HPS&ST Note

June 2017

Introduction

This HPS&ST monthly note is sent direct to about 7,400 individuals who directly or indirectly have expressed an interest in the contribution of history and philosophy of science to theoretical, curricular and pedagogical issues in science teaching, and/or interests in the promotion of innovative and more engaging and effective teaching of the history and philosophy of science. The note is sent on to different international and national HPS lists and science teaching lists. In one form or another it has been published for 20+ years.

The note seeks to serve the diverse international community of HPS&ST scholars and teachers by disseminating information about events and publications that connect to concerns of the HPS&ST community.

Contributions to the note (publications, conferences, Opinion Piece, etc.) are welcome and should be sent direct to the editor: Michael R. Matthews, UNSW, **m.matthews@unsw.edu.au** .

2017 IHPST Biennial Conference, Ankara July 4-7, 2017

Looking back, looking ahead: Achievements and perspectives in HPS studies in science education

Dates: July 4-7, 2017
Venue: Hacettepe Üniversitesi, Ankara, Turkey
Chairs: M. Fatih Taşar (*Gazi Üniversitesi*) and Gültekin Çakmakçı (*Hacettepe Üniversitesi*)
Website: **http://ihpst2017.wixsite.com/biennial-conference**

Education Papers at the Division of the History of Science & Technology (DHST) 25th International Congress, Rio de Janeiro, Brazil, 23 to 29 July 2017

The Interdivisional Teaching Commission (IDTC) of the DHST & DLMPS is sponsoring two symposia at the DHST Rio Congress. The first is on Innovative and Engaging Pedagogy in HPS teaching; the second is on using history of science in the teaching of science.

Additionally, there is another symposium in the programme on the utilisation of history in science teaching.

Innovative and Engaging Pedagogy in History of Science, Technology and Medicine

Designing a history of physics course at the University of Copenhagen: dilemmas, expectations and learning outcomes
Ricardo Karam, University of Copenhagen, Denmark

Teaching history of science in the elementary school
Suseli de Paula Vissicaro & Silvia Fernanda de Mendonça Figueirôa, UNICAMP, Brazil

Reading and writing historical narratives in science education to discuss the construction of scientific knowledge
Andreia Guerra and Hermann Schiffer, CEFET-RJ, Brazil

How much history of science research can secondary school students do?
Huiyi Wu, Needham Research Institute, University of Cambridge, UK

History of science and education: interdisciplinary approaches
Maria Helena Roxo Beltran, Pontifical Catholic University of São Paulo, Brazil

Writing, acting and engaging with historical scientific controversies
Bernardo J Oliveira, Verona Segantini and Marina Fonseca, Universidade Federal de Minas Gerais, Brazil

From written words to abstract concepts: teaching medical history through text analysis.
Jaime E. Bortz, Department of Public Health and Medical Humanities, Buenos Aires University, Brazil

Teaching history of science, technology and medicine in an interdisciplinary programme
Yolanda Eraso, Oxford Brookes University, United Kingdom.

Learning history of medicine with Voicethread
Graham Mooney, Johns Hopkins University, USA.

Teaching the History of Computer Technology with Art and Artifacts
Dov Lungu, York University, Canada

The effect of historical case-studies in the teaching and learning mathematics
Gustavo Morales, Erika Ortiz and Matias Saracho, National University of Cordo, Argentina

Interdisciplinary Teaching of mathematics, computer sciences, natural sciences, and technology courses at the University of Stuttgart
Andreas Haka, University of Stuttgart, Germany

Innovative teaching of global warming: history, science and politics
Richard Staley, University of Cambridge, UK

Myths about Africa's scientific legacy: Rigour throughout history and contemporary epistemic advantages
Helen Lauer, University of Dar es Salaam, Tanzania

Innovative teaching of computational metaphysics
Christoph Benzmüller, Freie Universität Berlin, Germany.

Teaching the Scientific Heritage of Croatia– Faustus Verantius
Vanja Flegar and Marijana Borić, Croatian Academy of Sciences and Arts, Department for the History and Philosophy of Science

A project seminar creating a website and books about the history of Stuttgart University Campus
Klaus Hentschel, University of Stuttgart, Germany.

Re-create experiments from history: inform the future from the past
Elizabeth Cavicchi, MIT, USA

Using History in Science Education

'Modes of Rationality' in the History of Science for Science Education
Agustín Adúriz-Bravo, Universidad de Buenos Aires

Modeling Newton's Lunar Precession Problem and its Role in Understanding "Scientific" Method
Pierre J. Boulos, University of Windsor

Acting on Curiosity, Voicing Questions: in developing as investigators, Learners break new ground in understanding science, history and ourselves
Elizabeth Cavicchi Edgerton Center MIT

Could History of Science improve discussions of scientific practices in science teaching?
Andreia Guerra, Cristiano Moura, Tania Camel

The employment of hydrogen gas as a fuel in three different historical moments: scientific contends and nature of science applied in teacher education.
Francisco Aparecido Cardeira, Thaís Cyrino de Mello Forato, Hélio Elael Bonini Viana, Universidade Federal de São Paulo – UNIFESP -

Teaching Chemistry in the Deutsches Museum: Between the alchemist's dungeon and high-tech chemistry
Susanne Rehn-Taube, Deutsches Museum, Museumsinsel 1, 80538 München, Germany

Is there a "good or bad" History of Science to Science teaching? A case study based on Arabic Medieval Science
Ana Paula Bispo da Silva, State University of Paraiba, Winston Gomes Schmiedecke, Federal Institute of Education, Science and Technology of São Paulo

New Histories of Science Education

Science for grownups: historical landscapes of adult STEM learning in the postwar United States
Karen Rader (Virginia Commonwealth University)

Fairs, Olympiads and the Fostering of Scientific Elites: Youth Science Competitions in Sweden during the Cold War (19571989)
Daniel Lövheim (Stockholm University, department of Education)

Grant Stories: A Historical Perspective on Extramural Funding Practices for Indigenous Education and Research Methodologies in STEM
Jessica C. Venable (McAllister & Quinn)

The Problem of History in Chemical Education: The "Nature of Science" as Contested Space
John C. Powers (Virginia Commonwealth University)

Imaginative Biology: an online resource providing a new approach to Science Education
Daniel GamitoMarques, (NOVA University of Lisbon)

Teaching historical practice practically – understanding science culturally
Peter Heering (EuropaUniversität Flensburg, Germany)

Popular Genres of Science Education and the Normative Uses of History of Science in the post National Science Foundation Era in the United States
Katherine Pandora (University of Oklahoma)

More information, and full congress programme, is available at:
http://www.ichst2017.sbhc.org.br/

British Society for the History of Science, Annual Conference, July 6-9, 2017

The BSHS turns 70 years old in 2017. We invite you to join us in marking this anniversary at our Annual Conference, Thursday 6 to Sunday 9 July 2017, at the University of York.

Please visit **http://bshsconference.org.uk/book-the-bshs-conference-2017/** for prices and more information, including a provisional programme. We warmly welcome non-speakers who wish to attend the conference, as well as those whose papers have been accepted for inclusion in the programme. All participants should register by the final registration deadline of 15 June.

Please address all queries concerning registration to office@bshs.org.uk.

Dr Adam Mosley
BSHS Conferences Committee Chair
a.j.mosley@SWANSEA.AC.UK

 # epiSTEME 7: Seventh international conference to review research on Science, Technology and Mathematics Education, 5-8 January 2018

Homi Bhabha Centre for Science Education (TIFR), Mumbai, India, 5-8 January, 2018

EpiSTEME-7 is the seventh in a series of biennial conferences aimed at reviewing research world-wide in science, technology and mathematics education. It is being organised by the Homi Bhabha Centre for Science Education, a National Centre of the Tata Institute of Fundamental Research, Mumbai, India.

Research in the field of science, technology and mathematics education (STME) has its thrust on teaching and learning issues and has its groundings in the cognitive, pedagogical, historical, philosophical and socio-cultural aspects of the sciences. Over the last five decades, STME research has made significant contributions towards science, mathematics and technology education.

The name epiSTEME connotes, at one level, a systematic study of knowledge, while as an acronym it suggests a meta-view of science, technology and mathematics education. The first epiSTEME conference was held in 2004 and the sixth in the series was hosted in year 2015. Over a decade, the epiSTEME conferences have played a pioneering role in nurturing the STME research community in the country, through networking and collaborations between groups within India and aboard. The proceedings and review volumes of epiSTEME conferences are looked upon as standard reference material in the field.

Structure of the conference

Three broad strands of research that impact STME will form the core of epiSTEME- 7 like previous epiSTEME conferences. Themes have been identified under each strand to reflect active research topics and areas of interest. Leading researchers in different field will be invited to give overviews of some of the themes within each strand.

Conference epiSTEME-7 will also have new focus strand – Discipline Based Education Research (DBER) at undergraduate level aimed at carrying systematic investigation of learning focused on a specific discipline like astronomy, biology, chemistry and physics and grounded in modern theories of learning and instruction. Such work is informed by historical evolution of concepts and practices of the given discipline. Discipline Based Education Research and Development (DBERD) work at the undergraduate level conducted globally has provided valuable insights about students' conceptual hurdles in the subjects and the environments that foster learning in classroom and laboratory settings.

Paper and poster sessions will complement the review talks. Pre and post conference workshops are being planned, the details for the same will be announced later. The

conference will include about 8 review talks, 32-40 paper presentations and 20-25 poster presentations. Additionally, time will be allocated for discussion sessions on STME issues of current importance. Approximately 120 participants are expected. The strands and themes are presented below.

