Antoine Thomas' Synopsis Mathematica, I found that the Chinese version was based on the Latin version, which was used as a textbook for the Kangxi emperor. In addition to mathematical work, Antoine Thomas also played an important role in the map-surveying in 1702. In this paper, I would like to discuss about Antoine Thomas' activities in the map-surveying based on both Chinese and European sources and analyse why his Synopis mathematica was used as a basis for the map-surveying in order to satisfy the Kangxi emperor. This will provide us a new perspective to understand the complicated social context why map-surveying was launched in early-eighteenth century China.

Keywords: Antoine Thomas, Chinese imperial court, the Kangxi emperor, map-surveying

The Power Structure of Science Translation in the late Qing Dynasty: A Case Study on the Translators group (ID 518)

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The article focuses on the group of translators included of Xu Shou (徐寿) and Hua Hengfang (华蘅芳) who are the earliest translators in Kiangnan Arsenal. The group of translators in this article refers to the people consisting of a particular relationship. The works translated by the group account for nearly 40% of the total translations in Kiangnan Arsenal. So it is of representative to science translation in the late Qing Dynasty. This article discusses the reasons of formation of the group of translators and their translation activities in Kiangnan Arsenal. Through the investigation of Hua Hengfang's family and its relations with Xu Shou, it comes to the conclusions that Hua Yilun (华翼纶), Hua Hengfang's father who is county magistrate of Yongxin in Jiangxi province, played the most important roles in the formation of the translation group and established a bond between the group and Tseng Kuo-fan (曾国藩)who pioneered the Westernization Movement. By studying on the group translations and their activities, it also indicates that translation activities of the group in Kiangnan Arsenal not only reflects the ideas of the Westernization Movement, but also shows the interaction between the translators group and Tseng Kuo-fan et al. In a word, the persons in different levels structures of powers have different effects on translation activities, which has heavy impacts on the developmental direction of science and technology in the late Qing Dynasty.

Keywords: translators group, Hua Yilun, Hua Hengfang, Xu Shou, Tseng Kuo-fan, power structures, late Qing Dynasty

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On Tseng Kuofan's Thought of Science and Technology (ID 460)

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Tseng Kuofan has been known as a distinguished strategist and politician in modern Chinese history, as he initiated the well-known Westernization Drive under the framework of which he organized and participated in a series of science and technology practices. The present article, based on Tseng's biographical sketch and historical documents, intends to explore Tseng's thought of science and technology embedded through his series of science and technology practices, which includes: adapting advanced western equipment, establishing modern arsenals to manufacture machineries, setting up translation agency to translate scientific and technological works, sending students overseas to receive benefits from western education of modern civilization and promoting new-style science and technology education to cultivate local science and engineering talents. After that, the paper concluded the characteristics of Tseng's science thoughts, which is opening, complexity and systematicness. Meanwhile the discussion of the thesis indicates that Tseng's success is twofold: being militarily and politically empowered, and creating favorable conditions through his social and political influence. As an influential politician and strategist in Chinese history, Tseng Kuofan has contributed to the development of science and technology in modern China. He acted as a stimulating force in advancing science and technology of modern China, and his thoughts and practices of science and technology have laid a

good foundation for the development of science and technology in the initial stage of modern China and for the modernization of China in the history of the world.

Keywords: Tseng Kuofan, science and technology, practices, thoughts

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Observing with Precision: Geographical Survey and State Formation in Republican China, 1911–1949 (ID 501)

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Observing with Precision understands the connection between geographical survey and modern state politics in a particular context of the historical transformation of China from an empire to a nation. It focuses on the role of topographical, route, and cadastral surveys, as techniques of precise measurement, in mediating between geographical knowing and political changes. Specifically, it shows that the measurement, demarcation, and classification of the land provided the rationale and means for scientific and administrative authorities to jointly define the "spatial fix" of the national territory. Geographical technology was an agent of modern mentalities and the territorialization of control.

The technique of precise measurement is exposed as a social artifact. There was a close interplay between the gradual unfolding of surveying technology within the social context, and the process in which a centralized authority gradually replaced the non-territorial authorities of race, place, and historical lineage. Indeed, the surveys were concerned with resolving the tension between the commitment to precision and structural constraints (e.g., financial difficulties and local resistances). Examining this process helps identify the temporal correspondence between the shifting local-central power relations and the shifting scientific convention for standardizing the knowledge gained through technology to facilitate spatial extension.

Keywords: triangulation, mathematical reasoning, geographical knowledge, nation building, twentieth-century China

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"No Science, No National Defense": The Historical Impact of the national defense science movement of China from 1941 to 1949 (ID 508)

Jiajing Zhang *(University of Chinese Academy of Sciences, Beijing, China),* ***Bin Shi*** *(Freelance, Beijing, China)*

In 1941, the Chinese Anti-Japanese War entered into a stalemate; Chiang Kai-shek put forward a slogan "No Science, No National defense; No national defense, no country", which officially promoted the national defense science movement.

This is a movement to popularize science, which is planned and organized by the government. Various local governments actively responded to it. Many scientific clubs took actions to call on scientists to join in it.

This movement takes the main form of holding science fairs, science performance and scientific paper competition, translating new knowledge of European and American national defense, and setting up special awards of national defense, so as to propagate and popularize the scientific knowledge of national defense. Governments at all levels and civic institutions reacted enthusiastically and actively joined to promote the national defense science movement. The National Defense Science Institute in 1943 and the National Defense Science Fair held in Chongqing in 1944 represented the culmination of this movement.

This movement, combined with improving the national defense, has three important impacts on the development of science at that time. First of all, the knowledge of science about the national defense was popularized among ordinary people, who realized the power of science in war, and the basic scientific literacy of them was improved in a way. Secondly, the government, influenced by the campaign, strived to develop the national defense science. Thus, the development of science in China at that time placed a particular emphasis on applied disciplines and neglected basic disciplines. Thirdly, it triggered a fierce discussion on scientific ethics among scientists and scholars, who started to rethink the negative effect of science.

Keywords: national defense science movement, science and war

China's struggle to solve the clothing problem: Mei Ziqiang's time and opportunity (ID 511)

Tian Tian *(University of Chinese Academy of Sciences, Beijing, China)*

Mei Ziqiang, a Chinese technologist on the textile engineering who got the doctor degree in Soviet Union after the establishment of the People's Republic of China, was the founder of the China's high-production carding machine. His development of the high-production carding machine in 1950s and 1960s, supported by the government, was not interrupted by the political movements or the economic difficulties, as the carding machine is a core part of the cotton textile equipment, and the cotton textile industry was one of the focal points in the economic construction of PRC because it was involved in people's clothing problem. Mei's development, lasting nearly a decade, succeeded to increase the machine-hour output of the carding machine to 25 kilograms from only 5 kilograms. Mei was not alone in his time. His experience after the establishment of the PRC exemplified that a generation of Chinese technologists and scientists shared a common fate with their homeland and the special time. This paper uses the data from the Collecting Project of the Old Scientists' Career to review Mei's career and his development of the high-production carding machine, which suggested the technologists' fate related with the nation's political and economic requirements, and also shows what the technologist can and cannot do in the nation's strategy to a certain extent.

Keywords: Mei ziqiang, carding machine, China's cotton textile industry, Great Leap Forward, 1950s, 1960s

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The Construction of "Abolished Calendar" in Public Discourse during Republic of China (ID 531)

Yan Wu *(Inner Mongolia Normal University, Hohhot, China)*

On January 1st, 1912, the Republic of China was founded. At the presidential inauguration, SunYat-sen (孫中山, 1866–1925), the temporary President announced adopting the Republican Era (中華民國紀年) and the Gregorian calendar, namely, the solar calendar that had been adopted broadly by western countries. However, since a calendar being in close related to everyday life and customs, a new calendar could not be fully accepted and used shortly after being promulgated. Therefore, for a very long time there existed a "dualistic society" in terms of calendar, the Gregorian calendar being adopted by officials and the elite whereas the traditional calendar was still used by lower classes (ZUO Yuhe, 2002). On the other hand, in order to seize the power of discourse in the political field, some warlords who controlled the local regimes also attempted to recover the former calendric and era system.

In 1927, the National Government was established in Nanjing and basically unified the regime of China. In the following year, the government initiated a movement named "abolishing the traditional calendar and imposing the national calendar," in which the calendric system consisting of the Republican Era and the Gregorian calendar was established as "National Calendar". At that time, many intellectuals, including astronomers, all realized that both the Gregorian calendar and the traditional calendar had advantages and shortages. However, in the discourse of "revolution" and "westernization", some radical intellectuals referred to the traditional calendar as "abolished calendar" (*feili*, 廢曆) while promoting the Gregorian calendar.

As for the authority, the government of Republic of China accepted the appellation soon after, consolidating the either-or incompatibility between the "Abolished Calendar" and the "National Calendar." It emphasized the "National Calendar" as the national symbol and the "posthumous instruction of SunYat-sen", who was the first leader of Kuomintang (Chinese Nationalist Party), arousing public cultural feelings of identification by recounting history. In the public sphere, the "Abolished Calendar" was loaded with some interpretations that didn't belong to it, and was assimilated with "bad" images, by which Chinese traditional calendar had been decried. In doing so, the idea that the Gregorian calendar was "more scientific" and "advanced" was constructed.

Keywords: "abolished calendar", calendar reform, social construction of science, National calendar

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Session 13: Science, Religion and Power in the Middle Ages

Chair: ***Erwin Neuenschwander*** *(University of Zurich, Zurich, Switzerland)*

Innovation versus tradition in 13th century natural philosophy: Nikephorus Blemmydes' "Epitomi Fysikis" (ID 483)

Manolis Kartsonakis *(The Hellenic Open University, Heraklion, Greece)*

The study of the essay "Epitomi Fysikis", written by the byzantine scholar Nikephorus Blemmydes (1197–1272), highlights a very interesting period of the Byzantine Empire, though inadequately worked out. That is the period of the exiled Greek – speaking Byzantine Empire at Nicaea in Asia Minor (1204–1261) which was established after the conquest of Constantinople by the crusaders of the Fourth Crusade. On the other hand, during that period the Latin – speaking Europe had just reinvented the riches of the ancient Greek sciences and the consequent research was inspired by the thomistic synthesis and the averroism.

Blemmydes' essay has been composed sometime after 1258 and it contains several chapters where the author deals with fundamental principles of Nature (such as the definitions of time and space, motion and its causes, the elements of Cosmos, the eternity) and introduces to us his views on specific issues such as the planetary motions and other astronomical phenomena, interpretations for earthquakes, lightnings, thunderclaps, winds, rainfalls and so on. Consequently, the "Epitomi Fysikis" can be considered as an elaborate and detailed essay on Nature of that era. On the other hand, it indicates Blemmydes' range of knowledge and his philosophical background as he uses references not only from the Platonic and the Aristotelian corpus but from Archimedes, Eratosthenes, Posidonius, Galen, Alexandros of Aphrodisias, Ptolemy, Cleomedes, Ioannes Philoponus, Damascius and Simplicius. So, we intend to show that Blemmydes has confronted natural processes following the attitude of a Christian who was attracted by the ancient Greek philosophy.

Keywords: Blemmydes, Natural philosophy, 13th century, Byzantine

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Changing Roles: Hungarian Learned Jurists until 1437 (ID 398)

Péter Haraszti Szabó *(Hungarian Academy of Scienses – Eötvös Loránd University, Budapest, Hungary)*

This presentation aims at demonstrating the changing roles of the people, who were employed at the Hungarian Royal Court in the middle ages after their jural studies at a university. The MTA-ELTE History of Universities Research Group's main aim is to collect students from the territory of the medieval Hungarian Kingdom attending medieval universities into a database and to collect their prosopographical data. (I have to underline that in the following Hungarian has only territorial meaning.)

Initially (the end of the 12th century) the medieval Hungarian academica peregrinatio tended towards the University of Paris, mainly the faculty of theology. During the first third of the 13th century, the most Hungarian students preferred the University of Bologna, especially the faculty of law. The most

of them were ecclesiastical, and in the end, they became officers of the Royal Court, particularly in the Royal Chancery. Their career began with a canonry, and few of them gained higher office at the chancery. For example, the Báncsa family should be mentioned. The archbishop, Stephen and his three nephews appeared in Bologna or Padua, at the faculty of canon law. During the Arpadian Age (1000–1301) almost thirty law students can be revealed from the sources and the two third of them got a degree (mainly the doctor of canon law and also some licenciate and bachelor). Eleven students gained an office at the Royal Court. The students of the civil law need a detailed presentation, since each of them learned under the reign of king Béla IV (1235–1270), who intended to set up his court similar to Emperor Frederick II (1220–1250). It is well-known, that Frederick was one of the last emperors, who wanted to demonstrate his omnipotence through the ecclesiastical sphere.

Until 1387 the number of the university students tripled, and we have further information about their later career in 47 cases. 21 of them gained an office at the Royal Court, mainly at Royal Chapel, not at the Chancellery, contrary to the former 'tradition'. Many of them became a royal chaplain, and sometimes the count of the Royal Chapel. Because of the latter office, they were royal envoys and ambassadors and they led diplomatic delegations to Avignon, Prague, Turin, Paris or Rome, so they were the head office of the Hungarian diplomacy. It has to be emphasized too, that the count of the Royal Chapel was the Secret Chancellor as well, who was responsible for the royal charters. Consequently, in the 14th century the real centre of the learned jurists was the Royal Chapel in the medieval Hungarian Kingdom.

During the reign of King Sigismund (1387–1437), the Royal Chapel slowly began to lose its importance. This change began in the last third of the 14th century, when more and more laymen made their way into the king's court. The last significant count of the Royal Chapel was Miklós Alcsebi, and after his death (1430) the Royal Chapel lost all juristic activity, it remained only its spiritual role. At the same time, King Sigismund replaced the tasks of the Royal Chapel to the Royal Councillors. This group was assembled by the king himself, thus Sigismund could keep his eyes on the Kingdom's affaires, meanwhile the Councillors became also the 'speaking-tubes' and the executors of their sovereign.

This 150-year period gives us a possibility to have an insight into the mechanism of the Hungarian rulers' decision-making, which leads to some questions about the officeholder studies. How important were the studies during the students' later career, did they have a significant role in the predominancy at the royal centre? Which were the main aims of the peregrination and why? What was the influence of the studies on the knowledge, relationships and moreover, on the family, wealth and future?

Keywords: University history, Learned jurists, Medieval Hungary, Hungarain royal court, Hungarian chancery, Canon Law

Science and Power in the Medieval Islamic World: A Case Study of Ptolemy's Almagest (ID 6)

Maria Americo *(New York University, New York, USA)*

The iteration of the Almagest, the seminal work on mathematical astronomy by the second-century CE Greek polymath Claudius Ptolemy, in the medieval Islamic world will be used as a medium through which to examine the relationship between science and the state in this paper. From its translation into the Arabic language (as part of a state-sponsored translation movement) in the 9th century; through several centuries of adaptation, critique, and improvement upon the Ptolemaic astronomical system; and down to the non-Ptolemaic astronomical reforms of 12th-century Andalusia and 13th/14th-century Iran and Syria, Muslim astronomers involved in the project of the rethinking of Ptolemaic astronomy interacted with the existing power structures at every turn. The relationship will be characterized generally as one of mutual dependency and support, as the state funded, patronized, and pursued scientific inquiry for its purposes, while the scientists took advantage of these resources to advance their own research, careers, and lives. The juncture between the state, science, and religion

will also come under consideration, as it is difficult, if not impossible, to separate religion and the state in what I will argue was an Islamic extension of the late antique world. Following the model of notable late antique scholars such as Garth Fowden (Empire to Commonwealth; The First Millennium Refocused), I will use the evidence of the Islamic Ptolemaic astronomy project to argue that the way in which Muslim scientists and the state interacted with one another echoes the interaction of those two groups in earlier late antique societies. It is common knowledge that the Muslim state (especially, but not only, the Abbasid caliphate, the originators of the Arabic translation movement) adopted many power structures, imperial customs, and modes and methods of rulership from their late antique predecessors, the Greeks and, most especially, the Persians. But the similarities among the interaction between scientists and state in all of these late antique cultures have not been fully explored; I intend to do so in this paper.

Keywords: astronomy, Claudius Ptolemy, Muslim scientists, Islamic world, late antiquity

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Ibn al-Majdī (d. 1447) – Astrological practices and the office of the muwaqqit (ID 546)

Fien De Block *(Ghent University, Ghent, Belgium)*

In this presentation I will discuss the astrological practices of Ibn al-Majdī (d. 1447) in the context of his function as a *muwaqqit* at the Azhar mosque in early fifteenth century Cairo, capital of the Syro-Egyptian Mamlūk Sultanate (ca. 1250–1517). The function of *muwaqqit*, typically performed in the religious institution of a *madrasa* or a mosque, consisted in the calculation of the times and direction of Islamic prayer. It has generally been assumed that this function gave scholars of astronomy the opportunity to practice a religiously accepted branch of their discipline, in the service of Islam. Because of their association with religious institutions, so it was further assumed, *muwaqqit*s abstained from practising astrology (Saliba 1994, 32). Because Ibn al-Majdī was a *muwaqqit* who also practised astrology, he is conceived as an exception to the rule (Charette 2007, 562). I will however argue that Ibn al-Majdī is a typical example rather than an exception of the way in which scholars gained social prestige and status in the Mamlūk Sultanate. Instead of deriving their legitimisation from religious institutions as self-contained sources of authority, scholars gained social respect and status from the broader network of personal ties with other scholars and with members of the military ruling elite. Institutions did play an important role, but rather as nodes in a network of individuals within which authority circulated than as centres from which authority emanated (Berkey 1992, 23) (Chamberlain 2002, 77). Appointed *muwaqqit* at the Azhar mosque in Cairo and head of the teachers in the *Jani-bakiyya madrasa* by the Mamlūk sulṭān al-Ashraf Barsbay, Ibn al-Majdī derived his social status as a reputed astronomer, religious scholar *and* astrologer from a combination of personal ties to the ruling elite on the one hand and — as a teacher— to the community of scholars on the other (Brentjes 2008, 133). Through this case study I want to shed new light on the presumed negligibility of astrological practices in this period, thereby opening up new avenues for future research on this topic.

Keywords: Ibn al-Majdī, muwaqqit/Islamic timekeeper, astrology, astronomy, religious institutions, authority, social respect, early fifteenth century, Mamlūk Sultanate, Cairo

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Session 14: Science, Technology, and Gaining Power on New Spaces

Chair: ***Emma Sallent Del Colombo*** *(Independent Scholar, Barcelona, Spain)*

High Tech Europeans in 16th Century Algonkian America: Scientific Expertise and the Evolution of Speculative Financing of North American Exploration and Settlement (ID 424)

Brent Lane *(University of North Carolina, Chapel Hill, USA)*

The early modern period is often characterized as an era of transformative European-centered developments. The Scientific Revolution marked the emergence of modern science when advances in mathematics, physics, astronomy, biology and chemistry provided new methods of investigation and understanding. The Age of Discovery denoted a time in which extensive overseas exploration emerged as a powerful factor in European culture and globalization. The period also laid the foundation for the emergence of Modern Capitalism with innovations in banking, mercantilism and company structuring enabled entrepreneurial globalism.

Emerging scholarship emphasizes the interdependence of these concurrent phenomena, ascribing the advancements in science and capitalism to the requirements of European exploration and exploitation of New World opportunities. This interpretation requires further examination that may be provided by archaeological and archival research into early modern European settlement efforts in North America. Unlike the rapid Spanish and Portuguese colonization in Central and South America, European efforts to settle eastern North America progressed slowly. Failures of several French, Spanish and English colonies, often attributed to inadequate technical and scientific expertise, incurred financial losses that poisoned the environment for much New World speculative investment. Rightly skeptical patrons and prospective investors required greater assurance that the schemes of promoters were sound, their commercial prospects credible, and their results verifiable.

The paper examines how one such promoter, the English courtier Sir Walter Ralegh, sought to counter investor skepticism by incorporating scientific expertise as an integral component of exploration and colonization. In his 1584–90 Roanoke Colony expeditions Raleigh emphasized the inclusion of recognized scientific and technical experts and their performance of field research to substantiate his venture premise. A former venture capitalist himself, Professor Lane analyzes recent archival, archaeological and cartographic discoveries related to the Roanoke Colony to describe how the necessity of private investment elevated Raleigh's personal predilection for scientific investigation to a capital solicitation necessity. In so doing Raleigh's Roanoke venture strategy anticipated the research-intensive business template of modern "high tech" entrepreneurs.

Keywords: venture capital, speculative investment, joint stock companies, scientific expertise, colonization, metallurgy, botany, pharmaceuticals, mechant adventurers

Scientific Progress vs. Power: 17th-Century Jesuit Explorations in Asia vs. the Portuguese Maritime Monopoly to China (ID 5)

Gerhard F. Strasser *(The Pennsylvania State University, University Park, PA, USA)*

For the Jesuit order the 17th century was the heyday of explorations of the Far East. Missionaries gained access to the Chinese court due to their expertise in modern science and technology, such as astronomy or cartography.

These Jesuits needed to rely on Portuguese ships for their maritime transportation from Europe to China as the King of Portugal held the monopoly on all shipping to the Far East.[1] As the century progressed Dutch and English warships increasingly harassed the Portuguese carracks, which resulted in a sizeable loss of missionaries en route.

