HPS&ST NEWSLETTER

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JUNE 2020

The HPS&ST NEWSLETTER is emailed monthly to about 8,400 individuals who directly or indirectly have 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, engaging and effective teaching of the history and philosophy of science. The NEWSLETTER is sent on to different international and national HPS lists and international and national science teaching lists. In print or electronic form, it has been published for 25+ years.

The NEWSLETTER 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 NEWSLETTER (publications, conferences, opinion pieces, &.) are welcome and should be sent direct to the editor: Michael R. Matthews, UNSW (m.matthews@unsw.edu.au).

The NEWSLETTER, along with RESOURCES, OBITUARIES, OPINION PIECES and more, are available at the website: http://www.hpsst.com/

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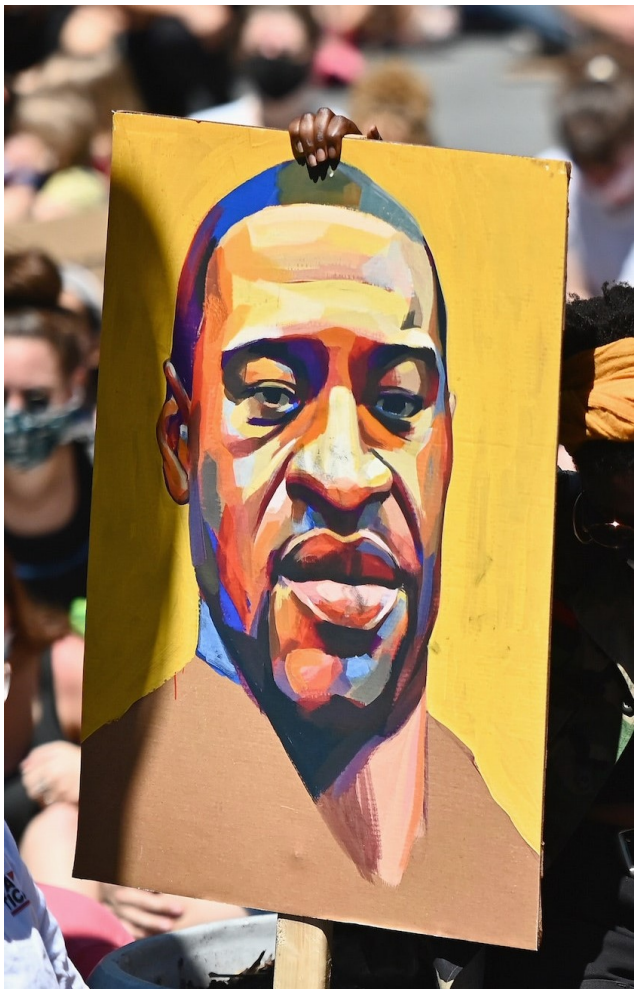


Many professional HPS and Science Education organisations, societies and editorial boards have voiced their support for the Black Lives Matter campaign. The editor and assistant editors of this newsletter, and undoubtedly a good many readers, likewise express their dismay at the tragic killings of Black people in the US, Canada, France, and Australia that have been the immediate cause for the campaign. The international campaign is united in its quest for justice for the murdered George Floyd, Sandra Bland, Breonna Taylor, Freddie Gray, Eric Garder, Trayvon Martin, Tamir Rice, and countless other Black people. While it is clear there must be immediate police reform, such reform is not enough, since racism is both deep and broad in scope. Other far-reaching changes to our social and legal institutions are necessary.

Additionally, racism is not just a Western problem: West-Bank Arabs, Uyghurs, the Rohingya people, Amazonian Indians, West Papuans, and countless other minorities suffer from systemic and systematic racist economic, educational, housing, policing, health and social policies imposed by majorities in their own countries.

Please support Black Lives Matter here.

Isis Provides Access to Online Work on Systemic Racism

In an effort to contribute to the ongoing discussion about systemic racism and racist violence in the United States and around the world, powerfully voiced in the BLM campaign, the co-editors of the US History of Science Association publication *Isis* have compiled a selection of articles from recent years that examine the role of science in constructing and perpetuating assumptions about race, and the consequences of these practices for society.

The works listed are critical examinations of Western science, and of the discipline of history of science. The co-editors especially encourage readers to look at the newest Isis feature, an "Open Conversation" from the June 2020 issue between nine scholars on the topic of the field's diversity and how we measure it. This and several other articles listed here are free to read without a subscription for a limited time.