Strand 1. Historical, philosophical and socio-cultural studies of STM: implications for education
Theme 1: History and Philosophy of STME
Theme 2: Socio-cultural and gender issues in STME
Theme 3: Science and Technology Studies

Strand 2. Cognitive and affective studies of STME
Strand 3. Curriculum and pedagogical studies in STME
Strand 4. Discipline Based Education Research with emphasis on undergraduate science education

Call for Submissions
Papers are invited on the themes listed above. Submissions must be made online in the form of full papers of 6-8 pages (maximum of 8 pages including references). Details and a template for submission may be downloaded from the conference webpage.

All submissions go through a double-blind review process. Accepted papers are published as Proceedings, distributed during the conference on the pen drive and can be downloaded from the conference site (http://www.hbcse.tifr.res.in/episteme). Review talks along with the discussions are documented in a series of volumes called The epiSTEME Reviews.

Dates:
Submission of Papers: July 1, 2017
Notification of acceptance: August 15, 2017
Submission of revised paper: September 30, 2017
Registration with payment: October 20, 2017
Dates of conference: January 5-8, 2018

Contact
Convener epiSTEME 7
Web: **https://episteme7.hbcse.tifr.res.in/**
Email: **episteme7@hbcse.tifr.res.in; episteme7.2018@gmail.com**

British Journal for History of Science, Book Reviews

Dr James Stark, the incoming Reviews Editor for the *British Journal for the History of Science*, is pleased to circulate the latest set of books received by the journal for review. If readers are interested in reviewing any of the titles listed then please do get in touch with him.

https://www.cambridge.org/core/journals/british-journal-for-the-history-of-science/information/books-received

For information for prospective reviewers, please see: https://www.cambridge.org/core/journals/british-journal-for-the-history-of-science/information/book-review-information.

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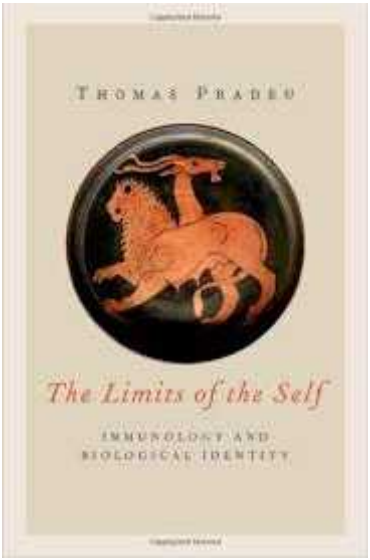
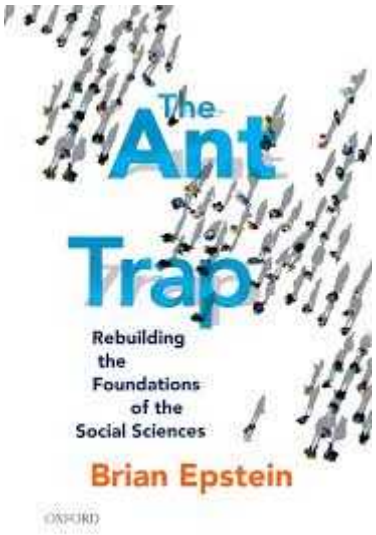
LSE Lakatos Awards

The London School of Economics and Political Science (LSE) is pleased to announce the winners of the 2015 and 2016 Lakatos Awards. The 2015 award goes to Thomas Pradeu of CNRS and the University of Bordeaux for his book *The Limits of the Self: Immunology and Biological Identity* (Oxford University Press, 2012). The 2016 award goes to Brian Epstein of Tufts University for *The Ant Trap: Rebuilding the Foundations of the Social Sciences* (Oxford University Press, 2015). Each will win a prize of £10,000.





The Lakatos Award is given for an outstanding contribution to the philosophy of science, broadly construed, in the form of a book published in English during the previous five years. It is generally considered the most prestigious book prize in the field worldwide.

The two prizewinners will receive their awards and deliver their prize lectures at the LSE in the autumn of 2017, at a time and location to be confirmed later. The lectures will be open to the public.

Dr. Pradeu's book is praised by the Selectors as "a profound examination of the ways in which our current understanding of the immune system can shed light on the metaphysical

questions of identity and selfhood." It is notable in its "impressive grasp of a wide range of literature both on the history and the current theory of immunology," engaging with "real cutting edge science" and demonstrating "a detailed understanding of the relevant science and scientific practices." Its "accessible and original" discussion makes a "distinctive and important contribution to the expansion of the scope of philosophy of biology," and should be "of considerable interest well beyond the philosophy of the biomedical sciences."

Professor Epstein's book is rated as "an extremely serious and significant book, as good a treatment of the metaphysics of the social world as there is, by some way." It provides "an outstandingly elegant illustration of why metaphysical foundations really matter to the practice of science," and "opens the door to a more productive philosophy of social science than has hitherto been available." The arguments are "careful and rigorous," with "the right mixture of theories and examples," arriving at "quite original conclusions." The book is praised as "beautiful and engaging", "original and ambitious", "exemplary in its clarity", and "extremely enjoyable to read."

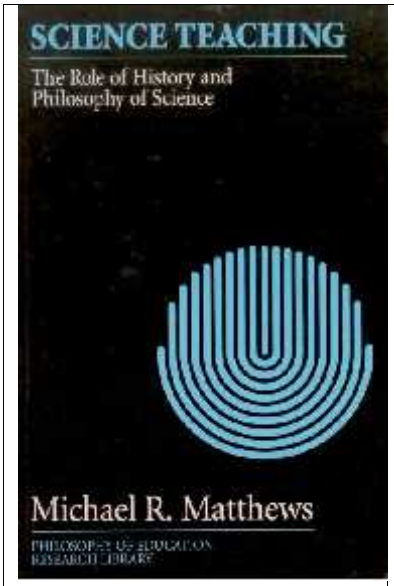
Nominations are invited for the **2018 Lakatos Award**, with a deadline of **Monday 2 October 2017**. (Regrettably, the 2017 competition will not take place.) The 2018 award will be for a book published in English with an imprint from 2012 to 2017 (inclusive). Any person of recognised standing within the philosophy of science or an allied field may nominate a book, with permission from the author(s). Self-nominations are not allowed.

Please address nominations, or any requests for further information, to the Award Administrator, Tom Hinrichsen, at t.a.hinrichsen@lse.ac.uk.

For further details about the award and about Imre Lakatos, see:
http://www.lse.ac.uk/philosophy/lakatos-award/

Translations of *HPS and Science Teaching* Book

One of the first books devoted to the contribution of history and philosophy of science to theoretical, curricular and pedagogical issues in science teaching was Michael R. Matthews *Science Teaching: The Role of History and Philosophy of Science* (Routledge, 1994). The book was commissioned by Israel Scheffler and published in the Routledge Philosophy of Education Research Library for which Scheffler was the editor. A Greek translation was published (Epikentro Press, 2007), also a Korean translation (Book's Hill Publishers, 2014).

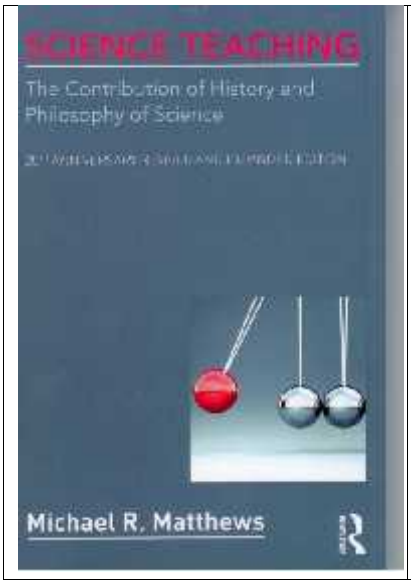


1994

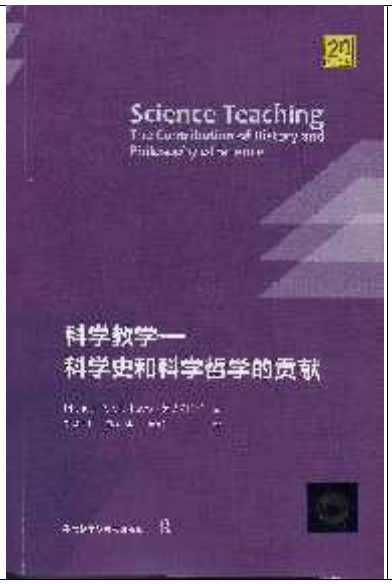
2007

2014

Routledge commissioned a revised, expanded, up-dated 20th anniversary edition that was published in 2015 in their Science Education list. This was an indicator that HPS had 'come in out of the cold' and was part of the mainstream of science education debate and research. This year a Chinese translation (Foreign Languages Technical and Research Press, Beijing) and a Turkish translation (Bogazici University Press, Istanbul) have been published. The latter is being launched at the July IHPST Ankara conference by Gürol Irzik, a Turkish philosopher who has engaged with science education issues.



2015



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These translations reflect the international, trans-cultural recognition that HPS can make important contributions to theoretical, curricular and pedagogical issues in science education. This recognition is also reflected in the fact that in the first two years since publication there have been 84,573 chapter-downloads from the Springer site of the *International Handbook of*

Research in History, Phuilosophy and Science Teaching
(**http://www.springer.com/gp/book/9789400776531**)

Opinion Page: *What's Wrong with HPS and What Needs be Done to Put it Right?*

Nicholas Maxwell, *Philosophy Department, University College London*

After a sketch of the optimism and high aspirations of HPS when I first joined the field in the mid-1960s, I go on in this essay to describe the disastrous impact of "the strong programme" and social constructivism in history and sociology of science. Despite Alan Sokal's brilliant spoof article, and the "science wars" that flared up partly as a result, the whole field of HPS and STS is still adversely affected by social constructivist ideas. I then spell out how in my view Philosophy of Science ought to develop.