An excellent atlas of the Chinese empire published in 1655[2] suggested to the Jesuit General in Rome that a land route to the Far East might be a viable alternative. In 1656 ordered two young Austrian priests to take the Silk Road and document their itinerary so that mission stations could subsequently be established. Johannes Grueber (1623–1680) survived the ardous, eight-year-long travels. Due to border wars, however, the two had to switch to the caravan route to Hormus instead and from there to ships to Macao, from where they reached Beijing in 1659.

Grueber began his work as a mathematician for the imperial court. In 1661 he and his companion received imperial letters of protection to facilitate their travels to India via Tibet and Nepal. They reached Lhasa in October of 1661, where Grueber produced numerous sketches. Together with his material on their subsequent stay in Nepal these were incorporated upon his 1664 return to Rome along with a brief travelogue of their journey in a fellow Jesuit's 1667 publication, *China* [...] *illustrata*.[3]

During his three-month return Grueber displayed his scientific, ethnological, and geographic expertise, which convinced the Jesuit General of the land route as a viable alternative. Grueber was to embark on a second journey to China via Russia; before reaching the Czarist lands, however, he fell ill in Constantinople, where he was ordered back to Rome.

What had happened? During Grueber's stay the procurator of the Chinese Mission—who happened to be in Rome—presented a memorandum that raised the matter of the Portuguese shipping monopoly. He predicted that the King would use his power and authority to forestall any undercutting of this century-old sinecure, which could result in the elimination of the financial subsidies the Jesuit order received from Portugal.[4] While these objections were not immediately heeded and did not prevent the departure of Grueber on his second journey the subsequent letter of King Alfonso VI to the Jesuit General[5]—reiterating these objections—forced the Jesuits to abort this mission.

And thus it was political power that prevented any further scientific exploration of the overland route to China. For the few remaining years of his life Father Grueber—the most knowledgeable specialist in this field at the time—was not even allowed to stay in Rome but was sent to remote Transylvania as a troop chaplain for the armies fighting the Turks. Science and technology, one might say, were sacrificed to political—and financial—power.

[1] Treaty of Tordesillas (1494), dividing the newly discovered lands among the then two major seafaring nations, Spain and Portugal. It granted Portugal the maritime monopoly over all traffic to the Far East. See URL: *https://en.wikipedia.org/wiki/Treaty_of_Tordesillas* (accessed 10/10/2015).

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[5] Cornelius Wessels S.J.: *Early Jesuit Travelers in Central Asia 1603–1721.* The Hague: Nijhoff 1924, 173. King Alfonso's letter to the General of the Society of Jesus was dated July 17, 1664, three months after Grueber's departure on his second mission.

Keywords: Jesuit missionaries, Far East, Johannes Grueber, Silk Road, Lhasa, Tibet, Chinese mission, Portuguese shipping monopoly, Treaty of Todesillas, King Alfonso VI

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Travelling to Spain and Portugal. Joan Salvador and Antoine Jussieu's: connected interest, shared practices and personal strategies (ID 593)

Emma Sallent Del Colombo *(Independent Scholar, Barcelona, Spain)*

Joan Salvador i Riera (1683–1726), who owned an apothecary in Carrer Ample in Barcelona, was, perhaps, the most learned and well connected member of a lineage, which for six generations manage to undertake a Cabinet of Curiosities, accidentally and incredibly preserved till present days almost in his completeness.

He studied in Montpellier with Magnol and Tournefort in Paris, and in 1715 was appointed corresponding member of the *Academie des Sciences*. In 1716–1717 he travelled thought the Iberian Peninsula accompanying Antonie Jussieu (1686–1758), his brother Bernard (1699–1777), botanists of Louis XIV, and the painter and engraver Philippe Simmoneau.

During their journey they visited acquaintances, went to see interesting venues, churches, palaces, towns and cities, gathered anecdotes and collected specimens which enlarged with Iberian flora the collections of the *Jardin du Roi* in Paris.

Thanks to the travel diary written by Joan Salvador, *Viatge d'Espanya i Portugal*, and other materials kept in the Col·lecció Salvador in the Botanical Institute in Barcelona and those collected by the French counterpart and preserved at the archive of the *Musée d'Histoire Naturelle* and the *Academie des Sciences* in Paris, we will try a comparative and integrated study in order to share some light on agencies, interests, goals and power relationships of this naturalistic *joint venture*.

Keywords: Joan Salvador, Antoine Jussieu, Natural History, XVIII century

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Wolfgang von Kempelen and his study trip to the Salzkammergut. An Order of Maria Theresia in 1775. (ID 450)

Alice Reininger *(University of Applied Arts Vienna, Vienna, Austria)*

Wolfgang von Kempelen belonged to a group of officers of the Habsburg Monarchy of the 18th century, who possessed an extensive technical knowledge and was for this reason requested by the sovereign Maria Theresia to carry out various tasks. Kempelen, Councillor of the Hungarian Court Chamber in Pressburg (today Bratislava, Slovakia), in his capacity as director of salt mining in the Kingdom of Hungary was put in charge to take care of all aspects of this field.

In 1775 Maria Theresia commissioned Wolfgang von Kempelen to travel to the Salzkammergut (southern Upper Austria) in order to study various means of transportation for salt and heavy loads and

accordingly to construct suitable means after his return, to use these means successfully in the Kingdom of Hungary. The Salzkammergut has a long and successful history of mining salt dating back 3000 years. Salt mining and salt trade were monopolies of rulers. Due to the geographical characteristics specific methods of transportation of heavy loads had been developed to bring these loads to the processing plants located in the Salzkammergut. Not everybody was allowed to study these methods. Technical achievements were kept a careful secret because they meant advantage in production. Science tourism on behalf of the ruler and for purposes of research for professional reasons! After Kempelen's return to Pressburg, he adapted a special kind of a lift for heavy loads for the ship pier in Szolnok on the river Tisza. Wolfgang von Rudnyansky, he was Kempelen's travelling companion – he was also charged with an order of Maria Theresia – managed to persuade residents from the Salzkammergut to emigrate to the Maramures and there to turn an area that was densely wooded and also rich in mineral resources into arable land. How successful both men were, is set out clearly in this lecture.

Keywords: Habsburg Monarchy, 18th century, technical knowledge, science tourismus, Salzkammergut

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Natural History and military discipline at unconquered territories: The Malaspina expedition in Vava'u island (1793) (ID 538)

Marcelo Fabian Figueroa *(National University of TucumánNational / Scientific and Technical Research Council, Argentina, Tucuman, Argentina)*

The Malaspina expedition was the most important scientific travel organized by the Spanish monarchy in the 18th-Century, it was oriented to the assessment of the colonial empire in relation to the other European's ones, especially in the Pacific Ocean. In this paper I study the relationship between collecting practices and natural history during Malaspina expedition's visit to Vava'u, an islands group in Tonga islands which was mentioned by Cook on his third voyage. Malaspina visited Vava'u for a month, following up on Francisco Mourelle who was the first European to come to the islands on March 1781 from Mexico, and carried out an act of possession for Spain. In spite of the shortness of the stay, from May to June, naturalists collected and recorded a rich amount of natural and anthropological information. So, what restrictions were imposed upon the work of naturalists? What was the relationship between travelers and natives in this unconquered territory? In this paper I argue that travel instructions issued by Alejandro Malaspina were written protocols oriented to configure the fieldwork practices of naturalists on a contested colonial ground inhabited by indigenous no subjected to Spanish domination. I do this by approaching travel account, instructions and letters written in relation to the development of collecting practices on ground which allow me to sketch an scientific set of practices which were based upon a military discipline.

Keywords: collecting, empire, travel, instructions, natural history

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Session 15: The Attitude of Scientists towards Totalitarian Systems in the 20th Century

Chairs: ***Dieter Hoffmann*** *(MPI for the History of Science, Berlin, Germany),* ***Stefan Wolff*** *(Deutsches Museum, Munich, Germany)*

Adaption and Cooperation of physicists in Nazi-Germany (ID 452)

Stefan Wolff *(Deutsches Museum, Munich, Germany)*

Still in the 20th century many scholars believed that science could be separated from politics rather strictly. However, especially in Germany support of the government and the army did not count as political whereas e.g. any act in the sense of pacifism did. After the defeat in World War I a conservative-nationalistic attitude dominated among German scholars and led to a general acceptance of the new government under Hitler in 1933. Never before a German government had intervened in science and learning in such a rigorous way. This began already in April 1933 with the exclusion of all those who in the view of National-socialists did not belong to the "German race".

We discuss the reaction of German physicists by the example of two eminent scholars who have the reputation of keeping a clear political distance to National Socialism: Max von Laue and Max Planck. Just in these two cases we will demonstrate that their putative apolitical attitude was no hindrance for a cooperation with the NS-state. First of all, they tried to preserve the high professional standards of physics in Germany. For example, they helped to fill the gaps caused by the displacements. On one side they despised and fought the small group of ideological Nazi-physicists like Stark, but on the other Planck gave speeches in favour of the government and Laue as well as Planck were even prepared to adapt internal rules of science to Nazism step by step. This did not happen by formal orders of the ministry but by anticipatory obedience mostly. So in spring 1934 there was a consensus to postpone the award of the Planck-medal as the two potential prize winners were emigrants. We analyse this development till the expulsion of "Jewish" members of the German Physical Society in December 1938. After the war it was especially Laue who tried to whitewash German physicists arguing that being a physicist had nothing to do with politics.

Keywords: Science and politics, Physics in 20th century, National Socialism, Expulsion of, Max von Laue, Max Planck

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Stefan L. Wolff, The Establishment of a Network of Reactionary Physicists in the Weimar Republic in Carson, Kojevnikov, Trischler, Weimar Culture and Quantum Mechanics, London 2011, 293–318.

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Unpolitical scientist, aeronautical advisor, goodwill ambassador: Ludwig Prandtl's political performance in Nazi Germany (ID 465)

Michael Eckert *(Deutsches Museum, Munich, Germany)*

Ludwig Prandtl (1875–1953) is famous as a pioneer of modern fluid mechanics. He founded the Aerodynamische Versuchsanstalt (AVA) and the Kaiser-Wilhelm-Institut für Strömungsforschung in Göttingen. Prandtl's students became professors at technical universities and aeronautical research facilities both in Germany and other countries (such as Theodore von Kármán in the USA). Prandtl's name provides symbolic capital until today: a Ludwig-Prandtl-Ring is awarded "for outstanding contributions

in the field of aerospace engineering"; each year the Gesellschaft für Angewandte Mathematik und Mechanik (GAMM) invites a leading expert of this field to present its annual Ludwig Prandtl Memorial Lecture. Yet Prandtl was also a celebrated representative of aeronautical research in Nazi Germany. Although he disliked Nazi politics, as he experienced it with the expulsion of Jewish colleagues and with denunciations in his institute, Prandtl gradually adapted to the Nazi system. Abroad he assumed the role of a goodwill ambassador for Nazi Germany. From 1942 to the end of World War II he directed a high ranking advisory board (Forschungsführung) of Göring's Air Ministry. Prandtl's attitude – both as an advocate of traditional academic values and as a loyal and even ambitious collaborator with Nazi authorities – will be described on the basis of extensive archival studies for Prandtl's biography.

Keywords: Ludwig Prandtl, National Socialism, Aeronautics, Fluid mechanics, Germany

Hans Thirring and Engelbert Broda – Scientists in Times of National Socialism and Cold War (ID 440)

Wolfgang L. Reiter *(The Erwin Schrödinger International Institute for Mathematical Physics and Faculty of Physics, University of Vienna, Wien, Austria)*

The theoretical physicist Hans Thirring (1888–1976) and the physical chemist Engelbert Broda (1910–1983), both professors at the University of Vienna, are presented in context of their scientific work and their biographical backgrounds as political activists of the peace movement and the Pugwash movement. Thirring as a theoretician is best known for his joint work with the mathematician Josef Lense on general relativity (Lense-Thirring Effect); Broda was working on the allied atomic bomb project after his forced migration to England. Both their private and academic lives are deeply inflicted by the Nazis; Thirring was dismissed by the Nazis from his position at the university in 1938, Broda, a member of the Austrian Communist Party since 1930, emigrated to England in 1938. After Broda's return to Austria in 1947 as one of the very few scientific remigrants he was engaged in setting up radio chemistry at the University of Vienna, published widely against the arms race and was an early proponent of environmental policy; Thirring predominantely dedicated himself to activities of the peace movement of the 1950th and early 1960th (e.g. Pugwash Conferences, Thirring Plan for disarmament of Austria). In the course of the discussions on the construction of a nuclear power plant in Austria, Broda took a strong warning position of its environmental implications, at odds with his political comrades; from 1957 to 1963 Thirring served as a member of the Bundesrat, the second chamber of the Austrian Parliament, as a representative of the Socialist Party. In the political climate of the 1950th and 1960th in Austria both men of science and prominent activists of the civil society had no chance to be accepted as members of the Austrian Academy of the Sciences.

Keywords: University of Vienna, Physics, Chemistry, Pugwash, forced migration, National Socialism, peace movement

Peter Adolf Thiessen (1899–1990): From National-Socialist to a Socialistic Model Scientist and Science Manager. (ID 543)

Dieter Hoffmann *(MPI for the History of Science, Berlin, Germany)*

Peter Adolf Thiessen, born in 1899 in Schweidnitz (Silesia) and deceased in 1990 in Berlin (East), was a gifted physical chemist who subscribed early on to the Nazi ideology and party membership. This affiliation was instrumental for his outstanding scientific career during the Third Reich: He became not only the successor of the banished Fritz Haber as director of the famous Kaiser Wilhelm Institute for Physical Chemistry and Electrochemistry in Berlin-Dahlem, but also one of the leading science-policy makers and managers, who greatly contributed to the Nazi transformation of the German research and higher-education system. Despite these involvements, he was drafted by the Soviets after the end of

WWII to help advance their post-World War II research, in particular to take part in the Soviet atomic bomb project. Released with high honors by Soviet authorities ten years later (1955), Thiessen was able to restart his career as a model scientist and science manager in the socialist German Democratic Republic (GDR / East Germany). He became director of a new founded institute of the Academy of Sciences and played a central role in science policy during the early GDR. The talk will describe the details and context of the bizarre continuity of Thiessen's career.

Keywords: Thiessen, Science Manager, Third Reich, Socialistic East Germany, Career Continuity

Conviction and Loyalty (ID 468)

Gábor Palló *(Budapest University of Technology and Economics, Budapest, Hungary)*

During the formation of the Stalinist regime scientists still had options in Hungary. They could either stay in their country and accept the new and still unknown political and intellectual circumstances or run away from it. After the iron curtain fell down this option disappeared, they could not flee anymore. There was, however, a third option. Scientists, who fled from the right wing authoritarian regimes before and during the Nazi rules, thought to have a chance to return to Hungary after the war. Physicist Lajos Janossy (1912–1978) exemplified this option. He studied in Germany with Schrödinger and Laue, became a successful physicist by studying cosmic rays with Blackett in Manchester, later in Dublin, and returned to Hungary in 1950. The paper shows how this ideologically and philosophically committed scientist adapted himself to the circumstances he found in Hungary during the Cold War period.

Historians at the cross-roads. Polish historians milieu and its attitude to Stalinism, 1945–1956. Henryk Wereszycki and Stefan Kieniewicz case. (ID 441)

Leszek Zasztowt *(Polish Academy of Sciences, Warsaw, Poland)*

In spite of numerous studies and books on Stalinism in Poland, there is no solid monograph focused on the differentiations of approach of historians milieu toward Stalinism. The situation in general looked similarily as with the rest of Polish intelligentsia, depicted in details by Czeslaw Milosz in his *Captive Mind*. On the other hand we must remember that important part of the pre-war Polish historians found themselves in exile after the war, mostly in the United States and Britain (including the most prominent figure of Oskar Halecki). On location in Poland the milieu was gradually divided on those who were condemned by a new authorities (as Stanisław Kutrzeba, Wladyslaw Konopczynski, and Henryk Wereszycki – all from conservative Cracow), and those who – more or less – were seduced and involved in relations with the authorities, very often because of the beginning of their academic career at that time. The attitude to Stalinism significantly differed in both circles. At the moment – in the second half of 1940s – the majority at least was hideing their negative sentiments, and looked at the first glace – at least – as a positive supporters of the new regime. Althought – what we know now – large part of them was linked i.e. with Catholic church, and they did not accept Soviet model of Marxism-Leninism-Stalinism. There was also a numerous group of true supporters mostly of the young generation in the 50s (significant part of them in 1960s formed the circle of dissidents and contestants – being a well known critics of the regime – as Leszek Kolakowski, Witold Kula and many others). The interesting example, how to cope with Stalinism" were Henryk Wereszycki and Stefan Kieniewicz, both prominent historians in the 1960s and later. The first one was condemned as the enemy of the system, the other was acknowledged as – at least – its supporter. They have been colleagues and their correspondence which was published (edited by Elzbieta Orman, Cracow 2013, 792 pp.) uncovers and expose the peculiar detailes of the situation of historians in Stalinist time. When we see it from insight the phenomenon seems much more complex, and the divisions were in fact much deeper and more puzzled. Being a member of the communist party did not decided of being an unhonest or undicent fellow. On

the other hand both historians did not enter the ranks of members. Wereszycki as the victim of the regime, and Kieniewicz as it advertisement banner.

Keywords: Poland, Stalinism, Historians, Henryk Wereszycki, Stefan Kieniewicz

Modernization and militarization of Italian classrooms during Fascism (ID 597)

Donatella Germanese *(Max Planck Institute for the History of Science, Berlin, Germany)*

The educational use of new technologies is often linked to efforts at modernization in society. By introducing new media as didactic tools, governments may follow experts' recommendations, ignite discussions, or both. During Fascism, Mussolini's dictatorship developed an ideology of modernization considered in line with the Italian scientific tradition. Declarations of cultural supremacy grounded in the glorious past were part of the regime's propaganda as well as the envisioned future modernization. Though compulsory schooling was regulated in Italy by state law since 1877, in the early 1920s the average illiteracy rate was still as high as 27%, with a wide gap between urban and rural regions. A new education law was adopted in 1923, national radio broadcasting programs for the classroom were established in 1934, and, finally, an educational film department was founded in 1938 (Cineteca Autonoma per la Cinematografia Scolastica), the same year when the Fascist government reformed the education system and passed the racial laws.

This paper analyses Fascist educational radio programs complemented with written instructions for teachers; propaganda for aviation addressing children; discussions about cinema for school, and pupils' reactions to screenings. It is concluded that the wave of enthusiasm for new mass media like cinema and radio facilitated the instilment of racist and belligerent ideology into children's mind.

Keywords: Modernization, Fascism, Schooling, Media, Children

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Session 16: The Power of Ideas, Practices and Instruments in Physics and Chemistry

Chair: ***Pere Grapi*** *(Universitat Autònoma de Barcelona, Sabadell, Spain)*

Instruments of Experimental Physics in the Chemistry Laboratory at the End of the Eighteenth Century (ID 425)

Pere Grapi *(Universitat Autònoma de Barcelona, Sabadell, Spain)*

Up to the second half of the eighteenth century the equipment of chemical laboratories resembled to that of the workshops of metallurgical assayers, smelters, apothecaries or distillers. This was because the academic chemists of early eighteenth century took advantage of the devices, tools, techniques and materials used by those artisans. In France, Gabriel-François Venel was one of the most emblematic representatives of this academic chemistry. More than 700 articles published in the *Encyclopédie* of Diderot and D'Alambert are owed to him. Among them, it is worth mentioning above all, the influential article *Chymie* published in 1751. However, it was in the article *Instruments* where Venel stated the meanings of the term "instrument" in chemistry, not only as a laboratory utensil for chemical operations but also as an agent of chemical changes.

The studies of the English experimental philosophers on the different kinds of air had their impact on the instrumental equipment of chemical laboratories in the eighteenth century, incorporating essentially pneumatic troughs and accessories such as siphons, retorts and funnels. During the last quarter of the eighteenth century, and as a result of the approach between chemistry and physics, chemical laboratories begun to be equipped with machines and instruments that until now could only be found in the cabinets of physics. The article *Laboratoire* of the second edition of Macquer's *Dictionnaire de Chymie* of 1778, reflected reliably this change of scenery in the chemical laboratories. All those instruments coming from experimental physics would continuously find their own space within the chemistry laboratory until being consolidated itself in the early nineteenth century. This presentation will examine the process of settlement of the instruments associated with experimental physics within the chemistry laboratory throughout some representative texts and authors.

Keywords: chemistry laboratory, Instruments, experimental physics, Venel, Macquer

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To see what you hear: The visualization of soundwaves in 19th century (ID 428)

Jasmin Janka *(Europa Universität Flensburg, Flensburg, Germany)*

One of the classical experiments first done in the late 18th century was developed by E. F. Chladni. The sound figures, later known as Chladni figures, were an important impulse to the research in the young field of physics called 'acoustics'.

Most of the scientist working on acoustics started their research with comprehending the experiments of the sound figures. And they worked on them, modified them, improved them and developed additional features. For over 60 years this simply breadboard brought one new idea after the other in the understandings of acoustic phenomena.