- Open Conversation: Diversifying the Discipline or Disciplining Diversity? (Special section, June 2020) FREE TO READ
  - Projit Bihari Mukharji, Myrna Perez Sheldon, Elise K. Burton, Sebastián Gil-Riaño, Terence Keel, Emily Merchant, Wangui Muigai, Ahmed Ragab, and Suman Seth, "A Roundtable Discussion on Collecting Demographics Data"
- Andrew D. Evans, "'Most Unusual' Beauty Contests: Nordic Photographic Competitions and the Construction of a Public for German Race Science, 1926–1935," (June 2020)
- Elise K. Burton, "Red Crescents: Race, Genetics, and Sickle Cell Disease in the Middle East," (June 2019)
- Ryan Dahn, "Big Science, Nazified? Pascual Jordan, Adolf Meyer-Abich, and the Abortive Scientific Journal Physis," (March 2019)
- Christopher Heaney, "How to Make an Inca Mummy: Andean Embalming, Peruvian Science, and the Collection of Empire," (March 2018)
- Jim Wynter Porter, "A 'Precious Minority': Constructing the 'Gifted' and 'Academically Talented' Student in the Era of Brown v. Board of Education and the National Defense Education Act," (September 2017) FREE TO READ
- Ashley Kerr, "From Savagery to Sovereignty: Identity, Politics, and International Expositions of Argentine Anthropology (1878-1892)," (March 2017) FREE TO READ
- Alexander Statman, "Fusang: The Enlightenment Story of the Chinese Discovery of America," (March 2016)
- Focus: Relocating Race (Special section, December 2014) FREE TO READ
  - Suman Seth, "Introduction"
  - Suman Seth, "Materialism, Slavery, and The History of Jamaica"
  - Helen Tilley, "Racial Science, Geopolitics, and Empires: Paradoxes of Power" Warwick Anderson, "Racial Conceptions in the Global South"
  - Yuehtsen Juliette Chung, "Better Science and Better Race?: Social Darwinism and Chinese Eugenics"
  - Duana Fullwiley, "The 'Contemporary Synthesis': When Politically Inclusive Genomic Science Relies on Biological Notions of Race"
- Christopher Crenner, "Race and Laboratory Norms: The Critical Insights of Julian Herman Lewis (1891–1989)," (September 2014)
- Leila Zenderland, "Social Science as a "Weapon of the Weak": Max Weinreich, the Yiddish Scientific Institute, and the Study of Culture, Personality, and Prejudice," (December 2013)
- Matthew Farish "The Lab and the Land: Overcoming the Arctic in Cold War Alaska," (March 2013)
- Warwick Anderson, "Hybridity, Race, and Science: The Voyage of the Zaca, 1934–1935," (June 2012)
- Chris Manias, "The Race prussienne Controversy: Scientific Internationalism and the Nation," (December 2009)
- Constance Areson Clark, "'You Are Here': Missing Links, Chains of Being, and the Language of Cartoons," (September 2009) FREE TO READ

- Fred Jerome, "Einstein, Race, and the Myth of the Cultural Icon," (December 2004)
- Michael G. Kenny, "Racial Science in Social Context: John R. Baker on Eugenics, Race, and the Public Role of the Scientist," (September 2004)

International History, Philosophy, and Science Teaching (IHPST) Group Statement in Support of the Black Livies Matter Movement

In the US and Brazil, people are experiencing events of racism. Such events belong to a long history of systematic racism, violence, discrimination, and oppression. People are in the street asking for changes. According to the International History, PHilosophy, and Science Teaching (IHPST) Group's Bylaws (article XI), the group is against racism, sexism, and other forms of discrimination. The IHPST Group stands in solidarity with the protestors marching for the Black Lives Matter movement and supports all worldwide non-violent effors to promote equity and justice The IHPST Group works to improve science teaching as a way of promoting equity and social justice in the world.

Other Professional Statements on the Black Lives Matter Campaign

We highly recommend reading the following professional statements in support of the Black Lives Matter campaign.

We all must fight against structural and institutional racism, both in academia and in wider society.

American History Association (AHA)

American Physics Society (APS)

American Chemical Society (ACS)

American Institute of Biological Sciences (AIBS)

American Philosophical Association (APA)

American Educational Research Association (AERA)

Canadian Society for the History and Philosophy of Science, Editors' Letter Comuniqué (N.101, Summer 2020)

European Society for Evolutionary Biology (ISEB)

The Geological Society of America (GSA)

International Astronomical Union (IAU)

International Council of Museums (ICOM)

National Association for Research in Science Teaching (NARST)

Philosophy of Science Association (PSA)

The International Network for the Study of Science and Belief in Society: 'Seed Funding and Small Research Grants'

INSBS supports the growth of high-quality international research examining the relationship between science and religion, in relation to cutting-edge social issues and individuals' lived

experiences.

We aim to foster and support research that examines any social or cultural aspect of science, technology, engineering, mathematics or medicine (STEMM) in relation to any religious, spiritual or non-religious tradition, position or worldview, including unbelief.

Aims

This scheme seeks to promote the growth of the social study of science and religion globally, by supporting the ongoing development of an international network of active academic researchers in order to stimulate new avenues of individual or collaborative research.

Eligibility Requirements

Researchers at any career stage who work on the social study of science and religion in society may apply. The scheme has been designed to support academics just starting out in their careers in the field or seeking to establish themselves further by conducting socially relevant research in this field.