It is, to begin with, vitally important to recognize the profoundly problematic character of the aims of science. There are substantial, influential and highly problematic metaphysical, value and political assumptions built into these aims. Once this is appreciated, it becomes clear that we need a new kind of science which subjects problematic aims - problematic assumptions inherent in these aims - to sustained imaginative and critical scrutiny as an integral part of science itself. This needs to be done in an attempt to improve the aims and methods of science as science proceeds. The upshot is that science, philosophy of science, and the relationship between the two, are all transformed. HPS becomes an integral part of science itself. And becomes a part of an urgently needed campaign to transform universities so that they become devoted to helping humanity create a wiser world.

1 High Aspirations of HPS in the 1960s

I discovered the work of Karl Popper in the early 1960s, partly as a result of attending his seminars at the LSE, and I was immensely impressed. Here was a philosopher passionately concerned with profound, real problems of the real world which he tackled with fierce intellectual integrity and great originality. There was first his transformation of science - or at least of our conception of science. Laws and theories cannot be verified in science, but they can be empirically falsified, and that is how science makes progress. As a result of subjecting theories to fierce sustained attempted empirical refutation, we eventually discover where they go wrong, and are thus provoked into thinking up theories which do even better, until they are in turn refuted. Scientific knowledge is simply made up of our best, boldest imaginative guesses that have survived all our most ruthless attempts at empirical refutation.[1]

Then there was his generalization of this falsificationist conception of science to form a radically new conception of rationality. To be rational is to be critical. Just as science makes progress through subjecting our best conjectures to fierce attempted falsification, so more generally, in all areas of human life, we can best hope to make progress by subjecting our best attempts at solving our problems to fierce criticism. Empirical testing in science is just an especially severe form of criticism.[2]

The entire tradition of western philosophy had got it wrong. Scepticism is not the enemy to be vanquished - or to be indulged until it can go no further, thus revealing a bedrock of certainty, as with Descartes, and many empiricists. Quite the contrary, scepticism is our friend, the very soul of reason. It is by means of imagination subjected to sustained,

ferocious scepticism that we can learn, and make progress. Science is institutionalized scepticism.

What impressed me most, however, was the application of these ideas to the profound problem of creating civilization or, as Popper called it, "the open society". Rationality is the critical attitude. But this is only really possible in an "open" society, a society, that is, which tolerates a diversity of views, values and ways of life. In a "closed" society, in which there is just one view of things, one set of values, one way of life, there can be no possibility of criticism, since to criticize A we need, at least as a possibility, some alternative view B. Thus the rational society is the open society - not a society enslaved to some monolithic, dictatorial notion of "reason", but simply a liberal society that tolerates and sustains diversity of views, values and ways of life, and can, as a result, learn, make progress, and even create and pursue science.[3]

But the move from the closed to the open society has a severe penalty associated with it. We move from certainty to doubt. Living in the open society requires that we shoulder the adult responsibility of living in a state of uncertainty, of doubt. Everything we believe, everything we hold most dear, and value - the very meaning and value of our whole way of life - may be wrong or misconceived. Doubt is the price we pay for civilization, for reason, for humanity, and for science. In his masterpiece *The Open Society and Its Enemies* (1945), Popper calls this essential doubt "the strain of civilization", and he points out that all too many people cannot bear it, and seek to return to the false certainties of the closed society. Even some of our greatest thinkers have sought to do this, and they are the enemies of the open society - above all, for Popper, Plato and Marx.[4]

Popper demonstrated, it seemed to me, that it was possible to be an academic philosopher and yet retain one's intellectual integrity.[5] I moved down to London from Manchester (where I had studied philosophy) and got a job as lecturer in philosophy of science in the Department of History of Philosophy of Science at University College London. Larry Laudan and Paul Feyerabend were among my departmental colleagues.

It was an exciting time and place to be doing history and philosophy of science (HPS). London felt like the HPS capital of the world. HPS seemed to be a fledgling academic discipline, having associated with it all the excitement, freshness, high aspirations and optimism of a new discipline. There was the idea that each wing needed the other: history of science would be blind without philosophy of science, which in turn would be empty without history of science. Natural science seemed to be the one great human endeavour that undeniably made progress across generations and centuries. Aside from mathematics, in no other sphere of human endeavour did this happen - not in art, music, literature, politics, or morality. There was technological progress, certainly, and economic progress too, but these were closely linked to, and dependent on, scientific progress. It was the great task of HPS to work out how science did make progress, and what might be learned from scientific progress about how to make progress in other areas of human life: art, literature, law, education, politics, economics, international relations, personal flourishing and fulfilment. Popper had shown the way. But he could hardly be the last word on the subject. Popper's philosophy needed to be applied to itself, and subjected to sustained critical scrutiny in an attempt to improve on it. And there were plenty of contending ideas around, most notably, those of Thomas Kuhn, Imre Lakatos and Paul Feyerabend.

2 Decline of HPS

But then HPS fell into a sad decline, and lost its way. Feyerabend argued for methodological anarchy, for the view that, in science, "anything goes".[6] Barry Barnes and David Bloor.[7] launched "the strong programme": science must be understood in purely sociological terms, there being no such thing as scientific truth, fact, reason, method or progress.[8] Something similar came from postmodernism, French philosophy, Foucault, Derrida and others. The upshot was a whole new way of construing science, which may be called "social constructivism". Scientific knowledge is merely a social construct, having nothing to do with knowledge, truth and falsity, or reason. Sociologists and historians of science took to social constructivism, while philosophers of science looked on in amazement and horror, at the idiocy of it. As a result, HPS broke asunder. The integrated enterprise, bringing together history and philosophy of science, which had started out with such high hopes and aspirations, and which was still alive and kicking when I began my academic career around 1965, was no more. The fundamental problem of History of Science - How has scientific progress come about? - could not even be asked.

Then, as if matters were not bad enough already, Philosophy of Science began to degenerate into a kind of scholasticism that splintered into a multitude of specialized disciplines: philosophies of the specialized sciences - physics, chemistry, neuroscience, astronomy, botany, and so on. As a result, Philosophy of Science lost sight of the magnificent endeavour of natural science as a whole, and came to ignore the great, fundamental problems that were, initially, the whole raison d'être for its existence: the problem of induction, the problem of the rationality of science, the problem of how, by what means, science makes progress.

In 1996 the worst excesses of the social constructivists and anti-rationalists were brilliantly satirized by a spoof article by Alan Sokal.[9] The "science wars" exploded onto the scene, some scientists and philosophers of science springing to the defence of science against the corrosive acid of social constructivism, anti-rationalism and postmodernism. Paul Gross and Norman Levitt wrote a book assailing the worst excesses of postmodernist writing about science, and subsequently edited a book that continued the argument.[10] Alan Sokal and Jean Bricmont outraged French intellectuals with devastating criticisms of French philosophers' writings about science: Jacques Lacan, Luce Irigaray, Bruno Latour, Gilles Deleuze and others.[11] Noretta Koertge edited a book *Exposing Postmodernist Myths About Science*.[12] Others joined the affray. Social constructivists protested that distinctions were being ignored, contexts overlooked.

3 What Was Overlooked

Both parties to this dispute profoundly missed the point. The social constructivists were right to hold that orthodoxy could not make rational sense of science, but disastrously wrong to interpret science in purely sociological terms. Those who defended orthodoxy, the view that science does make progress and acquire knowledge, were right to criticize and reject social constructivism, but wrong to defend current orthodox views about science. Gross, Levitt, Sokal and company sprang to the defence, not of scientific rationality, but to a very seriously irrational conception of science masquerading as rationality. Everyone ignored the crucial questions: What are the real aims of science? Granted that they are profoundly problematic, how can they be improved?

The irrational view of science I have in mind, taken for granted by most scientists and philosophers of science, may called *standard empiricism* (SE). This holds that the basic intellectual aim of science is factual truth (nothing being presupposed about the truth), the basic method being to assess claims to knowledge impartially with respect to evidence. Considerations such as the simplicity, unity or explanatory character of a theory may influence what theory is accepted, but not in such a way that the universe or the phenomena are permanently assumed to be simple, unified or comprehensible. According to SE, what theory is accepted may even be influenced for a time in science by some paradigm or metaphysical "hard core" in the kind of way depicted by Kuhn and Lakatos[13] as long as, in the end, empirical success and failure are the decisive factors in determining what theories are accepted and rejected. The decisive tenet of SE is that *no substantial thesis about the nature of the universe can be accepted as a permanent part of scientific knowledge independently of empirical considerations* (let alone in violation of empirical considerations).

Even those who - like Feyerabend, social constructivists and postmodernists - reject the whole idea that science is rational, delivers authentic knowledge, and makes progress, nevertheless tend, in a way, to uphold some version of SE as the only possible rationalist conception of science. No rational account of science is possible, they hold in effect, because the only candidate, SE, is untenable (as shown by the failure of SE to solve the problem of induction).