To look on the protagonists and their working with the experiment is one part of my dissertation project. Using the histographical method of replication, I aim at developing an understanding, how the experiment evolved and how it brought many different insights in the field of acoustics. Therefore I redo many experiments of other scientist who worked with Chladni figures, for example Charles Wheatstone or Felix Savart.

The perspective around seemingly one single experiment, done by many participants who changed it and the resulting discussions and discoveries give a new view on how a physic field was explored.

In my talk I will discuss also, how the authority escribed to Chladni perhaps undermined the ideas of other scientist, who got different results in their repetition of the experiments on the sound figures. The power of one great name and his status of being a 'hero' prevented here the development of further thoughts and new theories about an existing structure of experimental results.

Keywords: Soundfigures, Acoustics

The power of thought in the Platonic solids versus the power of technology in modern crystallography (ID 448)

Françoise Monnoyeur *(Centre Jean Pepin, CNRS, Paris, France)*

Nowadays electronic microscopes let us discover the inside of matter at the atomic level and forget about the mathematical speculations of our ancestors to discover the origin and models of matter. Our technology makes scientific results fast and easy, and forgets about values and ideals at stake in the old science at a time when thought was the only tool of discovery. With the comparison of these two geometric models of matter apart from 1600 years but similar in their results, we will have the opportunity to appreciate what the power of technology made us loose: values, ideals, and deep thought in science. The power of technology deprived of what made us what we are, thinking scientists before being tool users. Contrary to Marx in *The German Ideology*, I will show with the comparison between the Platonic and Crystallographic models how everything begins in science with thinking, and how technology has progressively replaced it.

We will analyze how in the *Timaeus*, Plato relies on Pythagoras' theorem and his ideal of harmony to find the solids of the four elements (fire, water, air, and earth) but also on observation, experience and perception. More precisely, in the *Timaeus* of Plato, the four elements are modeled with geometric solids chosen according to the type of triangles (isosceles or equilateral) composing their faces. Mobility and stability are the properties associated with this model: the solids made of acute angles are supposed to be more mobile than the solids with right angles. The point of interest was to represent the transformation, for instance, of water into air through fire. Plato's only scientific instruments are geometry (Pythagoras' theorem), and his values of symmetry, harmony, and rationality.

Presently the study of matter, carried out by using advanced instruments like the electron microscope and x-ray diffractometer, has helped to describe in a precise way the structure of matter. For instance, it has been shown that carbon atoms can be bonded forming different geometrical structures, and as result of each structure different materials and properties are obtained: tetrahedral (kind of cubic) structures in diamonds, hexagonal networks in graphite, and forming a spherical structure in a fullerene. While the tetrahedral structure results to be the hardest known material, the hexagonal is very soft and slippery, and the fullerene extremely elastic. We shall consider how the discovery of solids in modern crystallography similar to the Platonic solids, relies mostly on perception and advanced technology.

These two examples will give us the possibility to measure the lost that technology has created in matter of thoughtful scientific research.

Keywords: geometric solids, matter, Plato, Pythagoras, crystallography, electronic microscope, properties of matter, triangles, geometric structure, carbon atoms

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Why Has the Bohr-Sommerfeld Model of the Atom Been Ignored by General Chemistry Textbooks? (ID 606)

Liberato Cardellini *(Marche Polytechnic University, Ancona, Italy),* ***Mansoor Niaz*** *(Universidad de Oriente, Cumaná, Venezuela)*

Bohr's model of the atom (1) is generally considered to be important by university-level introductory (first-year) general chemistry textbooks. Bohr's model successfully explained the stability of atoms, the ionization energy, and the spectra of hydrogen-like ions (Balmer series), that is, those having a single electron (for example, He^{+}, Li^{2+}, and Be^{3+}). Bohr's first model claimed to predict all the lines in the hydrogen emission spectrum. However, experimental evidence indicated a hydrogen series (anomalous Pickering-Fowler ultraviolet series), where, according to Bohr, there should have been none (2). A major shortcoming of this model was that it could not explain the spectra of atoms containing more than one electron.

In order to increase the explanatory power of the model, Sommerfeld hypothesized the existence of elliptical orbits. Sommerfeld (3) considered Bohr's analysis of the hydrogen spectrum as only approximate as it was based on only one quantum condition, the quantization of the angular momentum. Bohr's orbits were all in a plane, which was too simple an assumption. Sommerfeld not only specified the shape of the electron's orbit (which by analogy with planets in the solar system, could be elliptical instead of circular), but also its orientation in space. On the basis of this basic idea of elliptical orbits, the Bohr-Sommerfeld model of the atom was widely accepted by the scientific community as an alternative to Bohr's model. For example, Paschen's (4) measurement of the helium spectrum was in agreement with Sommerfeld's prediction.

We made a study on university-level general chemistry textbooks published in Italy and U.S.A. (5) Most general chemistry textbooks refer to the atomic models of Thomson, Rutherford and Bohr in considerable detail. This represent the tentative nature of scientific theories. Nevertheless, most general chemistry textbook authors simply ignore this aspect of the nature of science. Only three general chemistry textbook (out of 46) published in U.S.A. and five (out of 28) published in Italy included a description of the Bohr-Sommerfeld model along with diagrams of the elliptical orbits. Textbook authors and chemistry teachers either do not know or do not understand or do not consider the tentative nature of scientific knowledge to be important. We believe that the inclusion of the Bohr-Sommerfeld model in textbooks (albeit briefly) is necessary, especially if we want our students to understand how science progresses.

Keywords: Atomic model, Atomic spectra, Elliptical orbits, General chemistry textbooks, Hydrogen-like ions, Nature of science, Tentative nature of scientific theories

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Remarks on the Impact of Computers on Physics, Mathematics and Society (ID 504)

Rita Meyer-Spasche *(Max-Planck-Institut für Plasmaphysik, Garching bei München, Germany)*

A few programmable computing machines existed already in the 19-thirties and 19-fourties. Most of them were unique, constructed in the institutes of their users. Around 1955, larger numbers of commercially produced computers became available. As soon as there was a larger number of scientists with computing experiences, in the years 1968 to 1974, researchers working in different fields of mathematics and physics met at international conferences with titles like `Computers in Mathematical Research' or `Impact of Computers on Physics'. The participants told each other how much computers had already changed their work.

In this contribution, some of the experiences, observations and lines of thought will be retraced which accompanied this development or commented on it later on. Today, the words of the mathematician and computer scientist George E. Forsythe (1968) are still valid: `The question: ``what can be automated?" is one of the most inspiring philosophical and practical questions of contemporary civilization.' It is a political question as well: Should everything be automated that can be automated? Which ones of the technologically possible developments are desirable, which ones should we try to block? We will discuss the influence of the physics nobelist Hannes Alfvén (alias Olof Johannesson) and the computer scientist Klaus Brunnstein (1937–2015) on the German legislation with respect to IT security, social accountability and information privacy.

Keywords: history of mathematics, history of physics, 20th century, impact of computers, computers in research, IT security

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Session 17: Analyzing and Assessing Scientific Activity

Chair: ***Erika Luciano*** *(University of Turin, Turin, Italy)*

Selective Realist Strategies in Modern Science (ID 451)

Alberto Cordero *(CUNY Graduate Center & Queens Colege CUNY, New York, USA)*

Selective realists agree that successful empirical theories do not get everything right but they reject pessimistic inductions from the history of science, notably the one advocated Larry Laudan and its developments in the 1980s and 1990s. According to selectivists, a theory can be false as a monolithic whole yet still be true at less comprehensive levels, e.g. those corresponding to abstract and/or restricted theoretical applications. Empirically successful theories, they argue, are truthful in this way. The realist task, in their view, is to identify truthful theory-parts and do so convincingly, hence the labels "Selectivism" and "Selective Realism". Virtually all scientific realist projects today are of this variety. Current selectivist projects derive, most recently, from responses to Laudan's the pessimistic induction, but the approach they share is much older, or so I argue.

The proposed paper presents and discusses explicit selectivist moves found in major scientific works and period analyses. For example, selectivist moves are equally on view among many Copernicans, both in their approach to physical theories and broader theories. Consider Galileo's efforts to embrace realism about both the Bible and the Heliocentric Theory. In his letter to the Grand Duchess Christina of 1615, Galileo proposes that the Bible be read bearing in mind the role that some of the content played in helping uneducated people to get the messages relevant to how to achieve salvation. Only some select parts of the biblical text should receive literal, realist interpretation, Galileo argues. In his view, whether the Sun moves around the Earth or the other way around is not important to the Bible's intended message, which is about *salvation*. Cardinal Bellarmine advocated a view radically contrary to this, as did many natural philosophers at the time. According to the Cardinal (letter to Foscarini, 1615), dismissing any assertion clearly stated in the Bible would amount to rejecting God's word. Galileo, by contrast, was pointing to a selectivist way of separating the wheat from the chaff in successful scientific theories: look for truth and successful referential import in theory-parts rather than whole theories. The full paper elaborates on this and other cases, specifically from works by Kepler, Newton, Boyle, Hook, Lavoisier, Whewell, Maxwell, and Einstein.

Selectivism, it seems, has been the default realist position during most of the history of modern science.

Keywords: history of the physical sciences, realism/antirealism debate, selectivism

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A history of recent evaluation of science: power through knowledge and knowledge through power (ID 514)

Aline Waltzing *(Ecole des Hautes Etudes en Sciences Sociales, Paris, France)*

Science evaluations are power institutions, yet not only external to scientific practices and knowledge. Since the 1980s, a certain type of evaluation procedures has been institutionalised in various European countries, to target public institutions for research and higher education. Historical case studies of the emergence of such "evaluation agencies" in France and the Netherlands allow us to unfold the issue of "science and power, science as power" studying evaluation both as (scientific) knowledge production and as power practices.

In both considered cases, evaluation took place at the crossroads of governments and scientific communities. In the 1980s, while in the Netherlands evaluative power structures have been seized and constructed by universities, the French evaluation was rather set upon the scientific community – a schematic depiction that has to be nuanced in the following, using some detailed analysis of the case studies.

On one hand, evaluation appeared as a regulatory science, as knowledge of the State: the procedures were essentially tools for acquiring knowledge on the internal organisation of universities. This knowledge was external, for the administrative powers, but also internal: self-study was supposed to serve better management, for the sake of insuring an improvement of quality. Hence, evaluation has explicitly been a tool for governing academia.

On the other hand, scholars have continuously been involved in the making of evaluation structures and institutions, be it as enrolled peer experts, as conceivers of evaluation or by working on evaluation tools. Evaluation drew on scientometrics for instance and developed along with bibliometrical tools and their critique. It also built on quality management, a discipline that has a scientific claim. In this context, the production of knowledge around scientific activities affected their management: through evaluation procedures.

Keywords: history of evaluation, research evaluation, evaluation agencies, evaluation of higher education, quality management, scientometrics

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Session 18: Politics of Science

Chair: ***Ivana Lorencová*** *(National Technical Museum, Prague, Czech Republic)*

The role of the government in the organization of water transport routes (ID 166)

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The development of the vast northern part of Russia was done through waterways, which were already laid in ancient times: portage ways were laid between river upstreams, base points were created, many of which later became towns. These transport ways had transit functions (the basis of international trade between the southern Nordic) as well as served as a basis for the formation of the ancient Russian state.

A new stage in the development of waterways is associated with the transfer of the capital to St. Petersburg by Peter I. There was a great need for different building materials, products, etc. Peter I, who understood the importance of these waterways for the economic development of the northern regions and the construction of new and development of old cities, decided that it is necessary to create on their basis new developed transport ways. A few waterways were created: Northern Dvinsky, Mariinsky, Tikhvinsky and Vyshnevolotsky waterways – lake-river systems connected by man-made channels, with in-built wharves and gateways, with purified fairways of the rivers [2, 3, 4].

The first waterway developed under Peter I was Vyshnevolotsky waterway that connected the Volga river with the Baltic Sea – it has 6 small wharves and 8 water reservoirs. The North Dvina water system connects the basins of the Volga river and the Northern Dvina river and consists of seven lakes, four rivers and five channels. In the ancient period there were a number of portages in this area – these were the most important elements of communication in that period that determined the direction of settlement and development of this region.

During the 11 years of the reign of Paul I and his son, Alexander I, Mariinsk water system was developed that connected the Volga basin with the Baltic Sea and intended for supply of St. Petersburg with bread, forest and industrial goods. Through the Mariinsk water system wheat was delivered to Europe [5].

Peter I visited several times the construction of the Tikhvin water system that connected through the channel the mouth of the Volkhov river and the Syas river under the project approved by Paul I in 1811.

Now these historic waterways with preserved monuments of hydraulic engineering function in part, and are in part exhibits, sometimes half-ruined, are unique monuments of cultural-historical and natural heritage not only for the Russian North, but the whole Russia [1].

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Keywords: Ancient Russian state, Peter I, St. Petersburg, Northern Dvinsky, Mariinsky, Tikhvinsky, Vyshnevolotsky, Waterways, Paul I, Alexander I

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The role of the government in the organization of scientific research on natural resources in the XVIII – early XX centuries (using the example of the Smolensk province) (ID 167)

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Both in the tsarist and in modern Russia with well-constructed vertical of power, all the undertakings as a rule come from the "top". A striking example of this is scientific activity in the geographical area. For example, starting from the election of the Defense Minister S.K. Shoigu as the president of the Russian Geographical Society (RGS) and the President of Russia V.V. Putin as the chairman of its board of trustees various activities of RGS have increased significantly.

Large-scale studies of nature, natural resources, population and economy of Russia were undertaken in the XVIII century. Their initiators were the first persons of the state. Peter I by his order established the Department of Geography and the St. Petersburg Academy of Sciences. Later, Emperor Nicholay I ordered to establish RGS in 1845. Geographical studies were deployed both throughout the country and in its separate regions.

Particular attention of the authorities to the Smolensk province was due to its special geographical location: on the one hand it is close to the border, and on the other hand, due to its position at the crossroads of trade routes connecting different states and regions of the Russian Empire.

Starting from the XVIII century natural scientific and economic studies were deployed in the Smolensk province that may be divided into three periods [1].

During the first stage of the first period (XVIII cent. to 1745) under the influence of the reforms of Peter I researches were conducted in the military-administrative and trade areas. Descriptions of the territory and maps were made: military, hydrographic to improve navigation between the northern capital and southern provinces. During the second stage (1745–1765) the Department of Geography, headed by M.V. Lomonosov organized academic expeditions. During the third stage general surveying was conducted at the command of the Empress Ekaterina II, which was accompanied by mapping of the territory and the creation of unique maps.

During the second period (beginning of the XIX century – beginning of the XX century) large-scale field studies were carried out by V.V. Dokuchaev, A.A. Tillo, D.N. Anuchin, performing the state tasks of studying natural resources. Under the project approved by Emperor Nicholay II in 1897 the first population census of the Russian Empire was conducted.

The third period (beginning of XX century) was a period of complex geographical studies of all components of the nature of the Smolensk province, carried out by local naturalists A.N. Engelgardt, K.D. Glinka, A.V. Kostyukevich, Y.Y. Alekseev.

Therefore, starting from the XVIII century the range of objects under study deepened and widened, the amount of collected material increased. Geographic works carried out on the territory of the Smolensk province make outstanding scientific and cultural heritage of Russia which is of global significance.

The work is performed under project №14-05-00618 of the Russian Foundation for Basic Research; №15-03-00749 of the Russian Foundation for Humanities and program Basic Research of the Presidium of Russian Academy of Sciences in 2016 №28.

Keywords: Russian Geographical Society, Peter I, Smolensk province, Department of Geography, St. Petersburg Academy of Sciences, Ekaterina II, general surveying, large-scale field studies, natural resources, government

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Science and scientists in interwar international diplomacy: West-East perspectives (ID 389)

Emilia Plosceanu *(Ecole des hautes etudes en sciences sociales, Paris, France)*

At the end of the Great War, the scholar makes an unprecedented entry on the scene of international diplomacy. While historians, geographers, archaeologists participate in the works of the commissions negotiating the Versailles Peace Treaties bringing proof to support the decision makers, epidemiologists, hygienists, demographers put their knowledge in the service of stabilizing "sanitary belts" against epidemics redoubling in this way the political frontiers established to protect "civilization" against bolshevism. The creation of the International Institute of Intellectual Cooperation in the aftermath of the Great War aims to cultivate this temporary alliance between science and politics by federating scholarly networks of all nations to support elaborating and promoting the program of the newly created League of Nations.

In the long and agitated history which binds together knowledge and power, how do the events around World War I come to reshape the relationship between science and politics in a globalized context giving birth to a new mission of the scholar as diplomat? This contribution addresses a sequence in the process of knowledge specialization which concerns the appeal to scholar's image and authority in political matters.

First, how do local scholars respond to the project of international diplomacy to create a scientific community across national borders based on universal consensus, along with a choral representation of scientific disciplines working together to pacify conflicts and rescue humankind?

Second, how does this scientific diplomacy transform practices of knowledge transfer between "central" and "peripheral" localities, and how does it foster competition between scientific disciplines and methods along national lines, if not their complete absorption by national ideologies?

To analyse the interplay of political and scientific interests within this configuration, we will discuss the asymmetrical status between Western and Eastern scholars, grounding our comparative analysis on a research on ten European countries conducted in the archives of the International Institute of Intellectual Cooperation.

Keywords: science and politics, interwar diplomacy, global-local, knowledge transfer, methodological nationalism

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Radio Landscape after the Battle. Cultural geography of radio-engineering industry in Poland after the WWII (ID 227)

Joanna Walewska *(Nicolaus Copernicus University, Torun, Poland)*

The primary task of the authorities after the war was to rebuild the industry. The problem was not only the destruction caused by the German army, which often devastated plants' machine parks, but also devastation made by the Red Army, which confiscated the surviving equipment and exported it to the Soviet Union. From March 1945, Polish Radio (PR, established by the pro-Soviet Polish Committee for National Liberation), which was involved in protection and acquisition of radio engineering equipment, has sent its employees to make a field reconnaissance. The action was temporarily and geographically correlated with the progress of the war front. Although the operation carried out by PR and government was accompanied by rhetoric of building from scratch, due to the massive destruction and poignant lack of radio-engineering specialists, it was primarily focused on acquiring and commissioning the least damaged factories and plants. In the first phase of the reconstruction in March, several plants in central Poland have been recognized as the key ones, among others: Phillips SA in Warsaw, radio-engineering factory in Wrzesnia and "IKA" plants in Lodz. Among the preserved documents there are extensive reports by engineer Retmański who visited Bydgoszcz, Torun, Nakło, Inowrocław and Pomerania in May and June 1945, where he described the ruined infrastructure. However, most of the existing plants were located in Lower Silesia (in the so-called "Reclaimed Territories" or Polish Wild West), which were organized on the basis of textile factories that during the war have been transformed by the Germans into radio systems factories (Telefunken, Hagenuk Werk-Kiel, Scharf Brothers). This paper, based on the analysis of reports created in the first months after the war by the PR employees, aims to look at the development of radio engineering industry from the perspective of cultural geography. I would like to show how the preserved infrastructure and its geographical distribution determined the development of the radio-engineering industry in the coming decade under auspices of the Communist government.

Keywords: Polish Radio, radio engineering industry, WWII, cultural geography

Session 19: Biopolitics

Chair: ***Michal Šimůnek*** *(Czech Academy of Sciences, Prague, Czech Republic)*

The Question of Racial Ancestry in Portugal (1884–1945): "Aryan Supremacy" As Fascination and as Fallacy (ID 570)

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The presentation aims at providing a comprehensive view of Portuguese intellectual's differentiated stances towards the idea of the supremacy of the "Aryan race" and the modern populations that were considered genealogical branches of this ancestral "race", an idea that, mainly due to the works of Arthur de Gobineau (1816–1882), *Essai sur l'inégalité des races humaines* (1853–1855), and of Houston S. Chamberlain (1855–1927), *Die Grundlagen des neunzhenten Jahrhunderts* (1899), gained considerable popularity, captivating the interest of many notable intellectuals of the final decades of the 19th century and the first half of the 20th century. Due to the extension of the presentation, we will be focusing our analysis mainly on three Portuguese authors, from diverse fields of study, that published works on this subject during the late 19th century and the first half of the 20th century, striving to elucidate why some considered the idea of "aryan supremacy" a fallacy or an unfortunate exaggeration, whereas others, on the contrary, were very sympathetic to the idea and even fascinated by it. In 1884, the historian Oliveira Martins (1845–1894), more than a decade before Chamberlain's 1899 *magnum opus*, published a study on universal history, where the "aryans" are *quasi* epically presented as the driving force of human history and the sole hope of the future for humanity. In 1913, the literary critic Ramalho Ortigão (1836–1915) reviewed the French translation of Chamberlain's *Die Grundlagen...*, but did not adhere to the author's pan-German sentiment, albeit acknowledging the important historical role of the "Germans" from the early Middle Ages to present time. During most of the first half of the 20th century, the physical anthropologist Eusébio Tamagnini (1880–1972) strived to demonstrate that the "Portuguese race" ranked high within the contemporary racial hierarchies and promoted eugenics as the best solution to avoid "racial degeneration".