Despite being almost universally taken for granted by scientists, SE is nevertheless untenable. SE very seriously misrepresents the aims of science. The intellectual aim of science is not to improve knowledge of factual truth, nothing being presupposed about the truth. On the contrary, science cannot proceed without making a very substantial and highly problematic *metaphysical* hypothesis about the nature of the universe: it is such that some kind of unified pattern of physical law governs all natural phenomena. Science seeks, not truth per se, but rather *explanatory* truth - truth presupposed to be explanatory. More generally, science seeks *valuable* truth - truth that is of intrinsic interest in some way or useful. This aim is, if anything, even more problematic. And science seeks knowledge of valuable truth so that it can used in social life, ideally so as to enhance the quality of human life. There are, in other words, problematic *humanitarian* or *political* assumptions inherent in the aims of science. In holding that the basic intellectual aim of science is *truth per se*, the orthodox position of SE misrepresents the real and highly problematic aims of science.

The vital task that needs to be done to develop HPS in fruitful directions - a task not performed because of the influential absurdities of "the strong programme", social constructivism and the science wars debate - is to give absolute priority to two fundamental questions: What are the real aims of science? What ought they to be? Ever since around 1970, when I began to consider these questions, those associated with HPS and STS ought to have put these two questions at the heart of science studies. If this had been done, science studies, in conjunction with sympathetic scientists, science journalists and others, might have helped develop a conception of science, and even a kind of science, both more rigorous and of greater human value than what we have today. Indeed, a new kind of academic inquiry might have emerged that is rationally devoted to helping humanity make social progress towards as good a world as possible. We might even have begun to see the beginning of a new kind of social world capable of tackling its immense global problems in increasingly effective and cooperatively rational ways. None of this has come about because the academic disciplines most directly responsible for helping to initiate these developments, HPS and STS, have been distracted by intellectual stupidities.

4 Why Standard Empiricism (SE) is Untenable

The key step that needs to be taken to permit these urgently needed intellectual, institutional and humanitarian developments to unfold is the widespread recognition that standard empiricism (SE) is indeed untenable, and needs to be replaced by something better. So, let us see why SE is untenable.

As it happens, reasons for rejecting SE have been spelled out in the literature again and again, ever since 1974.[14] But these refutations of SE have been ignored.

In outline, the refutation goes like this. Theoretical physics persistently only ever accepts *unified* theories - theories that attribute the same dynamical laws to the phenomena to which the theory applies. Given any such accepted theory - Newtonian theory, classical electrodynamics, quantum theory, general relativity, quantum electrodynamics, or the standard model - endlessly many disunified rivals can be easily concocted to fit the available phenomena even better that the accepted unified theory.[15] These disunified rivals that postulate different laws for different phenomena in a "patchwork quilt" fashion, are (quite properly) never taken seriously for a moment despite being empirically more successful. This persistent acceptance of unified theories in physics even though endlessly many empirically more successful, patchwork quilt rivals can readily be formulated means that physics makes a persistent assumption about the universe: it is such that all seriously disunified theories are false. The universe is such that some kind of underlying unified pattern of physical law runs through all phenomena.

If physicists only ever accepted theories that postulate atoms even though empirically more successful rival theories are available that postulate other entities such as fields, it would surely be quite clear: physicists implicitly assume that the universe is such that all theories that postulate entities other than atoms are false. Just the same holds in connection with unified theories. That physicists only ever accept unified theories even though endlessly many empirically more successful, disunified rival theories are available means that physics implicitly assumes that the universe is such that all such disunified theories are false.

In accepting the unified theories that it does accept - Newtonian theory, classical electrodynamics and the rest - physics thereby adopts a big, highly problematic metaphysical hypothesis, H, about the nature of the universe: it is such that all rival, grossly disunified, "patchwork quilt" but empirically more successful theories are false.

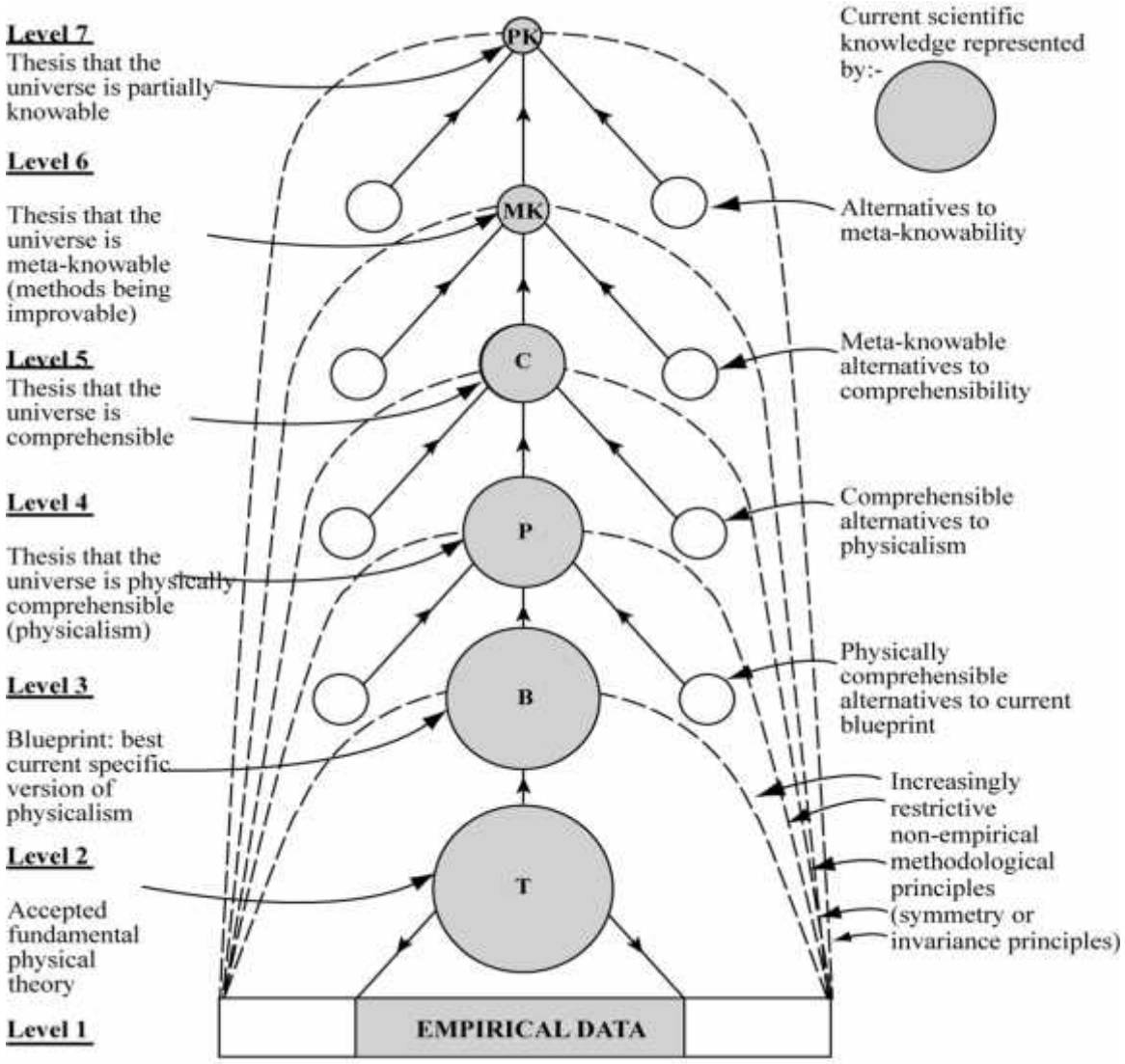

Figure 1: Aim-Oriented Empiricism (AOE)

H, though a metaphysical hypothesis, is nevertheless a permanent, even if generally unacknowledged, item of theoretical knowledge. Theories that clash with it, even though empirically more successful than accepted physical theories, are rejected - or rather, are not even considered for acceptance. Whenever a fundamental physical theory is accepted, endlessly many empirically more successful rivals, easily formulated, are not even considered just because, in effect, they clash with H. Thus, H is a permanent item of theoretical knowledge in physics, more securely established in scientific practice indeed than any physical theory. Physical theories tend eventually to be shown to be false, but H persists through theoretical revolutions in physics.[16]

Nevertheless, H is a hypothesis, a pure conjecture. How can we make sense of the idea that science is rational and delivers authentic knowledge if the whole enterprise depends crucially on accepting such an unsupported hypothesis as a secure item of scientific knowledge - a hypothesis that exercises a major influence over what theories are accepted and rejected in physics?

5 Aim-Oriented Empiricism (AOE)

In order to answer this question, we need to adopt a conception of science that I have called *aim-oriented empiricism* (AOE). Precisely because H is a substantial assertion about the nature of the universe, an assertion that, though purely conjectural in character, nevertheless exercises a major influence over what theories are accepted and rejected, even to the extent of over-riding empirical considerations, it needs to be made explicit within physics so that it can be critically assessed, rival hypotheses if possible being developed and assessed, in the hope that H can be improved on. We need a new conception of science which represents the metaphysical hypotheses of physics in the form of a hierarchy of hypotheses, as one goes up the hierarchy hypotheses becoming less and less substantial, and more nearly such that their truth is required for science, or the pursuit of knowledge, to be possible at all. In this way, we create a relatively unproblematic framework of hypotheses, and associated methodological rules, high up in the hierarchy, within which much more substantial and problematic hypotheses, and associated methodological rules, low down in the hierarchy, can be critically assessed and, we may hope, improved, in the light of the empirical success they lead to, and other considerations: see figure 1.