Keywords: Aryanism, Portugal, scientific racism, Eusébio Tamagnini, Oliveira Martins, Ramalho Ortigão

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Crossroads in Barcelona: from anthropology to genetics. The case of Santiago Alcobé Noguer. (ID 429)

Xavier Calvó-Monreal *(Consejo Superior de Investigaciones Científicas, Madrid, Spain)*

In Spain, in the middle of XXth century, the transition from physical to biological anthropology is well represented through the academic career of Santiago Alcobé Noguer, chair of Anthropology at the University of Barcelona from 1941 until his retirement in 1973.

Santiago Alcobé Noguer (1903–1977) studied at the University of Barcelona, where he took degrees in Natural Sciences and Medicine between 1920 and 1926. He received his Ph.D. in Natural Sciences at the University of Madrid and then continued his studies at the University Clinics in Freiburg and Berlin with between 1928 and 1929. For some years he practiced medicine, but later he devoted himself to teaching from 1941 until his retirement in 1973 at the chair of Anthropology at the University of Barcelona.

At the University of Barcelona, Alcobé held the positions of vice dean and dean of the Faculty of Sciences and, later, President of the University between 1963 and 1965. He also held positions in the Spanish Science Council (CSIC), first as director of the Center for Human and Animal Genetics in Barcelona and later as secretary and president of the Barcelona's Spanish Science Council Delegation until his death.

In his teaching, he was able to give an updated vision of anthropology, based in genetics and biostatistics. In the Faculty of Sciences, Alcobé devoted part of the program to General Genetics, within the subjects of General Biology and Anthropology, initiating research lines in this field. He also taught at the Medical School, introducing genetic contents in the General Biology course, as well as genetics at the School of Agriculture of Barcelona. Definitely, Biological Anthropology was established by Alcobé and his disciples, Antoni Prevosti, Josep Pons and Miquel Fusté among others, who completed their training in foreign universities in different fields from those taught in his chair.

The aim of this paper, part of a process that is just starting, is to show the transition produced in Alcobé from physical to biological anthropology and his influence on the development of genetics as a discipline in the faculty of Sciences of the University of Barcelona, mainly, but also cytogenetics and molecular biology, thanks to his institutional position in the Barcelona's delegation of the Spanish Science Council (CSIC).

Keywords: Physical Anthropology, Biological Anthropology, Genetics

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Lamarckian Power Politics: The Case of Pierre-Paul Grassé (1895–1985) (ID 581)

Emily Herring *(University of Leeds, Leeds, UK)*

Twentieth century evolutionism in France is seen as something of an oddity in the history of biology. Indeed, while British, American and German Darwinians were developing the Modern Evolutionary Synthesis, one of the leading zoologists in France, the radically anti-Darwinian Pierre-Paul Grassé, held the chair for Evolution in Paris from 1940 to 1967. He defended a certain form of neo-Lamarckism which echoed his spiritualist philosophy (inspired by Henri Bergson and Pierre Teilhard de Chardin), his Christian faith and his conservative (often reactionary) political views. Grassé was, from the 1940s to the 1970s, one of the most powerful decision-makers within French biological institutions. His career therefore presents itself as an interesting case-study to reflect on the dynamics of the relation between scientific research programmes and political, or institutional, forms of power.

Firstly, his rejection of Darwinism rested upon certain political and religious views and the stakes were high: Grassé believed that evolution was progressive and directional and that, with the advent of mankind, it no longer concerned the transformation of organisms, but took place on a spiritual level. Mankind was responsible for his own spiritual evolution. Therefore, policies regarding education and ideologies integrating moral values were the key to the progress of the human species and he saw President François Mitterand's socialist government as dragging humanity downwards rather than upwards. This is particularly apparent in Grassé's notebooks in his personal archive, which I recently had the opportunity to study.

Secondly, Grassé pushed his anti-Darwinian, religious and political agenda in his lectures, the conferences he organised, the research programmes he led and the job appointments he was responsible for. Therefore, attention to Grassé's considerable institutional power will offer valuable insight into a little studied case of institutionalised Lamarckism, in mid twentieth century Europe, distinct from the better-known case of Lysenkoism.

Keywords: Lamarckism, Pierre-Paul Grassé, French biology, Spiritualism

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The Origin of Life Debate in Portugal During the Estado Novo Regime (1933–1974) (ID 572)

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The origin of life was a regular topic of discussion among Portuguese scientists and intellectuals during the 19th and the 20th centuries, as studies on the history of evolutionary thought in Portugal have shown. However a thorough study of this subject is still lacking. Due to the extension of the presentation, we will seek to provide a synthetic view of the debate on the origin of life in Portugal during the rightwing conservative regime of the *Estado Novo* (1933–1974). Following Alexander Oparin's (1894–1980) and J. B. S. Haldane's (1892–1964) first accounts of the "primordial soup" theory in the 1920's

(1924 and 1929, respectively), the English translation of the former's *The Origin of Life* was published in English in 1938, thus making his theory on the origin of life accessible to a wider audience. In 1953, Stanley Miller (1930–2007) and Harold Urey (1893–1981) successfully produced amino acids by reproducing in the laboratory environmental conditions similar to those of early Earth, thus confirming Oparin's theory. Was there an early support for Oparin's origin of life theory on behalf of the Portuguese scientific community and intellectuals? What kind of reactions did the ongoing investigations within the field deserve from the Portuguese Catholic Church and catholic scientists and intellectuals, knowing that Portugal was a predominantly Catholic country and that the Catholic Church played an important role at all levels of education and scientific research, especially during the *Estado Novo* regime? Where any Portuguese translations of landmark publications on the subject published? Was any original Portuguese research conducted within the field? Were the new findings a privileged theme of Portuguese popular science publications? Was the "primordial soup" theory taken up by Portuguese secularist thinkers? These are some of the main questions we will be seeking to provide with answers throughout our presentation.

Keywords: origin of life, Alexander Oparin, J. B. S. Haldane, "primordial soup", Portugal, Estado Novo

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Biopolitical Ideologies of European Union: A Historical Approach (ID 527)

Bartosz Płotka *(Nicolaus Copernicus University, Toruń, Poland)*

In recent decades new biotechnological means and procedures to apply to human body have become available on the market. An immediate response to those new practices has emerged as a new discipline of practical and political philosophy. It was bioethics, represented by those who felt anxious about the possible outcome of using the new biotechnologies. In response to the claims of the opponents of biotechnology, the European Commission has started a legislative process of taking a political control over the technologies since 1988 and over the so-called life issues (such as *in vitro fertilization*) since 1998.

The aim of this work is to present a complex 20 years old history of the specific relation between science and politics on the example of chosen European Union's departments (e.g. The European Group on Ethics in Science and New Technologies or the European Council). The relation's specificity is that the new types of political thinking emerge during deliberation on biopolitical cases and on the base of these cases themselves. To analyse EU's biopolitical approach I use the neo-Weberian method of idealisation to reconstruct two antinomian ideal-types of bioliberalism and bioconservatism and a set of sub-types between them. The assumption behind it is that although the ideal-types do not exist in reality, they have to be operationalized by precise, logically and semantically separate criteria. Having those precisely selected and described criteria I examine the real cases by analysing which elements cause that they do not match to the ideal-types, which elements place them among the sub-types and which elements cause their historical change. Secondary method in this research is a content analysis method. I have used it to examine EU's documents that take into account bioethical matters.

The major findings of the research are 1) identification of ideological values on which EU's institutions have based their biopolitical decisions since 1988; EU's political approach towards biotechnological means and procedures; legal model supported and proposed by EU to apply to bioethical cases in the European countries; goods defended by EU in these cases, and 2) that EU's biopolitics in 1988–2010 was closer to the ideal-type of bioliberalism.

Keywords: biopolitics, European Union, biotechnology, bioethics, bioconservatism, bioliberalism, method of idealisation, ideal-types, biopolitical ideologies

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Session 20: Scientific Issues in the Astral Sciences

Chair: ***Helge Kragh*** *(University of Copenhagen, Copenhagen, Denmark)*

The age of the Sun and its sources of energy, ca. 1850–1910 (ID 423)

Helge Kragh *(University of Copenhagen, Copenhagen, Denmark)*

It was only with the discovery of the law of energy conservation in the 1840s that the Sun was considered a cosmic heat engine with a limited supply of fuel. How long had the Sun shone and for how long would it continue to shine? What was its source of energy? These questions were widely discussed during the Victorian era, not only by scientists but also by philosophers, writers and social critics. They were closely connected with the debate concerning the age of the Earth and the challenge from the new natural history based on evolutionary theory. Based on the principle of energy conservation, the first proposal was a meteoric theory (J. R. Mayer, J. Waterston), but it was soon replaced by a gravitational contraction theory (H. Helmholtz, W. Thomson). In both cases the Sun's thermal energy was due to gravitational potential energy. The Helmholtz-Thomson contraction theory was generally accepted for about half a century in spite of the problematically short lifetime it offered for the Sun. During the first decade of the twentieth century it was challenged by the hypothesis that the Sun derived its energy from radioactivity or other subatomic processes. However, the hypothesis was never developed into a proper theory, with the result that contraction theory remained alive. As A. Eddington expressed it, by 1920 it was "an unburied corpse." The talk will discuss the question of the Sun's energy ca. 1850–1910 in relation to a forthcoming book on the history of solar physics.

Keywords: Sun, solar energy, age of the sun, gravitational contraction, H. Helmholtz, W. Thomson

From Biblical Flood to Swedish Deluge: Astrology, Chronology and Political Propaganda in Prognostications by Joannes Latosinus (ID 582)

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Joannes Latosinus (Jan Latosz, 1539–1608) is today mostly remembered as an author of an erroneous proposal of calendar reform which he wrote in 1580s in reaction to the introduction of the Gregorian calendar and which eventually lead to a long-lasting exchange of polemical writings with the Polish Jesuits. However, apart from being one of the actors in the calendrical controversy, Latosinus worked as an astrologer. In 1594 he published in Cracow a Latin *Prognosticon* which he dedicated to emperor Rudolf II, in which he reinvigorated the traditional astrological model of great conjunctions of planets in order to show the purpose hidden in the past and the ultimate goal of human history. Since this publication apparently did not attract the attention of the imperial court in Prague, Latosinus made use of his ideas in another text, i.e. *Przestroga* (*A Warning*), which was published a year later and this time was dedicated to Duke Konstanty Wasyl Ostrogski (1526–1608), a powerful Orthodox magnate and future patron of Latosinus. In *Przestroga*, the Cracow astrologer developed further his chronological and astrological vision of great cycles of history and included a powerful vision of the great emperor coming from the north. These two texts, despite the fact that Latosinus's writings were prohibited due to his involvement in calendrical polemics, enjoyed somewhat unexpected popularity few decades later when the astrologically grounded prophecies of the northern ruler became even more evocative during the Swedish invasion of Poland-Lithuania. This paper will be aimed at showing the mechanism of transition from a text which is deeply rooted in the technical and intellectual framework of astrology and chronology to a form of political propaganda. While Latosinus's writings dedicated to the astrological account of world history were from the very beginning deeply embedded in the mechanisms of power and patronage, their career after the author's death shows how one's writings can be reinterpreted in a completely new political context and used as an element of completely different political agenda.

Keywords: Joannes Latosinus (Jan Latosz), chronology, astrology, great conjunctions, early modern political propaganda, early modern politics, patronage

Astronomy at the service of 16th c. States: Galileo and the longitude problem (ID 545)

Meropi Morfouli *(Paris Observatory, Paris, France)*

The quest for Longitude was related from its very beginning to the quest for power. An astonishing example is the creation of the Vereenigde Oost-Indische Compagnie or VOC a Company created in 1602 by the Republic of the United Netherlands the goals of which were military and commercial. This Company is frequently defined as the most powerful capitalist enterprise that ever existed. In order to achieve its goals, the VOC needed to find a solution to the "longitude problem". A precise solution to this problem could offer safe, fast and efficient navigation.

Galileo Galilei, very intrigued by this problem had an idea. Observing Jupiter with his telescope he discovered four satellites with very frequent eclipses. He considered that this celestial phenomenon could possibly solve the longitude problem. He drew up tables with the predicted satellite motions and conceived the idea of a precise "time-measurer" able to perform on a ship. Galileo communicated his idea to the Republic of the United Netherlands. In June 1637 he sent a letter to Lorens Reael (Governor General of the Dutch East Indies) explaining how one could prevent eventual problems in the realisation of his idea (the observer's stability in the boat, the position of the telescope) and how to manufacture a reliable timekeeper (or "time measurer").

Galileo studied the properties of the pendulum for a long time and discovered a uniform period of vibration in their motion, a property called isochronism that could potentially turn them into reliable timekeepers. In the Galileo Museum in Florence there is an exposition of a drawing (inv.2433) made by Galileo's pupil Vincenzo Viviani and by Galileo's son, Vinzenzo, claiming that this drawing:

"*reproduces the apparatus illustrated by Galileo in his letter of June 1637 to Laurens Reael, in which he explained his method of determining the longitude based on the observation of the periods of Jupiter's moons. This solution required a very precise time-keeping system. To this end, Galileo proposed a clock (inv. 2085) of his invention that made use of the isochronism of pendulums of equal length, a principle discovered by Galileo himself.*"

This "clock of his invention" is what Galileo calls his "time-measurer" mentioned above. After a meticulous study of the letter in question, one can find oneself very troubled by comparing Galileo's description and Viviani's drawing. The "time-measurer" described by Galileo is not that of a simple pendulum as one could expect. On the contrary it has a considerable number of particularities and it is very different from the one that figures on Viviani's drawing. This drawing may be inspired by Galileo's description, but it is very far from being its reproduction.

What we propose here is to present Galileo's "time-measurer", it's properties, it's precision in time measurement, to explain why the drawing does not correspond to Galileo's description, and in the end to develop a hypothesis of where Galileo could find the inspiration to create this kind of "time-measurer".

Keywords: Galileo Galilei, Timekeeper, Longitude

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Astronomy as a power tool in Cochinchina in João de Loureiro's (1717–91) time (ID 594)

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Today the international reputation of the Jesuit priest João de Loureiro (1717–91) rests mainly on his innovative botanical work especially his *Flora Cochinchinensis* published by the *Academia das Ciências de Lisboa*, in 1790.

Loureiro arrived in the ancient Kingdom of Cochinchina in 1742 and remained there almost continuously until 1777. By 1755, Loureiro was the only priest officially allowed to stay in the country following the religious expulsions that occurred in and after 1750. Surviving in an otherwise hostile and sometimes volatile environment, Loureiro played a variety of important roles during his stay at the Court. In particular, he was the King physician and Royal mathematician. The need to predict the occurrence of astronomical events relevant for astrological predictions led him to make regular observations of the sky. We know that he observed, for example, the transits of Venus of 1761 and 1769 and several eclipses. With his reputation based upon the precision of his predictions, João de Loureiro strove, in difficult conditions, to accompany astronomical developments. Curtailed from the natural Jesuit epistolary network, following the religious order expulsion from all Portuguese domains (1759) Loureiro tried, over the years, all communication lines available. At the end of his stay in Conchinchina his contact with the western world was mainly made via the East Indies Company network. This allowed Loureiro to acquire much needed bibliography.

In this paper we will present an overview of João de Loureiro's life and work using new primary sources. We will focus on his geographical and astronomical activities contextualizing them within the Cochinchinese's and Jesuit's practices and 18th century communications networks.

Keywords: History of Astronomy, Astronomical observations, João de Loureiro, Transit of Venus, Cochinchina, Vietnam

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Wars and Stars: Astral Sciences in Military Service from Asarhaddon to Hitler (ID 505)

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The paper to be presented will present a number of cases in different epochs in which astral sciences were used as strategic means in war. The kings of the Neo-Assyrian Empire (911 to 612 BCE) used to collect reports from the astronomers on the prediction of astral phenomena and their interpretations, which included the indications of favorable or unfavorable days for military actions. Such reports in Accadian are preserved on cuneiform tablets. According to Herodotus, Thales predicted the solar eclipse of May 28, 585 BCE and helped the Ionians to win a battle at the river Halys. Similarily explained Lucius Aemilius Paulus to his troups the natural causes of a lunar eclipse which occurred the night before the battle of Pydna in 168 BCE. His soldiers overcame their fear and won the battle. Greek astronomy and astrology found its way to India and there a special branch of the discipline to find a

favorable time for beginning a war was developed. In Sanskrit it was, called yātrā, and Varāhamihira (6th century CE) wrote the first independent treatises on it. One of these works was translated into Arabic and their content was integrated into the works on electional astrology, called ikhtiyārāt. In the 12th century a number of them were translated into Latin and formed the base of standard practice among European court astrologers. These were active until the 17th century. The most famous case is Wallenstein, the war leader of the Catholic League in the Thirty Years War, who commissioned horoscopes from Kepler and employed Giovanni Battista Seno as his personal astrologer. In the 20th century in the revival of astrology high politicians consulted astrologers, among whom Hitler was the most known. Based on these and other examples a typology of the strategic uses of astral sciences will be developed. The subject of astral sciences in military service is predestinated for the approach of "longue durée" in the study of the history of science. Further, there will be a special emphasis on the medieval Islamic world and Arabic sources, which are for the most part unpublished and still largely unexplored.

Keywords: astronomy, astrology, war, strategy, scientific consultants, Accadian, Greek, Sanskrit, Arabic

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Session 21: The Power of Scientific Networks and Institutions

Chairs: ***Frank James*** *(University College London and Royal Institution, London, UK),* ***Sally Shuttleworth*** *(University of Oxford, Oxford, UK)*

Science, politics and institutional rivalry in eighteenth-century Portugal: the origins of Lisbon Academy of Sciences (ID 533)

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In 1779, a scientific academy was finally established in Lisbon. The readers of the first draft of the statutes of the Royal Academy of Sciences of Lisbon would learn that the new institution aimed not only to promote scientific research, but also to establish a class devoted to the education of a number of young noblemen. Accordingly, the creation of a set of "pedagogical establishments" was planned. Although not exclusive of the Lisbon academy, pedagogical functions were hardly found in scientific academies. Yet, the plan of the Lisbon Academy of Sciences was not new to the Portuguese contemporaries. In fact, a plethora of scientific training institutions were created or reformed in Portugal in the late eighteenth century. Thus, why did the founder of the Lisbon Academy of Sciences decide to include science teaching in the academy's initial project? This paper argues that this decision did not stem exclusively from the Enlightened agenda of its founder, as historians tend to claim uncritically, but it should be understood against the context of political dispute and institutional rivalry that characterized Portuguese society in the last decades of the century. By approaching the case of the Royal Academy of Sciences of Lisbon, this paper aims, more broadly, to revisit the historiography of eighteenth-century scientific academies.

Keywords: Royal Academy of Sciences of Lisbon, Scientific Academies, Science teaching, Enlightenment, Universities, Military academies, Portugal

Antoine Gaubil, S. J., and his election to the Russian Academy of Sciences (ID 566)

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Antoine Gaubil (1689–1759), a French Jesuit and missionary to China where he resided since 1722 until his death, was one of the most outstanding scholars of his time. He published a number of works on the history of Chinese astronomy and chronology, translated the classical *Book of Documents* (*Shu jing* 書經), actively corresponded with a number of prominent European scholars, and was a member of the French Academy of Sciences and of Royal Society of London. In 1739 Gaubil was elected a foreign member of the Imperial Academy of Sciences of Russia.

The details of the election of Gaubil to the Russian Academy membership remain unknown. It appears plausible to suggest that his election was somehow related to the materials brought in 1734 by the Swedish engineer Lorenz Lange (or Lorents Lange, Russian Лоренц or Лаврентий Ланг or Ланге) (c. 1690–1752) to the French astronomer Joseph-Nicolas Delisle (1688–1768) who worked in St. Petersburg from 1725 to 1747. The published correspondence suggests that during his stay in Beijing in 1732 Lang contacted Gaubil who promised to provide him with these materials during Lang's next mission to Beijing scheduled to be conducted in 1735. We conjecture that Gaubil passed over his materials to Lang in 1732 rather than in 1735 or 1736 and that his election in 1739 was related to his work on cartography of China and of Eastern part of Russian Empire (the achievements of Gaubil in this field are also well known: he, for instance, drafted a Chinese-style map of China and Russia extending up to St.-Petersburg on request of Chinese Emperor). Even though there are some published documents that support the latter hypothesis, our attempts to substantiate it so far have not been very successful. However we were able to find an additional clue, namely, a draft of a letter written in 1761 by Gerhard

Friedrich Müller (Russian Фёдор Иванович Миллер, 1705–1783) to another Jesuit expert in astronomy, Ferdinand Augustin Haller von Hallerstein (1703–1774) who worked in China since 1739 and was also elected a foreign Academy member in 1765. It is possible that some information could be found in the letters passed over by Müller to Jesuits in Beijing; these letters were supposed to be delivered by two Russian explorers, N. I. Popov (Н.И. Попов, 1720–1782) and S. Ya. Rumovskii (С.Я. Румовский), who conducted astronomical observations in Siberia in 1761.

Keywords: history of cartography in China and Russia, Jesuit missions to China, Antoine Gaubil (1689–1759), Joseph-Nicolas Delisle (1688–1768), Ferdinand Augustin Haller von Hallerstein (1703–1774)

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Western knowledge as leverage for collecting knowledge and objects from Japan under her isolationist policy (ID 449)

Yuko Takigawa *(Kagawa University, Kagawa, Japan)*

During Japan's isolationist policy, western natural historians, such as Thunberg and Siebold who worked as medical doctors for the Dutch East India Company, or Langsdorff who participated in the Krusenstern Expedition known as the first Russian round-the-world expedition, obtained Japanese objects which included natural history specimens. In most cases, western visitors were not allowed to act on their own, so their collecting activities by themselves were severely limited. However, they were fully aware that the Japanese intellectuals, such as interpreters and medical doctors, were eager to learn the western medical practices. In addition, Japanese intellectuals were also enthusiastic about obtaining western information in every available method, including: conversations in person, media, usually books, scientific instruments, etc. For these reasons, western natural scientists used scientific property as leverage to practice their goals, i.e. collecting objects and information concerning Japan, which was not easily accessible for most Europeans. Among those strategies, it is worth analyzing ones by Siebold, who successfully built up a massive Japanese collection and brought it back to Europe, most of which was stored in Leiden. The collection was used as source materials to get Japanese scientific and cultural knowledge. In this paper, I would like to focus on both the strategies and practices which were used by western visitors, as leverage and a tool for acquiring objects and knowledge from Japan along with its limitations in the late 18th and the early 19th centuries.

Keywords: Siebold, Japan, natural history, cultural exchanges, Japanese collection, Thunberg, Langsdorff

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Collecting Minerals at the Royal Institution in the early nineteenth century (ID 477)

Frank James *(University College London and Royal Institution, London, UK)*

The Royal Institution in London was founded in 1799 for the purpose of providing scientific lectures to its members. This function continued when Humphry Davy (1778–1829) was appointed there in 1801 originally as lecturer in chemistry, but soon promoted to professor. His universally acknowledged brilliance as a lecturer put him in a very powerful position to set his own agenda for the institution. As is well known he added scientific research to the aims of the Royal Institution, something that had never been intended or envisaged by its founders. What is less well known, and has hardly been studied, is that from 1803 Davy began to establish a collection of minerals. In the ensuing years and funded by the Royal Institution he toured the British Isles for months on end ultimately collecting several thousand mineral specimens which were put on display in a large room in the Institution. The avowed public purpose of this collection was to provide information on the mineral resources of the islands with the intention of extending that knowledge to the Empire. It would then be possible, ran the argument, to exploit economically these resources for industrial use, something that was especially significant during the war against France. This illustrates the attitudes espoused by Davy and the Royal Institution about the potential power of science and its value to increasing the wealth of society. But Davy was also heavily interested in mineralogy and geology (a surprisingly understudied part of his career especially as his notebooks are full of information on minerals, strata and other geological phenomena). So it is possible that Davy used the rhetoric of the power of science for his own purposes.

Keywords: Royal Institution, Humphry Davy, Mineralogy, Collecting

Citizen Power: Citizen Science in the 19th and 21st Centuries (ID 506)

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The rise of the citizen science movement over the last twenty years raises important questions about the structures of power within institutional science, whilst also offering the potential for new models of scientific practice going forward. With its echoes of revolutionary fervour, and overturning the barricades, citizen science seems to promise a new democratic dawn. This paper will consider the recent rise of citizen science, in its various forms, whilst also placing it in historical perspective. It will draw on research being conducted by members of the AHRC funded project, 'Constructing Scientific Communities: Citizen Science in the 19th and 21st Centuries' (www.conscicom.org), which works with the world's largest citizen science network, Zooniverse, that has evolved from an initial project identifying galaxies in 2007, to a platform with over 40 different scientific projects, and an international community of 1.4 million citizen scientists. In particular, the paper will look at a recent project 'Orchid Observers' which worked directly with non-professional, expert groups in the UK on a project which will contribute to understandings of climate change. Such work highlights the importance of 'amateur' or non-professional groups within the structures of contemporary science, particularly in the field of biodiversity, where the repository of knowledge lies not with the professionals in universities, but amidst the local groups who coordinate the national records. The paper will place these developments in historical perspective, looking back to the nineteenth century, at a time when the professional structures of science were just being put in place. It will track an alternate history of communal participation in science which will challenge some of our received ideas about the rise of professionalism, and the dominance of university science. Understanding past models of participation could offer new ways of thinking about citizen science, and the power structures of contemporary science.

Keywords: citizen science, amateur and professional, Zooniverse, communal participation

Political Power Domination through Academic Institutions Suppression. The case of Succession War in Catalonia (ID 608)

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We present how the political power domination in the first years of XVIII Century in Catalonia carried on through the suppression of many cultural and academic institutions by the political power of the winners of the Succession War (1714). Our main interest is to find ways to introduce our local history related to science, to secondary education and to teacher training.

We begin remembering the main changes that the War caused on important legal, social and cultural aspects in the life of the Catalan people. We do a brief comparison between the cultural and academic institutions that existed in Catalonia before and after the Succession War, and especially between the ancient universities situated in several towns and new university (1717) established quite far from Barcelona. However, our main focus is not the bad consequences of this War, but how the Catalan people, only 50 years after the end of that War, begun to get back on a track with the creation of an Academy and other new institutions.

We focus then, on the 'Conferencia Physico-Mathematica Experimental', an academy created on 1764, and that, like other European science academies, tried to foster the study and experimental practice of the Physics in Barcelona. We summarize our analysis of the inaugural discourse of the Conference, through a comparison of the prefaces of several European science experimental books. We comment about some of the scientists that contribute to the foundation and the contributions of the Conference. To complete this perspective, we talk briefly about another institution, the 'Junta de Comerç' (1760), created by citizens that give support to the commerce and industry. Both institutions created academic chairs to teach experimental science and mathematics, as well as some applied arts or subjects. These institutions were the seeds of the reestablishment of the University in Barcelona on 1837.

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The Private Subscription Library as Intellectual Collective: Sharing Ideas of Science in the Early 19th Century (ID 360)

Alan Rauch *(UNC Charlotte, Charlotte, USA)*

The early nineteenth century saw a remarkable growth in what was called "the knowledge industry." Britain was transformed by new societies for the advancement of knowledge, new means of transporting knowledge, and new (and cheaper) forms of publishing ideas for the masses. One important manifestation of this transformation was the creation of private subscription libraries between the 1790s and 1830s. These libraries—which are still extant—served members of a rising mercantile and professional community that had little exposure to libraries whether at the major universities or in private (affluent) hands.

To that end, these rising professionals worked consortially to create remarkable libraries in the northern industrial cities of Liverpool, Manchester, Leeds, and Newcastle. Each library collected works that facilitated the "advancement of learning," in communities that were overwhelmed by the exponential growth of science, technology, and literature. Among these institutions (all still extant) is the Portico Library founded in 1806 by Peter Mark Roget and the physicians John Ferriar 1761–1815 and Edward Holme 1770–1847. Roget, though well known for his thesaurus, was renowned as a physiologist and as the author of the *Animal and Vegetable Physiology* (1834), one of the Bridgewater Treatises. Ferriar established a name for himself by determining that ghosts and apparitions were the result of disorders of the brain, rather than having any supernatural source. Holme may be familiar to scholars of the Child Labour Movement; his study of the health of children employed in the cotton-factories led to an interview by Lord Kenyon's House of Lords Committee on May 22, 1818. Later on, William Gaskell, the Unitarian Minister, advocate of popular education, and husband of Elizabeth Gaskell, directed the Portico as its Secretary.

My objective in this paper is to explore the idea of the library as a "safe" space for scientific knowledge, that not only made the most contemporary works of science available but did so in a socially progressive manner. The libraries, which existed well before the British Association for the Advancement of Knowledge (1831) and certainly well before science became professionalized enough for either scholarly scientific journals or large laboratory systems. The libraries thus provided a space for learning that might be conducted privately and individually, but was predicated on the understanding that the advancement of knowledge required a communal intellectual of like-minded individual and mutually supportive members.

Keywords: Dissemination, Science, Private, Libraries, Community, Expertise, Professionalization, Reading

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Scientific networks in European seismological research during the 1930s (ID 567)

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Modern seismology as a scientific discipline came of age in the early 20th century. Modeled over physics its practitioners built their theories on quantitative and objective data obtained by new and increasingly sensitive seismographs. As the sophistication of instruments increased so did the scientific network connecting the seismic stations. Data was routinely published in bulletins and exchanged through global networks, organized by international geophysical societies like *Association Internationale de Séismologie* and its national committees.

The societies actively initiated and coordinated international research through conferences and journals, especially in Europa where the seismologists were few, but networks also developed between individual seismologist and across societies.

In Denmark Inge Lehmann was the nation's sole seismologist from 1928 to 1952 and in charge of the seismic stations in Denmark and Greenland. As questions about the Earth´s inner structure was on the forefront of the scholarly discussion, Inge Lehmann was puzzled by her observation of the way some seismic waves passed through the Earth. In 1936 she published her finding, proposing a two-shell Earth model to account for existence of P-waves in the Earth's shadow-zone, exemplified in a single New Zealand earthquake. (1) Her theory about the Earth having an inner core was well received and became widely accepted within the following years.

Based upon Inge Lehmann´s correspondence, which previously has not been available for research, this paper explores the interplay between national research and international scientific networks in 1930s European seismological research, as expressed in Inge Lehmann´s study of P-waves.

Keywords: Seismology, network, european, 1930s, geophysic, Inge Lehmann, earthscience

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The paths of knowledge legitimization: innovation and pluridisciplinarity in innovation oriented institutions, schools and programs (ID 495)

Jean-Claude Ruano-Borbalan *(Conservatoire National des Arts et Métiers, Paris, France)*

At least, since the nineteen century the growth and spread off Education & training, techno-science and development of mass-medias is a co-evolutionary process. During the last half century, one saw the development of a new regime of scientific and scientific knowledge production, entangled to schooling, generalization of mass communication and communication networks. This regime is based on standardisation of technics and institutions of knowledge, and framed and promoted by strong research and innovation public policies.

The question of authority and Legitimization of knowledge, is one of the main one in this context. It has been really renewed, if one focus on some limit and transformative processes of knowledge construction and transfer. For example the constitution of specific technics for reputation and authority for scientific knowledge, linked to web (new metrics) and collective anonymous evaluations or standardized ranking processes of Institutions of knowledge production.

For another example, the emergence of a new kind of innovation and creativity oriented schools or cursus in higher education. This emergence, and it's justification discourses (innovation, design thinking, etc.) is often viewed and « revolutionary».

In this last example, the issue of the legitimization of knowledge emphasize debates on efficacy versus truth or science, pluridisciplinarity versus discipline oriented knowledge, validity of design thinking or

new pedagogical methods, implication of enterprises and organisations in the production of knowledge, etc. Those debates have to be put on the long haul where one see the constitution of an « engineering» and « project disciplines» global epistemic culture.

We'll present the first results of a current comparative research, looking at pedagogical or interdisciplinary activities in in a European comparative perspective that emphasize the legitimization process and justification discourses produced in the «new» schools or curricula where innovation is seen as a graal. We are studying some design schools, puridisciplinary centers (centre Michel Serres pour l'innovation, Oxford), and industrial programs (creative Wallonia, in Belgium, England and France.

The first steps of the research examine the question of pluridisciplinarity and its justifications, strongly enhanced as a «modernist» discourse supposed to develop innovation and economic or technological growth, in the economical and political view, driven by international institutions such OECD, is when applied, more and more syncretic, coming engineering and art, civil society and citizen mobilization in techno-science controversies, but also from humanities, pedagogy, etc.

The historical comparison shows that one can see numerous analogy withe the end of nineteenth century constitution of engineering sciences and institutions, where the same questions (in other ideological context) were developed.

Keywords: knowledge legitimization, design schools, pluridisciplinarity, authority of knowledge, engineering culture, project disciplines

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Session 22: The Attitude of Scientists towards Authoritarian Regimes in the 20th Century (Portugal and Spain)

Chair: ***Antoni Roca-Rosell*** *(Universitat Politècnica de Catalunya, Barcelona, Spain)*

Traditionalism and evolutionism: the co-construction of science and Francoism (1939–1975) (ID 579)

Clara Florensa *(Autonomous University of Barcelona, Barcelona, Spain)*

After the end of the Spanish Civil War (1939), a dictatorship was established. The new regime pretended to make a fresh start, to build a "New Spain", by returning to a traditional, conservative and Catholic model of society. According to a paternalistic and strongly authoritarian idea of the State (by which an educated elite, like minded with the established new regime, would guide the country to the best) the responsibility of guiding the country fell on the intellectuals. Francoist Spanish intellectuals enthusiastically took the challenge of constructing the conceptual fundaments for this New Spain. And, of course, this project involved science. Analyzing their discourses, writings and ideas for the new Spanish scientific policies, I will show the mutual construction of ideology and science in Spain during Franco's regime. This analysis will also highlight that Franco's regime was not monolithic: it will demonstrate how various factions elaborated different scientific discourses and policies in order to gain hegemony and political power inside Franco's dictatorship.

For this analysis, I will focus on the discourses these Francoist groups elaborated regarding evolutionary theories. For some of these intellectuals, the so-called traditionalists, the New Spain they fought for would never come true without annihilating from the Spanish culture those ideas, theories and movements (alongside their supporters), which they thought were the seeds for anarchy, communism and the loss of Christian values. Among these seeds, they counted Darwinism. I will show how these traditionalists supported a non-materialistic, finalistic-theistic view of evolution, opposed to Neo-Darwinism, in order to construct a Catholic science for their "new country". I will present their arguments, strategies and activities, which ranged from restricted elitist debates to public communication campaigns.

Keywords: Evolution, Francoism, Science and religion, Neo-Darwinism, Darwinism, Modern synthesis, Finalism, Theism, Evolutionary theories, Materialism

Negotiating the sky. UK plans to operate large telescopes in Franco's Spain (1965–1975). (ID 466)

Matteo Realdi *(Vrije Universiteit Amsterdam, Amsterdam, the Netherlands)*

In this talk I will address the blurring boundaries between the pursuit of a national scientific policy and the promotion of international scientific collaborations. The framework is the reorganization of optical astronomy in post-WWII Europe in terms of new research networks and facilities, which mainly consisted of searching overseas sites of excellent seeing condition, implementing transnational observational campaigns, and eventually installing powerful telescopes in both hemispheres.

In particular, I will describe the plans of British astronomy for a national observatory in the northern hemisphere that could compete with US optical telescopes, and I will focus on the different levels of the resulting negotiation with Spanish institutions to operate telescopes in the Sierra Nevada and the Canary Islands (1965–1975). In fact, the first initiatives promoted by small groups of astronomers gradually merged into a more complex endeavour, characterized by issues of prestige, power, and control. On the one hand, UK site-testing campaigns were welcomed by Spanish astronomers, since this activity could actually have positive effects on the backward state of astronomy in Spain, a field of study almost neglected during Franco's dictatorship. On the other hand, the official agreement to

install British telescopes was eventually reached after long and difficult negotiations, which reflected both the different strategies of the corresponding national scientific institutions, and the tense political relationship between Spain and UK.

Keywords: astronomical observatory, Royal Greenwich Observatory, site-testing campaigns, international scientific collaboration, science in post-WWII Europe

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Funding Science during the Portuguese dictatorial regime: The case of the Gulbenkian Institute of Science (ID 575)

Richard Marques *(Institute of Education and Citizenship, Mamarrosa; University of Aveiro; Institute for Interdisciplinary Research, University of Coimbra, Mamarrosa, Portugal),* ***Arsélio Pato Carvalho*** *(Institute of Education and Citizenship, Mamarrosa; Center of Neurosciences and Cell Biology, University of Coimbra, Mamarrosa, Portugal),* ***Carlos Fiolhais*** *(Faculty of Sciences and Technology, University of Coimbra, Coimbra, Portugal)*

In the second half of the 20th century, new scientific techniques and ideas led to the advent of Modern Experimental Biology (Lutz, 2002). In Portugal, the scientific research and education related to Modern Experimental Biology arrived only in the late 1960s, with the establishment of a private research institute, the Gulbenkian Institute of Science. In this work we show how private initiative and funding can change the scientific landscape of an underdeveloped country.

The Portuguese Republic was implanted in 1910, but a military coup led in 1926 to a dictatorship which lasted until 1974, when the military reinstalled a democratic regime. Salazar was the prime-minister during more than 40 years, a period known as "Estado Novo", where Science was not officially favored. Only after 1974 and, even more, after 1986, when Portugal entered the European Union, scientific research become a national priority, and emerged consistently at Portuguese universities and other institutions.

Nevertheless, some governmental funding agencies, supporting research and high education, were created during the dictatorial regime: the Union of National Education (1927), the Institute for Advanced Culture (1936), and the National Union of Scientific and Technological Research (1967). In the democratic regime, other agencies followed: the National Institute of Scientific Research (1976), and the Foundation for Science and Technology (1997), which continues its funding activities in the framework of the Ministry for Science and Technology (Fiolhais, 2011).

Private research institutions also played a role in Portuguese Science History: The Bento da Rocha Cabral Research Institute was created in 1923, the Calouste Gulbenkian Foundation in 1956, and the Champalimaud Foundation in 2004 (Fiolhais, 2011). The Gulbenkian Foundation founded the Gulbenkian Institute of Science in 1961, an institution which contributed greatly to the development of Science in Portugal (Fundação Calouste Gulbenkian, 1972; Calado, 2007).

In 1962, the Gulbenkian Institute of Science created the Center of Biology, which gave rise to four laboratories: Microbiology, Pharmacology, Physiology and Cell Biology (Fundação Calouste Gulbenkian, 1972). Most of the research and graduate education carried out at this center was related to Modern Experimental Biology.

In 1969, that Institute created an ambitious graduate program, the Oeiras Advanced Studies, under the direction of the Dutch Nicolau van Uden (1921–1991), director of the Microbiology Laboratory (Fundação Calouste Gulbenkian, 1972; Peinado and Leão, 2012). This program included intensive courses in Modern Experimental Biology and related areas. Many young teaching assistants and professors of national and international universities attended these courses, which in most cases provided their first exposure to Modern Experimental Biology. It was through these young faculty members that new techniques and scientific concepts were brought to the then existent universities, and were inserted in the academic curricula.

At the University of Coimbra, for instance, the scientific research and post-graduate education related to Experimental Biology benefited greatly from the Oeiras Advanced Studies. In the late 1970s, the Coimbra Advanced Studies were created with a philosophy similar to that of Oeiras. A well planted seed was giving fruits.

Keywords: "Estado Novo", Calouste Gulbenkian Foundation, Oeiras Advanced Studies, Nicolau van Uden, Modern Experimental Biology

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Archaeology and power in Portugal during the 60s of the 20th century: actors, networks and theories (a first round analysis) (ID 600)

Ana Cristina Martins *(Faculdade de Ciências Sociais e Humanas da Universidade Nova de Lisboa, Lisbon, Portugal)*

The 60s of the 20th century were very important for Portugal. In some ways they were innovative, following a series of events occurring after the end of World War II. Among these, the international pressure placed on domestic policy to promote international cooperation, including scientific. Despite never having centralized successive Portuguese political agendas, for reasons that have to do with the specific history of the country, archeology was not indifferent to this process. Actually, archaeology was then funded as had never been before, multiplying the number of thematic meetings and publications, including monographs, and journals. More than that, the opportunity arose to complement academic training in important European university centers, including English ones, opening the way to new international collaborations.

With this paper, we aim to understand how these initiatives, together with the influence of Structuralism, Functionalism and Processualism in Portuguese archaeology, resulted in new looks over the past. Thus, we will list actors, networks and theories, in order to understand the emergence and setup of groups and research projects, which strong-minded national archaeology during the following decades. Besides, and via social network analysis and actors network theory, we will analyze if and how this

new archaeological context was politically guided and used, as well as the extent and sorts of ties which existed between Portuguese archaeology and the political, institutional and individual powers.

Keywords: Archaeology, Science and power, Portugal during the 60ies, Archaeological networks, Philosophy and Archaeology

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Session 23: Global Approaches to Science and Power

New Brazilian Medicines Circulation on Global Scale (16th to 18th century): the various narratives of medicinal herbs (ID 557)

Danielle Almeida *(Fundação Oswaldo Cruz, Rio de Janeiro, Brazil)*

The focus of this presentation is how the medicinal herbs were introduced in the European medical canon on the 18th century. Thereunto, this presentation will be concerned with the various narratives of an herb through the centuries, as well as descriptions and experiments carried out to it be considered an effective medicine. For this purpose, a medicinal herb should move through a number of stages, which consisted: the observation of medical indigenous practice, his first European descriptions, the standardization of its common nomenclature, the experimental use by European physicians and apothecaries, and finally the commerce of these herbs through the Globe, which was tightly bound to their acceptance on the medical canon. Therefore, the presentation will discuss the trajectory of two medicinal herbs in Brazil: the ipecacuanha, which appears in first reports of Jesuit missionaries in the 16th century, and the aypana, that has been recorded with this nomenclature only in the late 18th century. It is important to note that different narratives about the remedies are related to power relations – the source who is talking about it – where indigenous knowledge need to be investigated, tried and tested by a European institution or scientific group that validate and reassure or dismisses the efficiency. In this sense, a native medicinal plant, for example, in South America, needs to be systematized and standardized within the European scientific canons to thereafter be considered effective and suitable for the large trade and consumption.