All this can be reformulated in terms of aims and methods. The aim of science is not truth per se, as SE holds. It is rather truth presupposed to be explanatory - or at least knowable. Precisely because this aim of science presupposes a problematic metaphysical hypothesis, the aim (or the hypothesis presupposed by the aim) needs to be represented in the form of a hierarchy of aims (or hypotheses) as indicated in figure 1, so that attempts to improve aims (or hypotheses) may receive the best possible help. As our scientific knowledge and understanding improve, so aims and methods improve as well. There is something like positive feedback between improving scientific knowledge and improving aims and methods - improving knowledge about how to improve knowledge. Science adapts itself to what it finds out about the universe.

It is this positive feedback, this interaction between improving scientific knowledge on the one hand, and improving aims and methods (improving assumptions and methods) on the other, that helps explain the explosive growth of modern science. For all this has gone on in scientific practice despite scientists paying lip service to SE. Allegiance to SE has been sufficiently hypocritical to permit aim-oriented empiricism (AOE) to be put into scientific practice, to some extent at least. Allegiance to SE has nevertheless obstructed full implementation of AOE, and has had damaging consequences for science as a result.[17]

There are now three key points to note about AOE.

1. It is not just theoretical physics that has a problematic aim because of problematic hypotheses inherent in the aim. This is true of most - perhaps all - scientific disciplines. Thus most, or perhaps all, scientific disciplines need to be understood in terms of diverse versions of the hierarchical, meta-methodological structure of AOE depicted in figure 1. The aims and methods of science change as we move from one science to another, and as we move within any given science from one time to another. The common factors are (a) something like the hierarchical, interacting structure depicted in figure 1; (b) the common endeavour to improve knowledge and understanding of the universe, and ourselves and other living things as a part of it. AOE provides a general solution to the problem of the nature of the progress-achieving methods of science.[18]

2. AOE solves fundamental problems in the philosophy of science: in particular, the problem of induction (the problem of the rationality of science); the problem of verisimilitude; and the problem of what it means to say of a physical theory that it is unified.[19]

3. AOE transforms the nature of science, the nature of philosophy of science, and the nature of the relationship between the two. And all this impacts on the nature of HPS and STS. Traditionally, philosophy of science has been conceived of, and practised, as a meta discipline, studying science in the same way as astronomers study the moon or distant galaxies. This might make sense if science had a fixed aim and fixed methods, as SE holds science does. But AOE asserts that, because the basic aims of science are profoundly problematic, they evolve as scientific knowledge evolves, and change from one science to another. AOE demands that there is a two-way interaction between science itself, on the one hand, and its aims-and-methods, or philosophy, on the other hand. Metaphysics and the philosophy of science become vital ingredients of science itself, concerned to help science make progress. The nature of science, the philosophy of science, and the relationship between the two, all change dramatically.[20]

Exploring probing questions about what the aims of science are, and ought to be, goes much further. For science seeks truth presupposed to be explanatory - explanatory truth as one might say - as a special case of the much more general aim of *valuable truth* - truth that is of intrinsic interest in some way, or of use. A science which increased our knowledge of irredeemably trivial, useless, utterly uninteresting truth would not be said to be making progress. Science both does, and ought to, seek truth that is of use or of value. Merely in order to be accepted for publication, a scientific paper must report a finding that meets some threshold of potential interest. Counting leaves on trees or pebbles on beaches does not, in itself, contribute to scientific knowledge even if the information is new and true.

But the aim of valuable truth is almost more problematic than that of explanatory truth. Of value to whom? And in what way? Is what science seeks to discover always of value to humanity, to those whose needs are the greatest? What of the links that science funding has with the military, corporations of one kind or another, and governments? Do the aims of science always respond to the curiosity and wonder of scientists, or sometimes to their career ambitions and vanity? Given that modern science is expensive, is there not always going to be an inherent conflict between the interests of those who pay for science - the wealthy and powerful - and those whose needs are the greatest - the poor and powerless?

If science is to pursue the problematic aim of valuable truth rationally, and in such a way that justice is done to the best interests of humanity, it is vital that science is pursued within the framework of a generalized version of AOE - humane AOE I have called it - so that three domains of discussion are recognized: (1) evidence; (2) theory; and (3) aims. The third domain of discussion, aims, is as important as the first two. At present it is "repressed"; it goes on in fund giving committees, and in private between scientists, but not openly in journals and conferences along with (1) and (2).

Sustained exploration of the problematic aim of valuable truth needs to attempt to articulate (a) what we conjecture to be scientifically discoverable, and (b) what we conjecture it would be of value to discover, so that we may try to determine the all-important region of overlap between the two. The scientific community may have expertise when it comes to (a), but cannot have any exclusive expertise when it comes to (b). If science is to come to serve the best interests of humanity, it is vital that scientists and non-scientists alike cooperate in

engaging in sustained imaginative and critical exploration of what it would be of most value for science to attempt to discover - what ought to be the aims and priorities of scientific and technological research. The institutional/intellectual structure of science needs to be changed to facilitate such aim-exploration. Journals and conferences need to be set up. Science journalism needs to contribute. SE, in misrepresenting the aim of science to be truth per se, in effect "represses" the real, problematic aim of valuable truth, and thus damages science by inhibiting the kind of sustained, cooperative exploration of actual and possible valuable aims science does, and might, pursue.[21]

It is important to appreciate that all this comes within the province of philosophy of science which is centrally concerned with problems about the aims and methods of science. Philosophy of science, in order to be done properly, must concern itself with moral, social, value questions about science. It must seek to call into question the less praiseworthy human aspirations science may seek to fulfil - the greed of corporations, the military might of some governments, the self-interests of some scientists. And it must explore neglected avenues of research that might lead to discoveries and technological developments of great potential value to humanity.

It does not stop here. For of course science seeks knowledge of valuable truth so that it may be used by people in life - ideally, so as to enhance and enrich the quality of human life. Science is to be used by people, either culturally, to aid the quest to know, to understand, or practically, as a means to the realization of other goals of value - health, security, travel, communications, entertainment, and so on. Science aims to contribute to the social world. There is a political dimension to the aims of science - once again, profoundly problematic. Everything said above about the value dimensions of the aims of science applies here too to the social, humanitarian or political dimensions. And this, too, comes within the province of philosophy of science, properly conceived. The orthodox distinction between "internal" factors (purely intellectual) and "external" (social, political, economic, evaluative) is a nonsense. At least, the way this distinction is usually drawn is a nonsense.[22]

6 Broader Implications

Elsewhere, I have argued that these considerations about the problematic aims of science have broader implications for social inquiry and the humanities, for academic inquiry as a whole, and for social life. In these fields, too, aims are profoundly problematic. A proper, basic task of social inquiry and the humanities is to help humanity build into the fabric of institutions and social endeavours - politics, industry, agriculture, economics, the law, the media, international relations - a generalization of the hierarchical, aim-improving methodology I have depicted above in connection with science.

The upshot of the argument is that we need a revolution in academia, so that the basic aim becomes, not just knowledge, but rather wisdom - this understood to be the capacity, the active endeavour, and the desire, to achieve what is of value in life, for oneself and others. Wisdom, in this sense, includes knowledge, technological know-how and understanding, but much else besides. The revolution in the nature, the aims and methods, of science is a special case of a broader revolution we need in academia, and in the social world, so that we may learn how to make social progress towards a wiser world.[23]

Notes

[1] See Popper (1959; 1963).
[2] "inter-subjective *testing* is merely a very important aspect of inter-subjective *criticism*, or in other words, of the idea of mutual rational control by critical discussion." Popper (1959, p. 44, note 1*). Popper refers the reader to his (1969, chs. 23 and 24) - first published in 1945.
[3] See Popper (1969).
[4] As in note 4.
[5] See my (2012a, pp. 688-699).
[6] Feyerabend (1975; 1978; 1987).
[7] Harry Collins, John Henry and others were, and still are (at the time of writing) associated with the movement.
[8] Bloor (1976); Barnes (1977; 1982; 1985); Barnes, Bloor and Henry (1996).
[9] Sokal (1998). See also Sokal (2008) for an annotated version of the hoax article, and essays on related matters.
[10] Gross and Levitt (1994); Gross, Levitt and Lewis (1996).
[11] Sokal and Bricmont ((1998).
[12] Koertge (1998).
[13] Kuhn (1962); Lakatos (1970).
[14] See my (1974; 1993; 1998; 2000b; 2002; 2004; 2005; 2007a, chs. 9 and 14; 2008; 2009b; 2011; 2014b; 2017a; 2017b).
[15] Here is a demonstration of this point. Let T be any accepted fundamental physical theory. There are, to begin with, infinitely many disunified rivals to T that are *just as empirically successful* as T. In order to concoct such a rival, T_1 say, all we need to do is modify T in an entirely *ad hoc* way for phenomena that occur after some future date. Thus, if T is Newtonian theory (NT), NT_1 might assert: everything occurs as NT predicts until the first moment of 2050 (GMT) when an inverse cube law of gravitation comes into operation: $F = Gm_1m_2/d^3$. Infinitely may such disunified rivals can be concocted by choosing infinitely many different future times for an abrupt, arbitrary change of law. These theories will no doubt be refuted as each date falls due, but infinitely many will remain unrefuted. We can also concoct endlessly many disunified rivals to T by modifying the predictions of T for just one kind of system that we have never observed. Thus, if T is, as before, NT, then NT_2 might assert: everything occurs as NT predicts except for any system of pure gold spheres, each of mass greater than 1,000 tons, moving in a vacuum, centres no more than 1,000 miles apart, when Newton's law becomes $F = Gm_1m_2/d^4$. Yet again, we may concoct further endlessly many equally empirically successful disunified rivals to T by taking any standard experiment that corroborates T and modifying it in some trivial, irrelevant fashion - painting the apparatus purple, for example, or sprinkling diamond dust in a circle around the apparatus. We then modify T in an *ad hoc* way so that the modified theory, T_3 say, agrees with T for all phenomena except for the trivially modified experiment. For this experiment, not yet performed, T_3 predicts - whatever we choose. We may choose endlessly many different outcomes, thus creating endlessly many different modifications of T associated with this one trivially modified experiment. On top of that, we can, of course, trivially modify endlessly many further experiments, each of which generates endlessly many further disunified rivals to T. Each of these equally empirically successful, disunified rivals to T - T_1, T_2, … T_∞ - can now be modified further, so that each becomes *empirically more successful* than T. Any accepted fundamental physical theory is almost bound to face some empirical difficulties, and is thus, on the face of it, refuted - by phenomena A. There will be phenomena, B, which come within the scope of the theory but which cannot be predicted because the equations of the theory cannot (as yet) be solved. And there will be other phenomena, C, that fall outside the scope of the theory altogether. We can now take any one of the disunified rivals to T, T_1 say, and modify it further so that the new theory, T_1*, differs further from T in predicting, in an entirely *ad hoc* way, that phenomena A, B and C occur in accordance with empirically established laws L_A, L_B and L_C. T_1* successfully predicts all that T has successfully predicted; T_1* successfully predicts phenomena A that ostensibly refute T; and T_1* successfully predicts phenomena B and C that T fails to predict. On empirical grounds alone, T_1*

is clearly more successful and better corroborated, than T. And all this can be repeated as far as all the other disunified rivals of T are concerned, to generate infinitely many empirically more successful disunified rivals to T: T_1*, T_2*, … T_∞*.

[16] For expositions of this argument see Maxwell (1974, part 1; 1993, part 1; 1998, ch. 2; 2000b; 2002; 2004, ch. 1; 2005; 2011; 2013.

[17] For expositions of, and arguments for AOE see works referred to in note 22.

[18] Maxwell (2004, pp. 39-47).

[19] Maxwell (1998, chs. 3-6; 2004, chs 1, 2, and appendix; 2007a, ch. 14; 2014b; 2017a; 2017b).

[20] See works referred to in note 15.

[21] See my (1976; 1984; 2001; 2004; 2007a; 2010; 2014a; 2017a; 2017b).

[22] See previous note.

[23] See Maxwell (1976; 1980; 1984; 1992; 2000, 2004; 2007a; 2007b; 2008; 2009a; 2012a; 2014; 2017a, ch. 8).

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Blay, Michel (2017) *Critique de l'histoire des sciences*. Paris: CNRS ISBN: 978-2-271-09184-0

"On a toujours tendance à faire remonter les commencements de la science aux Grecs anciens. On tient pour acquis qu'elle incarne un progrès en marche, qu'elle se construit linéairement, de manière cumulative, chacun ajoutant une brique à l'édifice commun. La science serait universelle, surplombante, détachée de tout substrat idéologique et culturel, et les écrits de nos prédécesseurs ne seraient que des essais, souvent naïfs, pour nous permettre de devenir ce que nous sommes.
Il n'en est rien. Nos prédécesseurs se préoccupaient de la construction de mondes ayant leur propre signification, leur propre cohérence, comme autant de systèmes de pensée à une époque donnée. La question du « progrès » n'a dans ce cadre pas grande signification.
En revanche, un chemin traverse la pensée occidentale depuis les Grecs : celui de l'ordre démonstratif, lancé par les Éléments d'Euclide, poursuivi en terre d'Islam, renforcé au XVIesiècle en Occident, où naissent les mathématiques comme nous les connaissons. Mais cet ordre démonstratif vaut pour sa forme, pas pour son contenu.
En prenant une position résolument critique, en revisitant les approches historicisantes de l'histoire des sciences, en interrogeant l'homogénéisation idéologique des pensées dans l'histoire globale, Michel Blay développe une nouvelle sensibilité aux constructions du passé comme à celles du présent, et ouvre une nouvelle voie pour l'avenir." (From the publisher)

More informations at: **http://www.cnrseditions.fr/histoire-des-sciences-et-des-techniques/7442-critique-de-l-histoire-des-sciences.html**

Chalmers, Alan (2017) *One Hundred Years of Pressure: Hydrostatics from Stevin to Newton*. Dordrecht: Springer. ISBN 978-3-319-56529-3

"This monograph investigates the development of hydrostatics as a science. In the process, it sheds new light on the nature of science and its origins in the Scientific Revolution. Readers will come to see that the history of hydrostatics reveals subtle ways in which the science of the seventeenth century differed from previous periods.
"The key, the author argues, is the new insights into the concept of pressure that emerged during the Scientific Revolution. This came about due to contributions from such figures as Simon Stevin, Pascal, Boyle and Newton. The author compares their work with Galileo and Descartes, neither of whom grasped the need for a new conception of pressure. As a result, their contributions to hydrostatics were unproductive.
"The story ends with Newton insofar as his version of hydrostatics set the subject on its modern course. He articulated a technical notion of pressure that was up to the task. Newton

compared the mathematical way in hydrostatics and the experimental way, and sided with the former. The subtleties that lie behind Newton's position throws light on the way in which developments in seventeenth-century science simultaneously involved mathematization and experimentation.
"This book serves as an example of the degree of conceptual change that new sciences often require. It will be of interest to those involved in the study of history and philosophy of science. It will also appeal to physicists as well as interested general readers."

More information at: **http://www.springer.com/gp/book/9783319565286#aboutBook**

Delbourgo, James (2017) *Collecting the World: Hans Sloane and the Origins of the British Museum*. Cambridge, MA: Harvard University Press. ISBN: 9780674737334

"In 1759 the British Museum opened its doors to the general public—the first free national museum in the world. James Delbourgo's biography of Hans Sloane recounts the story behind its creation, told through the life of a figure with an insatiable ambition to pit universal knowledge against superstition and the means to realize his dream.
"Born in northern Ireland in 1660, Sloane amassed a fortune as a London society physician, becoming a member of the Whig establishment and president of the Royal Society and Royal College of Physicians. His wealth and contacts enabled him to assemble an encyclopedic collection of specimens and objects—the most famous cabinet of curiosities of its time. For Sloane, however, collecting a world of objects meant collecting a world of people, including slaves. His marriage to the heir of sugar plantations in Jamaica gave Sloane access to the experiences of planters and the folkways of their human property. With few curbs on his passion for collecting, he established a network of agents to supply artifacts from China, India, North America, the Caribbean, and beyond. Wampum beads, rare manuscripts, a shoe made from human skin—nothing was off limits to Sloane's imagination.
"This splendidly illustrated volume offers a new perspective on the entanglements of global scientific discovery with imperialism in the eighteenth century. The first biography of Sloane based on the full range of his writings and collections, Collecting the World tells the rich and complex story of one of the Enlightenment's most controversial luminaries." (From the publisher)

More information at: **http://www.hup.harvard.edu/catalog.php?isbn=9780674737334**

Ebbs, Gary (2017) *Carnap, Quine, and Putnam on Methods of Inquiry*. Cambridge: Cambridge University Press. ISBN: 9781107178151

"Carnap, Quine, and Putnam held that in our pursuit of truth we can do no better than to start in the middle, relying on already-established beliefs and inferences and applying our best methods for re-evaluating particular beliefs and inferences and arriving at new ones. In this collection of essays, Gary Ebbs interprets these thinkers' methodological views in the light of their own philosophical commitments, and in the process refutes some widespread misunderstandings of their views, reveals the real strengths of their arguments, and exposes a number of problems that they face. To solve these problems, in many of the essays Ebbs also develops new philosophical approaches, including new theories of logical truth, language use, reference and truth, truth by convention, realism, trans-theoretical terms, agreement and disagreement, radical belief revision, and contextually a priori statements. His essays will be valuable for a wide range of readers in analytic philosophy." (From the publisher)

More information at:
http://www.cambridge.org/pt/academic/subjects/philosophy/philosophy-science/carnap-quine-and-putnam-methods-inquiry?format=HB#fPK6O2VU5qJ0ptQl.97

Elliott, Kevin C (2017). *A Tapestry of Values: An Introduction to Values in Science*. New York, NY: Oxford University Press. ISBN: 9780190260811

"The role of values in scientific research has become an important topic of discussion in both scholarly and popular debates. Pundits across the political spectrum worry that research on topics like climate change, evolutionary theory, vaccine safety, and genetically modified foods has become overly politicized. At the same time, it is clear that values play an important role in science by limiting unethical forms of research and by deciding what areas of research have the greatest relevance for society. Deciding how to distinguish legitimate and illegitimate influences of values in scientific research is a matter of vital importance.
"Recently, philosophers of science have written a great deal on this topic, but most of their work has been directed toward a scholarly audience. This book makes the contemporary philosophical literature on science and values accessible to a wide readership. It examines case studies from a variety of research areas, including climate science, anthropology, chemical risk assessment, ecology, neurobiology, biomedical research, and agriculture. These cases show that values have necessary roles to play in identifying research topics, choosing research questions, determining the aims of inquiry, responding to uncertainty, and deciding how to communicate information.
"Kevin Elliott focuses not just on describing roles for values but also on determining when their influences are actually appropriate. He emphasizes several conditions for incorporating values in a legitimate fashion, and highlights multiple strategies for fostering engagement between stakeholders so that value influences can be subjected to careful and critical scrutiny" (From the publisher)

More information at: **https://global.oup.com/academic/product/a-tapestry-of-values-9780190260811?lang=en&cc=us#**