Keywords: medicinal herbs, medicine, pharmacy, commerce, power, narratives, science, Portugal, South America

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Knowledge, Power and Empire: Medical manuscripts and Natural Sciences in 18th century Portuguese India. (ID 478)

Fabiano Bracht *(University of Porto/ CITCEM – Fellow CAPES/ Programa de Doutorado pleno no Exterior, Porto, Portugal)*

Portuguese Overseas Empire, connecting, from the 16th. century on, four continents: Europe, Africa, America and Asia is a privileged ground for the analysis of the production of knowledge in the Early Modern Age and its connection with power strategies and ways of empire building. Against this background, this paper aims at submitting to discussion a research project developed under the PhD program in History of the University of Porto. It is centred on the analysis of the production of medical texts in Goa, during the 18th century, and their circulation in Europe. The PhD project intends to focus on the diverse aspects involving the production of medical and natural philosophical texts in the Eastern Portuguese Empire. One of the main aims is to understand the relationship of their authors with the imperial power, that is to say, the political and religious authorities. In an Ancient Regime colonial

society, patronage and personal relationship were as important as formal education to guarantee prestige, recognition, funds or even protection to the scientific production and their holders. In this paper the discussion will be centred on three analytical axes. Firstly, it intends to identify and characterize the agents who produced such knowledge. Who were they? Where did they study and with which kind of intellectual setup did they interact with? Secondly, we will focus on the characteristics of the produced knowledge: was it based in a more European or autochthone background? Can we identify a hybrid medical knowledge containing elements of both European and Indian traditions? Finally, the paper will focus on the power structures they had to deal. With. How did they interact with the political, religious, social and racial dimensions of the Portuguese colonial society?

Keywords: History of Science, Pharmacy, Medicine, Portuguese India, Goa

A Portuguese science in the tropics: power and circulation of scientific knowledge in 18th century (ID 479)

Gisele Cristina da Conceição *(University of Porto/CITCEM – Fellow CAPES/Programa de Doutorado Pleno no Exterior, Porto, Portugal)*

There are many studies that analyze the formation of scientific thought in Portugal and its Empire during the eighteenth century as well as the construction knowledge about the Brazilian Natural World. This talk will be focused on understanding the scientific knowledge production, especially concerned with its circulation patterns of practices, materials and ideas between Portugal and its American colony. Our purpose will be understanding how the natural world of Portuguese America was observed and analyzed within the natural philosophical parameters of the period; the patterns of circulation this knowledge and the profile its producers. Therefore, the focus will not be directed to the materials and instrumental aspects of knowledge, but to more broad aspects such as networks of contacts, exchanges, and social interactions which are related to political, social and economic relationship between Portugal and Brazil. The existing relations between the Enlightenment thought which arrived to Portugal through the Crown initiatives, individual work, expatriate intellectuals, Crown military officers, and clerics, and the construction of a Portuguese Enlightenment Age in association with the colonial reality will constitute the core objects of our analysis. Therefore, in this paper we intend to analyze some of the historical aspects which are relevant for the understanding of the Portuguese Enlightenment and its relations with the colonial empire power structures. Furthermore, it will be based on the understanding of that throughout the eighteenth century, knowing and recognize the natural potential of the colonial territories meant having power, and these power relations definitely have reflected in the construction of science in the Portuguese Empire.

Keywords: Natural Philosophy, Portuguese America, History of Science, Enlightenment

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Indigenous Medicines in the European Pharmacies: Brazilian medicinal herbs in the Portuguese medicinal canon (ID 568)

Wellington Bernardelli Silva Filho *(Universidade de Lisboa, Lisboa, Portugal)*

By the middle of 18th century, the increasing shortage of gold extracted from the Brazilian mines – the major source of wealth of Portugal – made that Portuguese Crown, as well as settlers and merchants, seeks new sources of profits in the Brazilian colony. If previously the exploitation of native genera was mainly focused on pau-brasil (*Caesalpinia echinata*), this new framework has made that a better knowledge and commercial use of natural drugs would become the central focus to improve the Portuguese economy. In addition to the economic issue, a significant amount of physicians and apothecaries started to designate a major concern for the use of Brazilian medicinal herbs in the development of medical knowledge, as evidenced by numerous publications, especially in the Portuguese pharmacopoeia printed in the 18th century. The focus of this presentation will be how the Brazilian medicinal herbs were introduced in the Portuguese and, in the broader concept, in the European medical canon during the 18th and late 19th century. Thereunto, this presentation will be concerned with the various narratives of an herb through the centuries, as well as descriptions and experiments carried out to it be considered an effective medicine. For this purpose, a medicinal herb should move through a number of stages, which consisted: the observation of medical indigenous practice; his first European descriptions; the standardization of its common nomenclature, the experimental use by European physicians and apothecaries; and finally, the commerce of these herbs through Portugal and Europe, which was tightly bound to their acceptance in the medical canon.

Keywords: Portuguese pharmacy, History of medicine, 18th century Pharmacopoeias, Circulation of Medicinal Herbs

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Serums and vaccines against the bubonic plague in India: disputes, circulations and interactions (1896–1900) (ID 502)

Matheus Silva *(École des Hautes Études en Sciences Sociales, Paris, France)*

In 1896, India, especially Bombay, became a laboratory to different serums and vaccines against the bubonic plague developed and tested *in loco* by Europeans' *savants*, like the Russian Waldemar Haffkine, the Italians Allesandro Lustig and Gino Galeotti, and the French Alexandre Yersin and Paul-Louis Simond (Chakrabarti, 2012). The historiography of this process described it either as an European science's diffusion, like the French's historiography (Brossolet, Molaret, 1993), or as an assault to the colonized body (Arnold, 1993). However, it didn't question whether the products and their utilization were changed by this circulation, neither if, and how, the products competed against each other. The present work, in its turn, seeks to answer the following questions: how did the serums and vaccines circulate between India and Europe? How did the tests in India change their fabrication in Europe and their future application? How did the European *savants* interact with each other and with the actors

from the Indian society? To answer these questions, this research utilized the theoretical approach developed in the recent knowledge and objects' circulations studies (Raj, 2007; Raj et *Alli,* 2009) and analyzed the *savants*' letters, notebooks and scientific papers published in the period. The research concluded that, in one hand, the experience in the first years of the bubonic plague in India was fundamental for the products' development and standardization, because it enabled the sending of microbes' cultures to Europe, essential to improve the serums and vaccines' manufacture; the modification in the production by utilization of dead cultures instead of live ones, less dangerous to sea travels; and the products' evaluation with actual patients infected with the disease. On the other hand, it was the competition between products, and the controversies between the *savants*, which made it impossible for one in particular to gain hegemony in India, resulting in an almost concomitant utilization of several products against the bubonic plague during the first decade of the 20th century.

Keywords: Knowledge's circulation, Bubonic plague, Allesandro Lustig, Waldemar Haffkine, India, Tropical Medicine, Antiplague's serum, Alexandre Yersin, Paul-Louis Simond, Gino Galeotti

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Appropriating Africa: Taxonomic knowledge as a means of political legitimation of the Portuguese colonial agenda in the late 19th century (ID 574)

Catarina Madruga *(CIUHCT – Interuniversity Centre for the History of Sciences and Technology, Lisboa, Portugal)*

In the 1860's the Zoological Section of the *Museu Nacional de Lisboa* (National Museum of Lisbon) began to focus on collections of the unknown fauna of the African hinterland. Its director, the naturalist José Vicente Barbosa du Bocage (1823–1907), was to become a renowned specialist in African matters and, later, Minister of Navy and Overseas, and of Foreign Affairs. Bocage published in 1862 a set of *Instructions* for the collection and shipment of zoological specimens to Lisbon, which were circulated in the various Portuguese colonies and promptly yielded results. One year later he was already receiving shipments from Angola, and in 1864 he was publishing his first findings, regarding new species for the zoological catalogues. This process was to gain momentum in the following decades. Although these collections were gathered by explorers in the distant Portuguese Africa, they were identified, described, and given meaning only after their arrival in Lisbon. New zoological species were negotiated and claimed by the museum's director and its naturalists through their network of correspondents, and the publication of papers in national and international journals.

The production of scientific knowledge on Portuguese colonial territories was far from neutral. In the international arena, and in the context of the *Scramble for Africa*, the Portuguese monarchy had simultaneously to negotiate and claim control over the same African regions. This juxtaposition of interests focusing on Africa reveals how scientific knowledge and political positions are deeply interwoven. The description of new species of the African hinterland by Portuguese naturalists and collectors meant

much more than new scientific discoveries. Some of these species were actually established in confrontation with the reports of foreign travellers and collectors, and the authority of foreign naturalists.

This paper shows that the claim for authority in taxonomic knowledge was tightly connected with the claim for legitimation of the Portuguese occupation of African territories. In order to clarify this connection, this paper focuses on the process of description, negotiation and publication of new African species by Portuguese naturalists in order to illustrate the strength of scientific authority as a means of political legitimation.

Keywords: José Vicente Barbosa du Bocage, Taxonomic knowledge, Africa, Science and Empire

Perspectives on scientists as political agents in the Arctic (ID 573)

Urban Wråkberg *(The Arctic University of Norway, Kirkenes, Norway)*

The pursuit of science has not always been the most powerful motive of arctic exploration, yet expressions of national interests in the polar regions have for long been driven by lobbies in which scientists have often played decisive roles. There is a striking continuity over the last two centuries in this regard; scientists have acted as mediators between their academies, their international organisations and their national ministry; playing different cards of altruism or self-interest through the age of colonialism and into contemporary times in e.g. the Arctic Council and in the UN's science-based guidelines on issues of demarcation of the Exclusive Economic Zones of the Arctic Rim States.

The role of science and the importance of science lobbies in the formation of national geo-economic agendas of the polar regions are still often underestimated. It can also be demonstrated that such seemingly neutral parameters as the origin and distribution of place-names, design and positions of polar research stations, the frequency of field expeditions and the size of the scientific output of knowledge on an Arctic region have been shaped by political concerns and often proved useful as expressions of interests.

The present paper will exemplify from the pre-1920 international history of science focusing on the *terra communis* of the islands of Spitsbergen, today Svalbard, in the European sector of the Arctic Ocean. It will use this as preamble to the post-WWI negotiations in Paris which produced the Spitsbergen or Svalbard Treaty that still today regulates the access to business on the islands by citizens of any of its signatory nations. Looking into some details of the preparation and execution of the little know bilateral undertaking called the Russo-Swedish Arc of the Meridian Expeditions to Spitsbergen in 1898–1902 the dependence of science on state funding is illustrated. A future blueprint is also discernible in the role of the Russian and Swedish scientists involved as brokers of interests, moving rather freely between royalties, military experts and representatives of national governments in both countries. After their execution this series of expeditions became a powerful geopolitical footing for Swedish and Russian diplomats by which to claim stakes in the pre-WWI negotiations on the sovereignty of Spitsbergen.

Keywords: scientific advisors, geopolitics, lobbyism, Arctic, big science, governance

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Session 24: The Power of the Media

Chair: ***Ida Stamhuis*** *(Vrije Universiteit Amsterdam, Amsterdam, the Netherlands)*

A Preliminary Study on the Classification of Ancient Opera Stages in Shanxi Province Based on their Acoustic Characteristics (ID 607)

Yang Yang *(Shanxi University, Taiyuan, China),* ***Gao Ce*** *(Shanxi University, Taiyuan, China),* ***Ding Hong*** *(Taiyuan University of Technology, Taiyuan, China)*

The acoustic classification of ancient opera stages is the basis for their scientific studies. This paper, based on the data from field researches, the characteristics of ancient opera stages and the laws of sound propagation, classifies ancient opera stages in Shanxi into four types, that is, direct type, gathering type, reverberation type and resonance type. In this way, we may take a glance at their developing skeleton, and the correlations between their architectural components and singing and listening. It also indicates that the resonance-type ancient stages bear the typical characteristics of particular regions, which proves that the ancient Chinese architects could skillfully take the advantages of acoustic propagation. The finding is a great leap in the field of acoustic studies on ancient stages, and even is regarded as highly original in acoustic history, and an excellent proof of perfect combination of science and arts in ancient buildings.

The influence of Early Modern Western European gardens in the design of some 20th century royal gardens in Romania. Peles castle and the Late Renaissance landscape. (ID 583)

Alexandru Mexi *("Vasile Goldiş" Western University of Arad, Arad, Romania)*

Built in between the end of the 19th century and the beginning of the 20th century in a mountainous region in Romania, the Peles castle and its park and gardens were conceived according to the mid-16th and early-17th centuries Western European landscape design principles. Thus, the surrounding landscape, the forest, the park and gardens at the royal residence in Sinaia make up an overall image of a Late Renaissance landscape in which the Villa or, in this case, the royal castle, is integrated in a complex allegorical, alchemical and political programme that was designed to emphasize the connections between the Royal Family of Romania and the rest of the Royal Families from the continent. Moreover, besides creating visual connections with other royal courts (gardens!) in Europe, the park and gardens at Peles were designed to visualy highlight the political role and the divine power of the newly monarchs of Romania.

To this end, the following paper aims to emphasize the influences that Early Modern Western European gardens had over the design of the park and gardens at Peles and also to reveal the way that, by manipulating nature according to Late Renaissance and Mannerism principles, served as a way for achieving political goals.

Keywords: Early Modern, garden history, garden philosophy, Peles, influences, principles

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Television entertainment series and public perception of science – the power of moving images (ID 602)

Elisa Maia *(University of Lisbon, Lisbon, Portugal),* ***Ricardo Pestana*** *(University of Lisbon, Lisbon, Portugal)*

Television programs started to be broadcasted experimentally in the U.S. and the U.K. around 1930. In 1936 the BBC started the first world regular television broadcasting and in 1937 the first outside service was performed, accompanying the coronation of King George VI. The television services were suspended during war and resumed in 1946. In the U.S., television services started about the same time, but were not interrupted during war. The great difference between British and American television is that BBC television is a public service and in the U.S. television is mostly commercial. This difference contributed to shaping different formats of programming in the two countries. In other European countries television broadcasting started also in the mid-thirties, being interrupted by the war and resumed about the fifties.

Since the fifties television broadcasting grew very fast and different kinds of programs started to be emitted, like news, sports and entertainment. The potential of television for science education/popularization was soon acknowledged and mainly in t U.S. and U.K. scientific documentaries and series started to be produced. However, as more channels competed for audiences, usually low for most scientific programs, these were almost all gradually discontinued. On the contrary, the number of entertainment series increased over time, particularly since the eighties, being presently an important part of daily programming of many channels.

Some channels are specialized in cultural or education documentaries, but in this communication we do not intend to study the evolution of this kind of series. Our aim is to analyze entertainment series in which scientific or technological images are presented. In television, images are not static, and so, we have to consider sequences of moving images, having the power of conveying more or less correct ideas about scientists and scientific issues.

Our study is based on a larger study carried out in about 500 television series of different periods – from the late seventies to the present – where scientific moving images were searched, in order to discuss their possible influence on the public perception of science and scientific work.

Keywords: Moving images, Scientific and technological images, Public perception of science

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Solidarity movement and underground radio broadcasting (ID 577)

Agnieszka Dytman-Stasieńko *(University of Lower Silesia, Wroclaw, Poland)*

The aim of the presentation is to show the specifics of the Solidarność (Solidarity) underground radio in Poland.

On December 13, 1981, martial law was introduced in communist Poland. After a short period of legal operation of the first independent trade union "Solidarity", its activists, including the leader – Lech Walesa, were interned and Solidarity was delegalized in October 1982. The response of the opposition to the military action of the government was creation of alternative media, whose purpose was to inform the public about the real socio-political situation in Poland. Radio Solidarity, which broadcast in

various parts of the country as a collection of local initiatives under the banner of Solidarity, became one of the major media.

In a country behind the Iron Curtain, initiatives related to the broadcasting required creativity, the ability to create new DIY technologies only from available components (although a lot more components were unavailable), as well as adaptation to local conditions.

Among the more interesting ways of broadcasting, Solidarity radio from Warsaw, balloon radio from Toruń, Lublin radio network and radio initiatives in Wroclaw should be mentioned. In each of these cities different technologies were used. The type of the technologies depended on knowledge and ingenuity of the designers – both amateurs and scientists.

Activities related to Solidarity radio are examples of the struggle for freedom of speech and infoactivism. In these examples one can find various models of the technological functioning of their actors who fight the authorities with technology.

In-depth interviews with Solidarity activists is the basic methodology used in the presentation.

Keywords: radio broadcasting, alternative media, infoactivism, Solidarity movement, DIY technology, underground radio, In-depth interviews, communist Poland

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Session 25: Politics, Technology and Science in the 19th Century

Chair: ***Milada Sekyrková*** *(Charles University in Prague, Prague, Czech Republic)*

Geography, geographers and the foundation of nation(s) in France and Prussia (1800–1850) (ID 1)

Laura Péaud *(UMR 5600 Environnement, Ville, Société, Lyon, France)*

Between 1800 and 1850, geography is progressively becoming a full scientific field in Europe, built thanks to renewed institutional and academic principles. Among other places and countries, this process especially takes place in France and Prussia. Geographers involved in the process expect that their field will be finally considered as a proper science, compared for instance to history or mathematics. In order to complete this aim, they gradually organise geographical knowledge according to scientific patterns. The scientific and academic construction of a proper geographical field is influenced by a universalistic spirit, inherited from the European Enlightenment, but it is also deeply affected by the political context.

After the French Revolution and the Napoleonic Wars, both French and Prussian governments intend to (re)build a nation on renewed social, political, territorial, and even scientific structures. Geography, and moreover geographers, are playing a part in the process of founding nations.

During this period, indeed, geographical knowledge is more and more recognised as a strategic field by politics: it plays a major role in the states' politics and, therefore, in the different policies developed in this period. Maps, texts, books produced by geographers take place in various political programs. Some geographers are also individually or collectively close to politicians and they participate to the same sociological and ideological circles. Their ideas or objects are sometimes influenced by political and national projects, or take place in the political program. In this perspective, the production of geographical knowledge can be understood through the political context of France and Prussia. Geography and politics are highly connected to each other.

How the production of geographical knowledge between 1800 and 1850 in France and Prussia is related to politics? How the geographical discourse is linked to the political one? How the geographical field can help building a state? These are the questions that this paper will answer. Considering the sociology of the geographical field in France and Prussia and questioning the discourses produced by geographers in this period, this presentation intends to show the privileged relationship between geography and politics at the beginning of the 19th century. Crossing methods coming from sociology, history of science and geography, it will show that geography is essentially in a position of tension leading to the progressive nationalisation of geographical knowledge.

Keywords: geography, geographers, nation, politics, France, Prussia

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Electric units – the view from the periphery (ID 601)

Vitor Bonifácio *(Universidade de Aveiro, Aveiro, Portugal),* ***Jason Adams*** *(Universidade de Aveiro, Aveiro, Portugal)*

Technological and scientific developments, in the 19th century, led to a need to define and standardize electric units. Proposals were put forward both by individuals and associations like, for example, the British Association for the Advancement of Science.

In 1881 the first Congrès Internationale des Électriciens was held in Paris to discuss the current state of electric science, its applications and to reconcile and compare different processes of research. Further congresses were held in 1889 (Paris), 1893 (International Electrical Congress, Chicago) and 1900 (Congrès de l'électricité, Paris). In 1882 and 1884 two international conferences held in Paris dealt exclusively with the problem of electric units. In Portugal, as elsewhere, telegraphy was a main technological electric application although mainly depending on foreign expertise and capital. Invited to participate and despite an incipient industry, technological know-how and research the Portuguese government opted to be represented at all of the above congresses and conferences. The country representatives although mainly silent participants brought home the latest development news. In this paper we claim that the Portuguese involvement stemmed from the will to belong to an international scientific community instead of practical matters.

Keywords: Unit standards, Electricity and Magnetism, Technology

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Witnesses and experts in the judgments of the Imperial Court of Justice (1880–1938) (ID 524)

Raluca Enescu *(Humboldt University, Berlin, Germany),* ***Leonie Benker*** *(Humboldt University, Berlin, Germany),* ***Julian Sandhagen*** *(Humboldt University, Berlin, Germany)*

Lay witnesses were the privileged sources of information for trials until the 19th century. They provided facts by means of their statements, which were transformed into evidence by the legal process. The Constitutio Criminalis Carolina ruled over civil and criminal cases from 1532 until the criminal code of the German Empire was passed in 1871. Under section 67 the *sufficient proof* of a crime was defined by the deposition of two or three witnesses.

At the end of the 19th century, the judicial setting in several European countries underwent profound changes with the shift from testimonial evidence to physical and biological evidence. Their interpretation emerged from new scientific fields that entered gradually the courtroom, throwing shadow on lay witnesses who had become unreliable in studies on memory carried out by experimental psychologists.

From this evidential mutation arose forms of specialist knowledge delivered by expert witnesses called forensic experts.

The Imperial Court of Justice entered into activity on 1 October 1879, at the same time as the code of criminal procedure. The Court was the highest judicial institution and comprised several criminal senates, whose number was decided by the Chancellor of the German Empire. The code of criminal law was passed in 1871 and entered into effect in 1872, although it could not be applied uniformly across the territories until 1879, since the power of criminal justice belonged to the territorial rulers, a tradition anchored in the 13th century. In 1879 the code of criminal procedure entered into force and aimed at the unification of laws.

While the influence of experts had been stated from the beginning of their use by courts – not to substitute for the judge, i.e. not to express or decide if the defendant is innocent or guilty – this study investigates how the legal realm incorporated scientific knowledge in their judgments. Thirty-nine decisions rendered by the Imperial Court of Justice (*Reichsgericht*) about experts or their knowledge in criminal cases between 1880 and 1938 shed light on the arguments used by judges to incorporate specialist knowledge in courtrooms over a period of sixty years. The analysis of the points of appeal and their rejection or acceptance show a development of judicial practice towards a broader assimilation of specialist knowledge and experts.

Keywords: Criminal law, Imperial Court of Justice, Scientific knowledge, Forensic science, Arguments in judgments

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Session 26: Science, Religion, and Power Issues

Chair: ***Benjamin Le Roux*** *(Université de Bordeaux, Bordeaux, France)*

Science on Index: the censorious power of the Church against scientific publishing in 19th-century Italy (ID 463)

Carlo Bovolo *(Università del Piemonte Orientale, Vercelli, Italy)*

The presentation deals with the attempts of the Church to control the scientific publishing in the 19th-century Italy. In this century, and especially in its second part, due to the political unification of Italy and the process of modernization, the Catholic Church lost power and influence in the Italian society and culture, but the Holy See did not renounce to defend its principles and dogmas and to encourage a Catholic public opinion. In this context, also cultural and scientific issues assumed a political role. Mainly through the action of the Congregation of Index, the Church used its power to control also the scientific publishing, censoring and banning. During the century, the Congregation of Index took two different attitudes towards scientific publishing. In the first half of the century, when the power of the Church was wide yet, the Catholic censorship was vast and hit many scientists, heirs of the Enlightenment and forerunners of new theories. However, in the second half, when the Catholics clashed with the Italian State and laic society and the science gained a key role in culture, the Church, with the Index, focused especially on Catholic and ecclesiastical authors, leaving Catholic press and reviews (such as «La Civiltà Cattolica») the controversy against laic and positivistic scientists. The case of the evolution was exemplar. At the beginning of the century the Index bought attention on the natural history: on 1817 the Erasmus Darwin's *Zoonomia* was forbidden and between 1821–1828 Lamarck's theory was analysed, even if not banned, although the negative opinion of the censor. Later, after the publication of *Origin of species* nor Charles Darwin nor the Italian evolutionists were examined and condemned, because the Church wanted to avoid another "Galileo" case. Index's attention focused on some ecclesiastical writers (such as Caverni and Zahm), that tried to conciliate evolution with Revelation.

Keywords: Science publishing, Church, Congregation of Index, Science and Religion, Evolution, Darwinism, Index Librorum Prohibitorum

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Scientific knowledge as power of persuasion in a religious context (ID 433)

Benjamin Le Roux *(Université de Bordeaux, Bordeaux, France)*

The purpose of this presentation is to analyze how a scientific speech can be used as power of persuasion in a religious context. Our case study will concern a French botanist, Henri Devaux (1862–1956).

Devaux holds a research chair in plant physiology at the Faculty of Science in Bordeaux from 1906 to 1932. Specialized in plant gaseous exchanges, it is thanks to his work on the physical chemistry of monomolecular layers that he becomes internationally known. His findings in this field drove him to examine the absence of disciplinary frontiers which separate the studies of inert and living matter. From this moment, he defends the comprehension of molecular physics as a necessary condition in order to study life at the cell scale.

Fervent evangelical Christian, Devaux extrapolates his scientific reasoning to his religious convictions and asserts that the scientific fact and the religious fact would only be two faces of a unique whole, of a "science complète". By using the argument of the perfection of the world, he does not hesitate to declare his faith in his scientific papers where he attempts to convince his scientific peers of the existence of a creator God.

At the same time, he publishes through the local evangelical press, short exegetical notes based on scientific arguments. By undertaking a popularization work and using his expert position, Devaux intends to reassure the members of his community in their belief and convince them that the most up-to-date science is in accordance with the sacred texts.

Session 27: Environmental Studies, Climatology and their Political Environments

Chair: ***Leonardo Gariboldi*** *(Università degli Studi di Milano, Milano, Italy)*

Civilization to Death? Human Ecology as a Science for Survival in the Environmental Age (ID 540)

Christer Nordlund *(Umeå University, Umeå, Sweden)*

Due to the rise of severe environmental concerns in the 1960s, some scientists changed their view of contemporary science. To them progress in science (and science-based technology) affected nature and society in many negative ways. Promoting science-as-usual was in the worst-case scenario to promote civilization to death. Yet, science was at the same time looked upon as a means to solve the problems it had created. What was needed was a new type of "holistic" science that was able to understand humans as part of nature, contribute to a new economic system within ecological borders, and foster politics based on this knowledge. As a name for such a holistic and normative enterprise, that bridged and integrated natural science and human science, scientists adopted the concept "human ecology". It was a concept that had been used since the beginning of the 20th century but now was loaded with new meaning, as a "science for survival", able to steer "Spaceship Earth". Human ecology developed in different ways in different parts of the world. In Sweden, it was initially promoted mainly by natural scientists, notably a zoologist named Bengt Hubendick, who was director of the Natural History Museum in Gothenburg and later became a political adviser and public expert on environmental questions. The aim of the present paper is to use Hubendick as a prism in order to shed light on the early development of human ecology as a holistic and normative science of political importance. Furthermore, the presentation argues that the kind of human ecology Hubendick promoted was not that "holistic" after all. Although Hubendick made a grand synthesis, based on knowledge and data from all over the world, he never took human and social sciences seriously, and as a result his synthesis may be defined as "social biology" rather than human ecology.

Keywords: Human ecology, Environmental crisis, Environmental politics, Normative science, Sweden, 1970s, Bengt Hubendick

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Environmental Sciences under the Portuguese dictatorship: Inverting drought in Lisbon ca. 1940 (ID 12)

Ana Rodrigues *(University of Lisbon, Lisbon, Portugal)*

Lisbon was not the green city it is in present days. Photographs from the beginning of the twentieth-century show a totally dry city with almost no trees. In this paper, I will demonstrate as Anthropocene, man's action over nature, does not have forcibly to have a negative impact over nature. Lisbon's environment benefited tremendously from the power of men's knowledge.

Although many projects for public parks in Lisbon where projected since the nineteenth-century, none was built until the New State dictatorship reached the power. The first projects for the green area of Campo Grande in Lisbon go back to late eighteenth-century. The Park of Monsanto in the outskirts of Lisbon was first thought in 1868, inspired by the Bois de Boulogne in the surroundings of Paris. The Park Eduard VII, named as such in 1903 after a visit made by the British King to Lisbon, was projected since the *Passeio Publico* was transformed into a boulevard entitled Liberty Avenue (1882) and a park with the same name was supposed to give it continuity. Nevertheless, all these projects were only delivered by the architect Keil do Amaral ca. 1940.

This paper examines how the ecological nineteenth-century vision of Lisbon could only be delivered once a new scientific community of doctors architects and engineers emerged in Lisbon within the context of the dictatorship. Important essays written in newspaper by the doctors McBride on public health and on the necessity of Lisbon's lungs promoted the forestry in the surroundings of Lisbon. Architects such as Keil do Amaral who studied in Germany and visited the Amsterdam wood when it was being cultivated became fundamental scientific personas for the materialization of former utopias. The rationalism of their parks was the best symbol of the new scientific culture of precision and progress. The change of landscape also meant a change of culture. I hope that such a focus reveals the fundamental role of scientific activity in the ecological vision for the city of Lisbon, but also its dependence on the scientific, technological and political power to deliver it.

Keywords: Public parks, Lisbon, dictatorship, ecologic utopia, anthropocene, drought, city's lungs, landscape architecture

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Understanding and Controlling Climate at the End of the 18th Century. Kant's Reflections on Physical Geography and Geopolitics. (ID 470)

Silvia De Bianchi *(Autonomous University of Barcelona, Barcelona, Spain)*

This paper aims at showing why Kant established a deep relationship between the study of our planet, its structure and climate, and international law in his *Metaphysics of Morals* (1797). After reconstructing the legacy of seventeenth and eighteenth century studies in meteorology for Kant's writings on natural science[1] and ethics, I spell out how the philosopher thought of the relationship between physical geography and geopolitics and why we should interpret his late reflections as a political manifesto. In order to make sense of Kant's late view on meteorological and climatological phenomena and of its constitutive connection with the doctrine of right, I suggest that a deep investigation of the historical context is needed. In the second part of this contribution, indeed, I will show how governments managed to fund research on climate and meteorology on the ground of geopolitical strategies and suggestions informed by scientists between 1780 and 1795. I shall mention, in particular, the measures taken by George III in Great Britain, by Karl Theodor in Palatinate-Bavaria and by Catherine II in Russia. However, the virtuous processes of investing resources in the calibration of instruments and in

international campaigns of synoptic meteorological observations, such as those of The Palatine Meteorological Society in Mannheim, were interrupted due to the invasion of the French Army in 1795. The French wars (including the following Napoleonic wars) led to a substantial halt of the research programmes in meteorology and to a decisive damage of the circulation of knowledge in climate science, not only in Central Europe, but also in England, Prussia and Russia. For instance, the *Ephemerides Societatis Meteorologicae Palatinae* (1783–1795), the journal in which the results of the campaigns were published, was shut down and meteorologists had lost the possibility of sharing observations and experimental results on climate on a large scale.[2] Within this context, Kant's view, as emerges in his 1797 work, represented the political opposition to the Prussian warfare policies and to the French menace. Indeed, against the progressive dismantlement of meteorological societies after 1795, Kant supported a view according to which the research on climate and meteorological phenomena, as well as that of the structure of the Earth and its mathematical representation, should have been guaranteed by international laws and cosmopolitan policy. In turn, the possibility of applying the cosmopolitan right also depended on the development in understanding the climate. Kant's claim, thus, is representative of a view that presupposed the knowledge of climate and meteorological phenomena to be a constitutive tool in organizing human life on the planet. According to such a view, the knowledge of our planet was necessary to improve the ability of governments in 1) defining geopolitical borders thanks to the suggestions and forecasts made by experts in the field and 2) obtaining commercial benefits from discovering, exploring and exploiting territories in other continents.

[1] I will refer in particular to Kant's works on the theory of winds (1756, 1757), earthquakes (1756), history of Earth (1754) and to his lectures on physical geography.

[2] Only in the late 1820s, indeed, thanks to von Humboldt's proposal of a network of observatories, new research centres arose, such as the magnetic and meteorological observatory in Helsinki (1838), and the international cooperation could restart on a large scale, supported by governmental funds and powerful technological devices, such as the telegraph.

Keywords: Immanuel Kant, Physical Geography, Geopolitics, Climate, French Wars

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Session 28: Plants and Pharmaceutical Products in the Eastern Block

Chair: ***Soňa Štrbáňová*** *(Institute for Contemporary History, Czech Academy of Sciences, Prague, Czech Republic)*

Polish botanists facing difficult political conditions (ID 447)

Alicja Zemanek *(Jagiellonian University, Cracow, Poland)*

History of Poland abounded in dramatic moments. Until the 17th century, the Polish state played a significant role in politics and culture. The Cracow University (now Jagiellonian University) established in 1364, was an important centre of science in this part of Europe. In the 18th century, Poland has fallen into decline in terms of both economy and political significance. As a result, she lost her statehood for 123 years, partitioned into three neighbouring powers: Austria, Prussia, and Russia. In 1918, Poland regained independence, but after II World War she became one of the satellite countries of the Soviet Union. From 1989 onwards, Poland is again an independent country. Botany has developed there since the 15th century – and many botanists have contributed to the development of a number of various disciplines, and to the discoveries of new plant species. Like scientist in many other fields, botanist had to face changing political conditions of their times. In the 19th century, some botanists engaged in uprisings against the Russian rule and were imprisoned or exiled deep into Russia, and still some others were forced to emigrate. Because Polish universities were either closed or subjected to the interference from partitioning powers, large number of young Poles went to study abroad, principally to Germany and Austria. Many botanists perished prematurely in the First World War (e.g. Antoni Żmuda), whereas others (such as Bronisław Jaroń, Kazimierz Piech, Tadeusz Wiśniewski) – during the Second World War. Many of plant scientists, such as, for instance, Władysław Szafer – the Rector of clandestine Jagiellonian University, committed themselves to opposition movements against Nazi occupiers. After the war, some of them were imprisoned by the communist authorities (Karol Starmach), or persecuted as, for example, Dezydery Szymkiewicz. Luckily, a number of botanists survived these dramatic years. Sometimes, even the negative experience caused by political conditions exerted creative impacts on the scientific activity. Trips to study abroad favoured exposure to new ideas and contributed to making contacts with outstanding scientists. Some of nature scientists who emigrated, later travelled to poorly known parts of the world where they discovered new species of plants, like Józef Warszewicz who did it in Central and South America. Sometimes, the botanists exiled to Russia found employment there and carried out research, e.g. Bolesław Hryniewiecki – who conducted the studies of Caucasus, Ural Mountains, and other regions. It must be stressed that during the time of lost statehood, the development of science and culture contributed to the increase in the national awareness which later provided the basis for regaining independence. In botany, this patriotic attitude was reflected in, inter alia, development of Polish nomenclature of plants, as well as in creating the foundations for the protection of Polish natural riches in the mid-20th century.

Keywords: botany, Poland, political conditions

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USSR legislative impact on the pharmaceutical sector in Latvia (1940–1941) (ID 462)

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Introduction: Latvia's first period of independence lasted from 1918 to 1940. Until occupation all activities related to pharmacy area was monitored and controlled by the Pharmaceutical Administration. June 17, 1940 territory of Latvia was invaded by the Red Army. Due to the occupation pharmaceutical legislation was further regulated by the institutions of Moscow.

Material and Methods: Research material was obtained from Latvian State Historical Archive and periodical press of XX century. Research is descriptive and retrospective.

Results: In July 1940 was officially set that all pharmacy employees have to be register in pharmacist trade union. Pharmacist trade unions main tasks were the soviet political education and Russian language courses. In September 1940 the People's Commissar of Health asked to make an inventory in all pharmaceutical enterprises. Soon on the basis of 6th Article of the Constitution of the Latvian SSR, the Latvian SSR Supreme Council Presidium in October 28, 1940 issued a decree of nationalization for hospitals, pharmacies, medical supplies warehouses and chemical-pharmaceutical industrial enterprises. As a result 488 pharmacies were nationalized and the owners of private pharmacies became the managers. Along with the nationalization of pharmacies disappeared right of self-determination. This led to a shortage of staff particularly in rural pharmacies. Due to the lack of staff 23 pharmacies were closed. In October 1, 1940 the Pharmaceutical Administration was formally abolished and in its place the Main Pharmacy Board (GAP) was created according to Soviet Union practise. Favourable conditions for researches in pharmacy in Latvia had already developed at XX century 30's. In the University of Latvia, Division of Pharmacy scientific researches in pharmaceutical chemistry, nutrition chemistry, as well as hormone and vitamin synthesis were conducted. These trends also determined the future path scientific activities. USSR supported the development of the pharmaceutical industry, because medication import from European manufacturers was prohibited. In 1940 in Riga started to create vitamin and hormone medication factory and in year 1945 in Riga was built the first experimental penicillin factory in the Soviet Union. Also in year 1940 academic staff and researchers of the Pharmacy Division of Latvian University lost their positions and instead other to USSR loyal employees were appointed. Later in 1944, majority with the pharmaceutical science related persons left Latvia and went into exile. In summer of 1941 the Soviet occupation was replaced by German occupation.

Conclusions: After the first Soviet occupation, pharmaceutical industry in Latvia was mismanaged. A large proportion of medications from medication warehouses during the year were exported to Russia. Although in short period of the first occupation, no dramatic changes weren't realized, however, almost all the trends continued during the time of the second Soviet occupation. The obvious progress of scientific researches in pharmacy in Latvia started after year 1944. The rapid expansion of the pharmaceutical industry was contributed by the Academy of Sciences establishment in 1946.

Keywords: Pharmacy, Occupation, USSR legislation, Pharmaceutical Administration, Main Pharmacy Board, Nationalization, Pharmaceutical employees

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T. D. Lysenko and VASKhNIL during Wartime: The "Pre"-Prehistory of the August Session of 1948 (ID 474)

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Lysenko's monopoly on Soviet biological and agricultural sciences started in August 1948 when the abolition of Mendel-Morgan genetics research and education was endorsed via political pressure at the notorious VASKhNIL session; the monopoly lasted until January 1965. Historians have elucidated that throughout this period, there had been substantial action supporting orthodox genetics, and constant opposition to Lysenko, from the USSR Academy of Sciences. Soviet scientific communities had never permitted Lysenko to violate the autonomy of science.

On the contrary, VASKhNIL, as an independent institution of the Academy of Sciences, has been understood as the absolute stronghold of Lysenko. However, my research finds that during WWII, Lysenko's authority was challenged from inside VASKhNIL. During the war, Lysenko's agricultural proposals were met with strong objection, and their execution was sabotaged among the cadres of VASKhNIL who were regarded, generally speaking, as Lysenko's reliable proponents. Lysenko was criticized for not approving any agricultural proposals or schools that were against his policy. He failed to settle the internal turmoil in VASKhNIL by persuading agricultural specialists with scientific arguments and, in response to threats to his power, instead wrote to political leaders of the Kremlin seeking their help. In the fall of 1944, his situation was so dire that Lysenko himself requested Stalin and Molotov to release him from the responsibility of the president of the VASKhNIL.

After the war, Lysenko was exposed to a campaign organized against him by Soviet geneticists in cooperation with their Western counterparts. This event was a humiliating experience for Lysenko and could have evoked in him a motive to destroy genetics research, which creates a "prehistory" of the VASKhNIL session in August 1948. Since the opposition to Lysenko inside VASKhNIL was independent of the geneticists' postwar campaign, the wartime event Lysenko was involved in seems to have no connection to the destructive character of the August session. However, my research suggests a new interpretation. The wartime event made Lysenko realize his inability to defend his authority in the scientific community through scientific measures and led him to use non-scientific measures to defeat his opponents. In fact, Lysenko's petition to political leaders during the wartime is suggestive of his speech later at the August session in its style of denouncing his opponents and of appealing his legitimacy to the political bosses. In this sense, the wartime event can be regarded as the "pre"-prehistory of the August session of 1948.

*VASKhNIL stands for the V.I. Lenin All-Union Academy of Agricultural Sciences.

Keywords: Agricultural science, Genetics, Lysenko, Soviet Union, Stalin, VASKhNIL, World War II

Session 29: Contribution of "Unwanted" Russian Scientists to the World Science

Chair: ***Marek Ďurčanský*** *(Charles University in Prague, Prague, Czech Republic)*

Pitirim Sorokin's Sociology of Revolution: A Relic from the 20th Century or Intellectual Weapon for the 21st Century? (ID 457)

Dmitry Ivanov *(St. Petersburg State University, St. Petersburg, Russian Federation)*

Pitirim Sorokin (1889–1968) was the prominent Russian sociologist who participated in two revolutions of 1905 and 1917, emigrated from Soviet Union in 1923 to Czechoslovakia and then to the United States where founded Department of Sociology at Harvard University in 1930 and became the 55th President of the American Sociological Association in 1965. Being in 1917 an activist of the Socialist Revolutionary Party and secretary to Prime Minister Kerensky, Sorokin as a scholar involved in structures of power had opportunity to apply scientific knowledge in real social transformation. But his own experience of a revolutionary actor was rather negative and the only positive result of his struggle against authoritarian regimes of Czar and Bolsheviks could be seen in his book 'The Sociology of Revolution' published in 1925.

In that pioneering work, Sorokin anticipated all contemporary approaches to studies of revolutions. Sorokin analyzed numerous historical cases and identified 'natural' phases in the process of revolution started with repressive state crisis and finished with consolidation of a stronger state after the liberation period. He classified the causes of violent uprising as people's reaction to deprivations of different kinds coinciding in time. Sorokin also formulated the structural conditions that lead to revolutionary explosion. His positivist and behaviorist terminology and style look old-fashioned and naïve today, but the most frequently cited present-day theorists such as C. Brinton, T. Gurr, or T. Skocpol, actually developed their models for study within the framework initially elaborated by P. Sorokin. Analytical and prognostic power of his concepts of preconditions, causes, dynamics, and consequences of revolution have been proven by transition to the post-communist regime in 1989–1993 that can be considered as the third Russian revolution.

Sorokin's ideas rejected by Soviet regime got a chance to return to Russia after democratic turn of 1989. Sorokin has received status of the greatest national sociologist but his ideas are used in contemporary Russian academia selectively and in ritualistic way. His concepts of social and cultural dynamics are interpreted mostly as conservative view of Western civilization at the edge of fatal crisis. Such conservative perception of Sorokin's heritage correlates with authoritarian turn in Russia in recent decade. Analytical and prognostic components of Sorokin's concepts of social mobility and revolution seem to be irrelevant in the context of the new authoritarian regime. But current economic crisis and coming social crisis in Russia are stimulating reflections on the revolution causes and consequences and therefore reassessment of Sorokin's heritage relevance.