Elliott, Kevin C., Richards, Ted (Eds.) (2017) *Exploring Inductive Risk: Case Studies of Values in Science*. New York, NY: Oxford University Press. ISBN: 9780190467722

"Science is the most reliable means available for understanding the world around us and our place in it. But, since science draws conclusions based on limited empirical evidence, there is always a chance that a scientific inference will be incorrect. That chance, known as inductive risk, is endemic to science.
"Though inductive risk has always been present in scientific practice, the role of values in responding to it has only recently gained extensive attention from philosophers, scientists, and policy-makers. Exploring Inductive Risk brings together a set of eleven concrete case studies with the goals of illustrating the pervasiveness of inductive risk, assisting scientists and policymakers in responding to it, and moving theoretical discussions of this phenomenon forward. The case studies range over a wide variety of scientific contexts, including the drug approval process, high energy particle physics, dual-use research, climate science, research on gender disparities in employment, clinical trials, and toxicology.
"The book includes an introductory chapter that provides a conceptual introduction to the topic and a historical overview of the argument that values have an important role to play in responding to inductive risk, as well as a concluding chapter that synthesizes important themes from the book and maps out issues in need of further consideration." (From the publisher)

More information at:
https://global.oup.com/academic/product/9780190467722/?cc=us&lang=en&promocode=AAFLYG6#

Fox, Robert (2016). *Science Without Frontiers: Cosmopolitanism and National Interests in*

the World of Learning, 1870–1940. Corvallis, OR: Oregon State University Press. ISBN 978-0-87071-867-0

"In his long career, Robert Fox has specialized in the history of the physical sciences, particularly in France since 1700. In Science without Frontiers, he explores the discipline of science as a model for global society.
"Fostered by international congresses and societies, scientific collaboration flourished across linguistic and national borders from the mid-nineteenth century up until, and even after, the First World War. Projects such as the universal language Esperanto and the Dewey decimal system relied on optimistic visions of the future and were fueled by dramatic improvements in communications and transportation. The Institut international de bibliographie, founded in Brussels in 1895, emerged as a center for this collaborative endeavor.
"After the First World War, scientific internationalism met with new challenges as governments increasingly sought to control the uses of science and technology. Fox details the fate of cooperative scientific internationalism in Europe and the challenges posed to it by the rise of totalitarianism and the increasingly conflicting force of nationalism. He explores public expressions of scientific nationalism in museum exhibits and, most tellingly, in rival national pavilions at the Paris International Exposition of 1937.
"World War II might have shattered internationalist ideals for good, but grounds for optimism remain in the successes of international organizations like UNESCO and in the potential of electronic media as a way to achieve a vision of universal access to knowledge. Science without Frontiers offers a new way to think about science and culture and its relationship to politics amid the crises of the twentieth century." (From the Publisher)
More information at: **http://osupress.oregonstate.edu/book/science-without-frontiers**

Huffman, Carl A. (Ed.) (2017). *A History of Pythagoreanism*. Cambridge: Cambridge University Press. ISBN: 9781316648476

"This is a comprehensive, authoritative and innovative account of Pythagoras and Pythagoreanism, one of the most enigmatic and influential philosophies in the West. In twenty-one chapters covering a timespan from the sixth century BC to the seventeenth century AD, leading scholars construct a number of different images of Pythagoras and his community, assessing current scholarship and offering new answers to central problems. Chapters are devoted to the early Pythagoreans, and the full breadth of Pythagorean thought is explored including politics, religion, music theory, science, mathematics and magic. Separate chapters consider Pythagoreanism in Plato, Aristotle, the Peripatetics and the later Academic tradition, while others describe Pythagoreanism in the historical tradition, in Rome and in the pseudo-Pythagorean writings. The three great lives of Pythagoras by Diogenes Laertius, Porphyry and Iamblichus are also discussed in detail, as is the significance of Pythagoras for the Middle Ages and Renaissance." (From the publisher)

More information at:
http://www.cambridge.org/pt/academic/subjects/philosophy/classical-philosophy/history-pythagoreanism?format=PB#opljbs70KxqExWWv.97

Ingraham, John L. (2017). *Kin: How We Came to Know Our Microbe Relatives*. Cambridge, MA: Harvard University Press. ISBN 9780674660403

> "Since Darwin, people have speculated about the evolutionary relationships among dissimilar species, including our connections to the diverse life forms known as microbes. In the 1970s biologists discovered a way to establish these kinships. This new era of exploration began with Linus Pauling's finding that every protein in every cell contains a huge reservoir of evolutionary history. His discovery opened a research path that has changed the way biologists and others think about the living world. In Kin John L. Ingraham tells the story of these remarkable breakthroughs. His original, accessible history explains how we came to understand our microbe inheritance and the relatedness of all organisms on Earth.
> "Among the most revolutionary scientific achievements was Carl Woese's discovery that a large group of organisms previously lumped together with bacteria were in fact a totally distinct form of life, now called the archaea. But the crowning accomplishment has been to construct the Tree of Life—an evolutionary project Darwin dreamed about over a century ago. Today, we know that the Tree's three main stems are dominated by microbes. The nonmicrobes—plants and animals, including humans—constitute only a small upper branch in one stem.
> "Knowing the Tree's structure has given biologists the ability to characterize the complex array of microbial populations that live in us and on us, and investigate how they contribute to health and disease. This knowledge also moves us closer to answering the tantalizing question of how the Tree of Life began, over 3.5 billion years ago.
>
> More information at: **http://www.hup.harvard.edu/catalog.php?isbn=9780674660403**

Poser, Hans (2017). *Homo Creator: Technik als philosophische Herausforderung*. Wiesbaden: Springuer. ISBN: 978-3-658-08151-5

> "Technik bestimmt auf die mannigfaltigste Weise unser Leben und Zusammenleben. Obgleich sie von Platon und Aristoteles bis in das zwanzigste Jahrhundert in Einzelaspekten betrachtet worden ist, wurde sie erst in den letzten Jahrzehnten zu einem eigenständigen Gegenstand der Philosophie. Dennoch werden ihre philosophischen Probleme immer noch eher beiläufig behandelt. So geht es um die Klärung ganz zentraler und herausfordernder Aufgaben – von der menschlichen Schöpferkraft über eine Klärung, was ein technisches Artefakt ist, zum technischen Wissen, in all diesen Elementen verknüpft mit dem Verantwortungsproblem. Das Ziel ist eine Darstellung dieser faszinierenden philosophischen Fragen vor dem Hintergrund der Tradition. (From the publisher)
>
> English note about the book: The author gives a comprehensive philosophy of technology: he analyses the history of scientific approaches to technology as well as questions concerning contemporary developments. The ontology and anthropology of technology are discussed as well as questions of technology and awareness, the role of construction and of the theory of scientific approaches to technology in technosciences. One chapter is dedicated to human values shaping technological development.
>
> More details at: **http://www.springer.com/de/book/9783658081515**

Raphael, Renée (2017) *Reading Galileo: Scribal Technologies and the Two New Sciences*. Baltimore, Maryland: Johns Hopkins University Press ISBN: 9781421421773

> "Through remarkable research in manuscript materials that have never been studied before, Renée Raphael takes us into the mental processes of early modern readers, some famous, some not, as they grappled with Galileo's Two New Sciences. In this wonderfully innovative blend of history of science and book history, we learn about Galileo's sciences of matter and

motion, but also about methods of reading, note-taking, and teaching through which contemporaries absorbed this work into their thinking, often in more traditional ways than we might expect." — Ann Blair, Harvard University

More information at: **https://jhupbooks.press.jhu.edu/content/reading-galileo**

Steinle, Friedrich, Levine, Alex (2016) *Exploratory Experiments Ampère, Faraday, and the Origins of Electrodynamics*. Pittsburhg, PA: University of Pittsburgh Press. ISBN 978-0-8229-4450-8

"In this foundational study, Friedrich Steinle compares the influential work of Ampère and Faraday to reveal the prominent role of exploratory experimentation in the development of science. Focusing on Ampère's and Faraday's research practices, reconstructed from previously unknown archival materials, this book considers both the historic and epistemological basis of exploratory experimentation—and its importance to scientific development." (From the publisher)

More information at: **https://www.upress.pitt.edu/BookDetails.aspx?bookId=36631**

Wellmann, Janina (2017) *The Form of Becoming: Embryology and the Epistemology of Rhythm, 1760–1830*. Cambridge, MA: The MIT Press. ISBN: 9781935408765

"This beautifully written book is full of movement and insight. A daring and exquisite analysis of rhythm as episteme, it opens up new historical and philosophical fronts for accounts of time and change in art and science. Refusing today's tendency to separate 'art,' 'science,' and 'literature,' as detached from one another, Wellmann convincingly puts rhythm first, and traces development and movement in science and culture without having to claim that one impacts or constructs the other, making it as pertinent to the contemporary moment as to the past it recounts." —Hannah Landecker

"In a work of striking originality, historian Janina Wellmann rethinks the meaning of development circa 1800 in terms of rhythm. Casting her net wide, she draws on the aesthetics of verse and music, the sciences of botany and embryology, and the practices of fencing and dance to show how a new kind of natural law and a new kind of visualization in series captured the patterned flow of development of life forms, morphology in motion." —Lorraine Daston

More information at: **https://mitpress.mit.edu/books/form-becoming**

Authors of HPS&ST-related papers and books are most welcome to bring them to attention of the Note's assistant editor, Paulo Maurício at **paulo.asterix@gmail.com** for inclusion in these sections.