Keywords: sociology, revolution, Pitirim Sorokin, scientific knowledge, authoritarian regime

History, Politics and the Power of Science: Pitirim Sorokin's Theory of Socio-Cultural Dynamics (ID 481)

Yury Asochakov *(St. Petersburg State University, St. Petersburg, Russian Federation)*

Pitirim Sorokin's theory of socio-cultural dynamics (1) argued that the dynamic basis of European history, traditionally interpreted as a linear progress of rationality, was in reality the wave – a fluctuational transition from one type of civilization to another with both its form and content determined by a supersystem. Supersystem is an analytical integrating model for the whole of cultural systems forming the visible, empirical level of socio-cultural reality. The character, the style, of a supersystem is defined by the basic Weltanschauung, Worldview – a set of ideas on the nature of man and reality.

At the time of its arrival, Sorokin's theory was mostly perceived by the scientific community as rather a philosophical, than the scientific one, and was exposed to criticism for its alleged abstractness, speculativeness, and "theatricality" (2). Nevertheless, it helped to change the perception of modern history, by presenting it not as a series of separate political and economical crises, but as a systemic crisis. For its understanding/resolution it is necessary to depart from practically and theoretically useless mere political criticism.

The activities of Sorokin's Harvard Research Center in Creative Altruism as a practical part of his scientific project aimed at studying the potential semantics of a new Weltanschauung (3). In this context, his later publications concentrated on the analysis of intellectual and philosophical (4), sociological and social psychological (5) aspects and problems of power (6) with theory of socio-cultural dynamics becoming a heuristic means for detecting and understanding the meaning and underlying systemic content of the complex and contradictory processes of power and social changes.

This paper explores the outcomes of Sorokin's theory as an ambitious endeavor to unfold the power of social science as a prognostic, disciplining and guiding tool in the society's attempt to deal with otherwise obscure and uncontrolled forces of history.

Keywords: cultural systems, socio-cultural dynamics, power, Weltanschauung, Worldview, creative altruism, modern history

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Soviet physicists against the authorities to preserve the scientific heritage of Leonid Mandelstam (ID 592)

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Leonid Isaakovich Mandelstam (1879–1944) is an eminent Russian physicist, the founder of one of the leading schools of Soviet physics, member of the USSR Academy of Sciences. In the 1940s S.M. Rytov, G.S. Gorelik, E.L. Feinberg, M.A. Leontovich, S.P. Strelkov, et al. prepared for publication 5 volumes of Mandelstam's scientific works. The 4th and 5th volumes contained, in particular, Mandelstam's lectures on the oscillations theory and the theory of relativity. However, in 1949, when the 5th volume, which was already printed, was withdrawn from sale, and almost entire print was eliminated, but for a few copies, one of which saved in S.M. Rytov family. There was a real danger of losing the scientific heritage of academician Mandelstam.

S.I. Vavilov, the President of the USSR Academy of Sciences at that time, fought for the 5th volume to be published. To show that the Party ideological criticism was taken into account and to demonstrate that certain measures were taken he formally changed the name of the volumes editor, made minor ideological corrections which didn't affect the essence of Mandelstam's views on the theory of relativity, and wrote a foreword, where he emphasized the great scientific value of Mandelstam's lectures. S.M.

Rytov, V.L. Ginzburg and S.E. Khaikin were withdrawn from the Commission for the publication of Mandelstam's works. All these helped to get the 5th volume publish in 1950.

The main criticism of Mandelstam's lectures on the theory of relativity was related the fact that his philosophical views were far from the dialectical materialist philosophy, some of his statements contradicted with Marxism dogmas. Such confrontation of the party apparatus against the Mandelstam's works publication was connected to the campaign against cosmopolitism, that by the spring of 1949 had become evidently anti-Semitic. The 4th volume on the oscillations theory was published only in 1955.

In the S.M. Rytov's archive there are memories on the situation around the prohibitions of the 5th volume publication. S.I. Vavilov's diaries and his daily records as a President of the Academy of Sciences give additional information on this case.

Keywords: Soviet physics, theory of relativity, ideological pressure, science and power, L. I. Mandelstam, S. I. Vavilov

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NAME INDEX

A

Abir-Am, Pnina G. SY321, SY348
Adams, Jason SE25
Adamson, Matthew SY321
Aichner, Christof SY367
Aihua, Yang SE12
Alberts, Gerard SY299
Aleksiun, Natalia SY355
Almeida, Danielle SE23
Álvarez, José SY206
Alvarez Polo, Yolima SY380
Alves Gaspar, Joaquim SY316
Amaral, Isabel SY41, SY46
Ambrosetti, Nadia SY67
Americo, Maria SE13
Angetter, Daniela SY355
Arellano-Escudero, Nelson SY206
Ash, Mitchell G. SY367
Asochakov, Yury SE29
Aucouturier, Etienne SE3
Avxentevskaya, Maria SE1

B

Backhouse, Roger SY290
Badino, Massimiliano SE2, young scholar talk
Barahona, Ana SY40
Barreca, Francesco SY336
Barrett, Gordon SY70
Bayuk, Dimitri SE21
Belhoste, Bruno SY367
Ben Miled, Marouane SY110
Benezra, Genevieve SY321
Benker, Leonie SE25
Berenguer, Joaquim SY206
Besler, Gabriela SE4
Bettahar, Yamina SY206
Bevilacqua, Fabio SY37
Blum, Alexander SY17
Bonifácio, Vitor SE20, SE25
Bonolis, Luisa SY17
Borgato, Maria Teresa SE4, SY240
Borrelli, Arianna SY264
Bosch, Mineke SY24, SY121
Bovolo, Carlo SE26
Bozzay, Réka SY197
Bracht, Fabiano SE23
Bradley, Joseph SY72
Bravo Anduaga, Joel Ángel SE8
Brentjes, Sonja SY374
Brixius, Dorit SY205
Brock, Emily SY282
Bultman, Saskia SE11
Burgués-Flamarich, Carme SY200

C

Cabanel, Anna SY24
Cabré, Montserrat SY202
Cain, Friedrich SY82
Calvó-Monreal, Xavier SE19
Campos, Elisa SE5
Camprubí, Lino SY105
Canadelli, Elena SY336
Cantoni, Roberto SE10
Cao, Jingbo SY38
Cardellini, Liberato SE16
Cardoso de Matos, Ana SY206
Carneiro, Ana SY41, SY46
Carolino, Luis Miguel SE21
Carvalho, Arsélio Pato SE22
Castells, Marina SE21
Ce, Gao SE24
Ceccarelli, David SE9
Charpa, Ulrich SY290
Chemla, Karine SY290
Chen, Ting SY123
Chen, Wei SE12
Chen, Zhihui SY290
Choptiany, Michal SE20
Christie, John R.R. SY202
Ciesielska, Danuta SE4
Clucas, Stephen SY264
Cook, Alexandra SY41
Cordero, Alberto SE17
Cornelis, Gustaaf SE8

Coughran, Bruce SY348
Cozzoli, Daniele SY321
Cryle, Peter SY268
Cucu, Alina-Sandra SY105
Cœuré, Sophie SY321

D
da Conceição, Gisele Cristina SE23
De Bianchi, Silvia SE27
De Block, Fien SE13
De Bock, Dirk SE4
De Bont, Raf SY282
de Jong-Lambert, William SY116
de Mendonça Figueirôa, Silvia Fernanda SY41
Débarbat, Suzanne SE1, SY316
Debuiche, Valérie SY110
Delicado, Ana SY336
Diagre-Vanderpelen, Denis SY29
Dijksterhuis, Fokko Jan SY290
Diogo, Maria Paula SE6, SY105
Dobre, Mihnea SY290
Doel, Ronald E. SY321
Donohue, Christopher SY82
Dorsch, Kathryn SY82
Dostal, Ondrej SY157
Dronin, Nicolai SY321
Dror, Otniel SE10
Dröscher, Ariane SY41
Drzewiecka, Ewelina SE3
Duarte Rodrigues, Ana SY336
Dubald, Déborah SY205
Ducheyne, Steffen SE4
Ďurčanský, Marek SE29
Durnová, Helena SE5, SY299
Durovics, Alex SY197
Dytman-Stasieńko, Agnieszka SE24

E
Eckert, Michael SE15
Eisenstaedt, Jean SY17
Elina, Olga SE7, SY29
Enescu, Raluca SE25
Erman, Natalia SE18

F
Falk, Seb SY123
Fara, Patricia SE7
Fauque, Danielle SE9, SY115
Fedotova, Anastasia SY29
Feichtinger, Johannes SY72
Figueroa, Marcelo Fabian SE14
Filhao Conde, Antónia SY206
Fiocca, Alessandra SY67
Fiolhais, Carlos SE22
Flipse, Abraham Christiaan SE6
Florensa, Clara SE22
Fokken, Margriet SY121
Fonseca, Pedro SE19
Fox, Robert Koyré Prize winner
Franc, Martin SY72
Freedman, Robert SY40
Freguglia, Paolo SY67
Freyberg, Sascha SY374
Friedman, Robert Marc SY348
Frühstückl, Robert SY367

G
Gabrič, Aleš SY72
Gao, Xi SY142
Garcés, Beatriz SY206
Garcia, João Carlos SY316
Garcia-Lladó, Angela SE21
Gariboldi, Leonardo SE27, SY37
Gaukroger, Stephen SY268
Gavagna, Veronica SY67
Geiger, Katja SY355
Gericke, Niklas SY157
Germanese, Donatella SE15
Gessner, Samuel SY316
Gielas, Anna SY46
Gierl, Martin SY46
Godfroy, Anne-Sophie SY40
Gouzevitch, Dmitri SY206
Gouzevitch, Irina SY206
Graf von Hardenberg, Wilko SY282
Grapi, Pere SE16
Gropp, Harald SY240
Guedj, Muriel SY37

Guerra, Corinna SY202
Guevara-Casanova, Iolanda SY200

H
Haiming, Shi SE12
Hall, Karl SY321
Halleux, Robert SY170
Han, Qi SE12
Han, Yufen SY226
Haraszti Szabó, Péter SE13
Hashagen, Ulf SY299
Hermann, Tomáš SY116
Herring, Emily SE19
Herrnstadt, Martin SY374
Hirose, Sho SY290
Hoffmann, Dieter SE15
Hong, Ding SE24
Horst, Thomas SY316
Hrešanová, Ema SY149
Hu, Danian SY88
Huang, Jia SE12
Hudeček, Jiří SE12, SY290
Hudek, Adam SY72
Huenniger, Dominik SY46
Huistra, Pieter SY24
Husson, Matthieu SY123
Hyklová, Petra SY299
Hykšová, Magdalena SE4, SY299

I
Ito, Kenji SY263
Ivanov, Dmitry SE29

J
Jalobeanu, Dana SY264
James, Frank SE21
Janka, Jasmin SE16
Jareš, Jakub SE3, SY72
Ji, Zhigang SY38
Jiang, Lijing SY157
Jiang, Lu SY200
Johnston, Sean SY206
Juhász, Réka Ibolya SY197
Jůnová Macková, Adéla SY72

K
Kalling, Ken SY29
Kartsonakis, Manolis SE13
Katzir, Shaul SY37
Kaufholz-Soldat, Eva SY40
Kelényi, Borbála SY197
Keller, Agathe SY263
Kirsh, Nurit SE5
Klemun, Marianne SY29, SY41
Kline, Wendy SY149
Kobayashi, Tatsuhiko SY38
Kokowski, Michal SE8, SY170
Kolchinsky, Eduard SY116
Konashev, Mikhail SY116
Konstaninidou, Aikaterini SE21
Kotůlek, Jan SE5, SY299
Kouneiher, Joseph SE5
Kraft, Alison SY19, SY70
Kragh, Helge SE20
Krasnodebski, Marçin SY115
Kremer, Richard L. SY123
Krige, John SY321
Krivosheina, Galina SE1
Krizmanics, Réka SY247
Kroupa, Sebestian SY205
Kunštát, Miroslav SY72
Kůželová, Michaela SY70, SY247

L
La Rana, Adele SY17
Laifr, Václav SE12, SY290
Lajus, Julia SY321
Lalli, Roberto SY17
Lane, Brent SE14
Lanzarote-Guiral, José SY336
Laporte, Steven SY170
Laszlo, Pierre SE3, SY115
Lauze, Sabīne SE28
Le Roux, Benjamin SE26
Lee, Derek SY82
Lehmbrock, Verena SY364
Leitão, Henrique SY316
Lémonon, Isabelle SY40
Leong, Elaine young scholar talk

Levit, Georgy SY69
Lhoff, Brigitte SY355
Li, Liang SY123
Li, Mingyang SY226
Lin, Yu Cheng SE7
Linkiewicz, Olga SY367
Liu, Bing SY290
Liu, Jinyan SY88
Liu, Xiao SY88
Lloyd, Hattie SY13
Lopes Coelho, Ricardo SY37
Lorencová, Ivana SE18
Loskutova, Marina SY29
Lotysz, Slawomir SE3
Louis, Barbara SY367
Lövheim, Daniel SE3
Luciano, Erika SE17, SY367
Ludvík, Pavel SE5
Lund Jacobsen, Lif SE21

M

Maas, Harro SY290
Madruga, Catarina SE23
Maia, Elisa SE24
Malaquias, Isabel SE20
Malet, Toni plenary lecture
Marques, Richard SE22
Martins, Ana Cristina SE22
Martykánová, Darina SY206
Massa-Esteve, M. Rosa SY206
Matei, Oana SY78
Mattes, Johannes SY41
Mauriņa, Baiba SE28
Mayer, Jochen F. SY240
Mayer, Thomas SY355
Mayrargue, Arnaud SY37
McCarthy, Gavan SY13
Mészáros, Andor SY197
Mexi, Alexandru SE24
Meyer-Spasche, Rita SE16
Michaels, Paula SY149
Mikniene, Giedre SY13
Ming, Ding SY123
Mohr, Barbara SY41
Monnoyeur, Françoise SE16
Montava, Maria SY206
Moreno Mosquera, Asdrubal SY380
Morfouli, Meropi SE20
Morgan, Daniel P. SY123
Mota, Teresa SY41, SY46
Moxham, Noah SY46
Mülberger, Annette SY367

N

Napolitani, Maddalena SY29
Napolitani, Pier Daniele SY67
Navarro Loidi, Juan SY206
Nemec, Birgit SY355
Neuenschwander, Erwin SE13, SY13
Niaz, Mansoor SE16
Nicolaidis, Efthymios SE2, SY170
Nie, Fuling SE12
Nier, Keith SY115
Nijenhuis, Ida SY240
Niskanen, Kirsti SY24, SY121
Nizovtsev, Viacheslav SE18
Nordlund, Christer SE27
Nossum, Rolf SE5

O

Oghina-Pavie, Cristiana SY29
Olechnovičienė, Jadvyga SE7
Olšáková, Doubravka SY70, SY321
Omodeo, Pietro Daniel SY374
Opitz, Donald L. SY24
Osorio, Marisol SY206
Oswald, Nicola SY40

P

Palló, Gábor SE15
Pasini, Enrico SY78
Pastorino, Cesare SY264
Péaud, Laura SE25
Pereira, Ana SE19
Pérez-Pérez, Núria SY142
Perillan, Jose SY82
Perkins, John SY13
Pestana, Ricardo SE24
Petakos, Dimitris SE2

Phillips, Denise SY364
Pierrel, Jérôme SY69
Pita, João SE19
Plosceanu, Emilia SE18
Pogoda, Zdzisław SE4
Present, Pieter SE2
Puig-Pla, Carles SY206
Płotka, Bartosz SE19

R

Rabouin, David SY67
Radick, Gregory SY157
Ragouet, Pascal SY82
Railiene, Birute SY13
Ramsingh, Brigit SY115
Rauch, Alan SE21
Realdi, Matteo SE22
Reininger, Alice SE14
Reiter, Wolfgang L. SE15
Reiter-Zatloukal, Ilse SY355
Ren, Yufeng SE9
Renn, Jürgen SY17
Rentetzi, Maria SY19, SY40
Rey, Anne-Lise SY78
Rey, Olivier SY240
Ričkienė, Aurika SE7
Roberts, Geoffrey SY70
Robinson, Ann SY115
Roca-Rosell, Antoni SE22, SY206
Rodrigues, Ana SE27
Rodríguez-Salazar, Luis Mauricio SE8
Romero de Pablos, Ana SY40
Rommevaux-Tani, Sabine SY67
Roque, Ricardo SY157
Rosas-Colín, Carmen Patricia SE8
Rossiter, Margaret W. SY40
Roy, Pradipto SE10
Ruano-Borbalan, Jean-Claude SE21
Rubinson, Paul SY70
Rüdiger, Julia SY355
Řídký, Josef SE11

S

Sachse, Carola SY70, SY94
Saito, Hirofumi SE28
Sallent Del Colombo, Emma SE14
Sammarchi, Eleonora SY67
Samojlik, Tomasz SY29
Samokish, Anna SE1
Sanches de Oliveira, Guilherme SE4
Sánchez, Antonio SY316
Sandhagen, Julian SE25
Sandman, Alison SY316
Santesmases, María Jesús SY19
Sastre-Juan, Jaume SY336
Sauer, Barbara SY355
Sauer, Tilman SY299
Sava, Mircea SE8
Schär, Bernhard C. SY94
Schleper, Simone SY282
Schlicht, Laurens SY374
Schmaltz, Florian SY367
Schneider, Martina SY290
Schnöpf, Markus SY13
Schwerin, Alexander SY19
Sekyrková, Milada SE25, SY40
Serra, Isabel SE8
Serrano, Elena SY202
Shalimov, Sergey SY69
Shavrova, Tatiana SE29
Shi, Bin SE12
Shirokova, Vera SE18
Shuttleworth, Sally SE21
Silva, Matheus SE23
Silva Filho, Wellington Bernardelli SE23
Simões, Ana SE6
Sinelnikova, Elena SY72
Slepkova, Nadezhda V. SY29
Snytko, Valerian SE18
Sommer, Andreas SY82
Sommer, Vítězslav SY105
Somsen, Geert SY336
Spary, Emma SY205
Stam, Dineke SY24
Stamhuis, Ida H. SE24, SY240

Steinman, David SY374
Steinman, Dolores SY374
Stella, Marco SY82, SY116
Stephens, Elizabeth SY268
Stewart, John SY13
Straner, Katalin SY41
Strasser, Gerhard F. SE14
Suay-Matallana, Ignacio SY41
Surman, Jan SY82
Svanfeldt-Winter, Lisa SY121
Svobodný, Petr SY355
Sysling, Fenneke SY240
Szántó, Veronika SY78
Szögi, László SY197
Szumski, Jan SY247
Šidlovska, Venta SE28
Šimůnek, Michal SE19, SY69, SY367
Šišma, Pavel SY299
Šolc, Martin SY299
Štrbáňová, Soňa SE28, SY40

T

Taddia, Marco SY115
Takigawa, Yuko SE21
Takuwa, Yoshimi SE2
Tammiksaar, Erki SY29
Tao, Peipei SY200
Tar, Attila Szilárd SY197
Taranto, Pascal SY110
Tazzioli, Rossana SY299
Teichmann, Juergen SY374
Thébaud-Sorger, Marie SY202
Thomann, Johannes SE20
Tian, Miao SY380
Tian, Tian SE12
Tirard, Stéphane SY29
Tomilin, Konstantin SE3
Török, Borbala Zsuzsanna SY82
Torrens, Erica SY268
Tretzmüller, Thomas SY41
Turchetti, Simone SY321

U

Uhl, Heidemarie SY72

V

Valentines-Álvarez, Jaume SY336
Vallhonesta, Fàtima Romero SY206
Van Besouw, Jip SE4
van de Wal, Rozemarijn SY121
van Lunteren, Frans SY374
Van Tiggelen, Brigitte SY115
Vanpaemel, Geert SE4
Varela-Petito, Gonzalo SE6
Velasco-Martin, Marta SY40
Verburgt, Lukas M. SY240
Verdier, Norbert SY380
Větrovcová, Marie SY380
Vieira Souza da Silva, Luciana SE5
Vilén, Timo SE3
Vogt, Annette B. SE4, SY40, SY41, SY240
Volkov, Alexei SE21
Vykoukal, Jiří SY247

W

Walch, Sonja SY94
Walewska, Joanna SE18
Waltzing, Aline SE17
Wang, Hongchen SY38
Wei, Junchen SY142
Weldon, Stephen; SY13
Wille, Robert-Jan SY94
Wils, Kaat SY24, SY121
Wintergrün, Dirk SY17
Wolf, Jacqueline SY149
Wolfe, Charles SY78
Wolff, Stefan SE15
Wråkberg, Urban SE23
Wright, Aaron SY263
Wu, Yan SE12
Wulff-Barreiro, Enrique SE10

X

Xu, Fengxian SE12

Y

Yang, Yang SE24
Yao, Dazhi SY226
Yin, Xiaodong SY88
Yuan, Yuan SY142

Yusupova, Tatiana SY29

Z

Zarzoso, Alfons SY336
Zasztowt, Leszek SE15, SY247
Zaugg, Roberto SY364
Zehelein, Eva-Sabine SY348
Zemanek, Alicja SE28
Zhang, Baichun SY226
Zhang, Jiajing SE12
Zhang, Shu-jian SY142
Zhou, Célestin Xiaohan SY200
Zhu, Yiwen SY200

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