Coming HPS&ST Related Conferences

June 8-10, 2017, XVIII UNIVERSEUM European Academic Heritage Network Meeting, University of Belgrade, Serbia
Details at**: http://universeum.it/meetings.html**

June 19-20, 2017, Fears and Angers: Historical and Contemporary Perspectives, Arts Two Building, Mile End Campus, Queen Mary University of London

Details at: **https://projects.history.qmul.ac.uk/emotions/events/fears-and-angers-historical-and-contemporary-perspectives/**

June 22-25, 2017, 49th Annual Meeting of Cheiron: The International Society for the History of Behavioral and Social Sciences
Details at: **https://www.uakron.edu/cheiron/annual-meeting/2017.dot**

June 28-30, 2017, 22nd EURAS Annual Standardisation Conference - Digitalisation: Challenge and Opportunity for Standardisation, Berlin, Germany
Contact: Kai Jakobs at **Kai.Jakobs@cs.rwth-aachen.de**

June 29-July 1, 2017, 'New Perspectives on Science and Religion in Society', Newman University, UK.
Details at: **http://sciencereligionspectrum.org/engage/events/new-perspectives-on-science-and-religion-in-society/**

July 4-7, 2017, 14th IHPST International Biennial Conference, Ankara, Turkey.
Details at: **http://ihpst2017.wixsite.com/biennial-conference**

July 5-8, 2017, 2nd International Workshop in the Framework of "Hermoupolis Seminars" "Beyond Nature in Science and Literature", Syros.
Details at: **http://coscilit.eap.gr/**

July 6-7, 2017, Historical Perspectives on Essentialisation and Biologisation of Gender Interdisciplinary Symposium of the Working Group of Women's and Gender History (AKHFG) at the Ruhr-Universität Bochum, Germany
Organizers: Dr. Muriel González Athenas, Dr. Falko Schnicke and Prof. Dr. Maren Lorenz, **muriel.gonzalez@rub.de** **schnicke@ghil.ac.uk** **maren.lorenz@rub.de**

July 6-9, 2017, British Society for the History of Science annual meeting, York, UK
Details at: **http://www.bshs.org.uk/conferences/annual-conference**

July 16-21, 2017, International Society for the History, Philosophy, and Social Studies of Biology (ISHPSSB) 2017 Meeting, São Paulo, Brazil.
Details at: **http://www.ishpssb.org/announcements/148-ishpssb-2017-meeting**

July 18-19, 2017, Aesthetics of Science, Conference, University of Leeds.
Details at: **https://philevents.org/event/show/28694Flyer**

July 23-29, 2017, 25th International Congress of History of Science, and Technology (ICHST), Rio de Janeiro, Brazil.
Details at: **http://www.ichst2017.sbhc.org.br/site/capa**

August 5-7, 2017, Quo Vadis Selective Scientific Realism?, Durham University, UK
Details at: **http://community.dur.ac.uk/evaluating.realism/events.html**

August 24-26, 2017, European Workshops on Philosophical Practice, Mazuri, Poland
Details at: **http://mazury2017.pl/**

August 29-2, 2017, 11th International Conference on the History of Chemistry (11th ICHC) Trondheim, Norway
Details at: **http://www.ntnu.edu/11ichc**

September 6-9, 2017, European Philosophy of Science Association (EPSA17), UK, University of Exeter.
Details: **http://www.philsci.eu/epsa17**

September 7-10, 2017, 8th Tensions of Europe Conference Athens, Greece.
Details at: **http://8toe2017.phs.uoa.gr/**

September 12 – 14, 2017, Thinking about Space and Time: 100 Years of Applying and Interpreting General Relativity, Bern, Switzerland.
Details at: http://www.philosophie.unibe.ch/news/spacetime2017/index_eng.html

September 13-16, 2017, British Society for the History of Medicine Congress, Surgeons' Hall, Edinburgh, UK.
Details at: **http://bshm.org.uk/**

September 14-15, 2017, Joseph Banks: Science, Culture and Exploration, London
Details at: **http://www.rmg.co.uk/work-services/what-we-do/learning-partnerships/joseph-banks-science-culture-and-remaking-indo-pacific-world**

September 18-20, 2017, Mathematics and Mechanics in the Newtonian Age: historical and philosophical questions, University of Sevilla, Institute of Mathematics
Details at: **https://gecomat1216.wordpress.com/**

September 21-23, 2017, The 20th International Conference on Conceptual History
University of Oslo, Norway.
Details at: **https://tinyurl.com/jkycxg3**

September 20-22, 2017, The Sixth Conference of the European Network for the Philosophy of the Social Sciences (ENPOSS), Kraków, Poland
Details at: **http://uekwww.uek.krakow.pl/pl/uczelnia/wydzialy/wydzial-gospodarki-i-administracji-publicznej/wydzial/katedry/katedra-filozofii/enposs-2017.html**

September 22-24, 2017, Contemplating Science, Medicine, and Technology: Past and Present Challenges, University of Münster, Germany
Inquiries to: Philipp Osten **p.osten@uke.de**

September 28-30, 2017, The Making of the Humanities VI, University of Oxford, Somerville College, UK
Details at: **http://www.historyofhumanities.org/**

October 19, 2017, International symposium: Unix in Europe: between innovation, diffusion and heritage. Conservatoire National des Arts et Métiers, Paris, France
Details: camille.paloque-berges@cnam.fr or loic.petitgirard@cnam.fr

October 13-14, 2017, On Growth and form centenary Conference, University of Dundee and University of St Andrews, UK.
Details at: **https://www.ongrowthandform.org/2017/03/07/centenary-conference-call-for-papers/**

October 13-15, 2017, Workshop for the History of Environment, Agriculture, Technology & Science (WHEATS), University at Albany, History Department
Details at: **https://wheats2017.wordpress.com/**

October 24-28, 2017, Masterclass on Galileo's Methods of Investigation and Discovery, IRH-ICUB, University of Bucharest
Details at: **humanities@icub.unibuc.ro**

October 26-27, 2017, Making sense of data in the sciences, Leibniz University, Hannover, Germany
Details at: **https://dataintensivescience.wordpress.com/**

October 30-31, 2017, The Structure of Scientific Revolutions, Durham University, UK.
Details at: **http://community.dur.ac.uk/evaluating.realism/events.html**

November 1-3, 2017, Contours of The Future: Technology and Innovation in Cultural Context, Peter the Great Saint-Petersburg Polytechnic University, Saint-Petersburg, Russia.
Deadline: short abstract up to 150 words by 1 July 2017. Contact information: Natalia Nikiforova futurecontour@gmail.com

November 2-4, 2017, Novembertagung on the History of Mathematics 2017. Theme: "Tools for research in mathematics, history and philosophy", Brussels, Belgium.
Details at: **http://css.au.dk/arrangementer/27th-novembertagung-on-the-history-of-mathematics/**

November 9-12, 2017, Annual Meeting of The History of Science Society (HSS), Toronto, Ontario.

Details at**: https://hssonline.org/meetings/2017-hss-annual-meeting/2017-annual-meeting-call-for-papers/**

November, 17-18, 2017, 40th History of Technology Conference: Colors in Technology – Technology of Colors, Klostergut Paradies, Schlatt, Switzerland
Contact: Franziska Eggimann at: **franziska.eggimann@georgfischer.com**

November 23-24, 2017, Workshop Vaccines: Values, Present and Past, Uppsala University.
Details at: **http://medicalborders.se/**
Contact: Morag Ramsey, **morag.ramsey@idehist.uu.se**

November 30-1, 2017, Funding bodies and late modern science. Utrecht University, Cultural History Research Group and Descartes Centre.
Abstracts of 300 words should be submitted by 15 June 2017 and can be send to Pieter Huistra at **p.a.huistra@uu.nl** or Noortje Jacobs at **Noortje.jacobs@maastrichtuniversity.nl.**

December 7–9, 2017, Genealogies of Knowledge I: Translating Political and Scientific Thought across Time and Space, Manchester, UK
Details at: **http://genealogiesofknowledge.net/2016/11/23/genealogies-knowledge-i-translating-political-scientific-thought-across-time-space/**

January 5-8, 2018, Episteme 7, biennial conference, Homi Bhabha Centre for Science Education, Mumbai, India,
Details at: **http://www.hbcse.tifr.res.in/episteme**

March 10-13, 2018, NARST annual conference, Atlanta, USA
Details at: **http://www.narst.org/**

March 30-April 1, 2018, 13th Maghrebrian Colloquium on the History of Arabic Mathematics, Tunis City
Information from Mahdi Abdeljaouad **mahdi.abdeljaouad@gmail.com**

April 18-22, 2018, A Matter of Life and Death: Spaces for Healing in the Premodern Era Society of Architectural Historians Annual Meeting, St. Paul, MN.
Contact: Mohammad Gharipour (mohammad@gatech.edu) or Stuart W. Leslie (swleslie@jhu.edu)

June 7-10, 2018, Learning by the Book: Manuals and Handbooks in the History of Knowledge, Princeton University
Contact**: creager@princeton.edu** or mathias.grote@hu-berlin.de
deadline for abstracts: July 15th, 2017

June 16-26, 2018, The 6th UNILOG - World Congress and School on Universal Logic
Details at: **http://www.uni-log.org**

June 30 – July 2, 2018, 7th SPSP Congress, Ghent University, Belgium
Details, Erik Weber**, Erik.Weber@UGent.be**

November 21-23, 2018, Fourth Asian HPS&ST Conference, National Dong Hwa University, Hualien, Taiwan.
Details from: Dr Chia-Ling Chiang**, clchiang@mail.ndhu.edu.tw**