If you are not currently affiliated to a university, or other institution set-up to receive research grants, please contact our Grants Officer, Paula Brikci, at p.e.brikci@bham.ac.uk before applying.

Value and Duration

Two levels of grant funding are available:

1. Seed Funding: No less than £1,000 and no more than £5,000
2. Small Research Grants: No less than £5,000 and no more than £20,000

All projects must complete within ten months of the start date and are expected to complete no later than 31 July 2021.

Application Process

The scheme will operate on a rolling basis until at least 1 October 2020 when it will be reviewed. Applicants can apply anytime up until 1 October 2020.

Full details can be found in the Grants section of our website (www.scienceandbeliefinsociety.org), including Guidance for Applicants, Application Form and supporting document templates. If you are not already a subscriber to our website, you may wish to join our mailing list at to stay up to date with announcements and news.

University of Leeds, HPS Group Online Course

The History and Philosophy of Science group at University of Leeds has turned the videos of a public lecture series conducted in 2016-7 into a free, informal, online intro-to-HPS course, called "History and Philosophy of Science in 20 Objects."

A description of the course and how to join can be found here.

COVID-19: An Integrated Response

Brazilian scholars Charbel El-Hani and Virgilio Machado have published in *Ethnobiology and Conservation* an Opinion Piece on the need of an integrated and critical view on COVID-19. They discuss contributions from different academic sciences and beyond the academic sciences on COVID-19, counterposing them with a focus strictly on the health sciences or in academic sciences only; they consider how COVID-19 became a wicked problem and how this hampers an integrated approach to the pandemic, with serious consequences to public health; they briefly discuss the integration between traditional Chinese medicine (TCM) and Western medicine for treating COVID in China; and finally they discuss relationships between scientific work and values in COVID-19.

They maintain that to build an integrated view, different scientists and social actors should engage in trust relationships and accept mutual epistemic dependencies, as requisites for a concerted way of understanding and acting on the problem. Finally, an integrated and critical view of COVID-19 demands that we cast aside the myth of value-free science, consider the relationships between values and scientific work, and conceive how knowledge can be objective without being neutral. The paper is freely available here.

History and Philosophy of the Life Sciences Topical Collection 1

Seeing Clearly Through COVID-19: Current and future questions for the history and philosophy of the life sciences.

Editors: G. Boniolo – L. Onaga

Rationale: This epidemic of global proportions has seemingly surprised everyone, from laymen, laywomen and children, to politicians, economists, clinicians and biomedical researchers. The worldwide pandemic has drastically changed our ways of living and will likely continue to change our ways of living in the future. At the same time, historical reflections have indicated that there have been precedents for the conditions leading up to and representing the disastrous effects taking place. It is the right moment to humanistically reflect simultaneously upon what has been happening and what is going to happen to our lives, planet, socio-economical relationships, and interpretations of our own meanings of life. The time is critical to think seriously through these historical and philosophical issues in terms of global health and global justice.

HPLS wishes to invite a diverse group of scholars representing different regions of the world, disciplines, and intersectional concerns to produce short papers that each grapple with a historical-sociological-political-epistemological-ethical question. These papers would not only en-

gage with current aspects raised or stimulated by the COVID-19 pandemic but also with views concerning questions about our future. Together, we hope these collected papers could design a foundation for ongoing conversations that highlight the expertise and contributions of scholars in the history and philosophy of the life sciences.

In particular, we appreciate that the following themes could be tackled: scientific experts and laypeople; national science policies and international scientific organisations; governance and governmentality; uncertainty; policy requirements and political interference; big data; privacy and social control; herd immunity; eugenics; assessment of epidemiological positions; clinical and biomedical research; vulnerable and fragile groups; death and suffering; legal and illegal businesses; zoonotic diseases; environmental links; scientific globalisation; re-globalisation; vaccine research, animal models and experimentation on humans; structural and latent racism; agriculture; food security; etc.

Format: Short pieces of about 1000 words, excluding references (max 10), abstract consisting of no more than two or three sentences, and a maximum of three keywords. Each question has to be well-posed and effectively contextualised both in the literature and in real health and field frameworks.

Note: Titles, abstracts, and keywords, must include searchable terms like virus, SARS, coronavirus, COVID-19, SARS-COV-2, etc.

Publishing process: Authors have to send their pieces to HPLS through the Editorial Manager, choosing Notes & Comments and, then, our Topical Collection 'Seeing Clearly Through COVID-19.' Manuscripts will be handled by Boniolo and Onaga, and they will undergo a light reviewing process involving at least one external reviewer. Manuscripts will be sent to production and published online immediately following acceptance, so as to facilitate the swift publication of research pieces of high societal and scholarly relevance.

Time window: Beginning of papers acceptance: August 15, 2020; Closure of papers acceptance: December 31, 2020.

History and Philosophy of the Life Sciences Topical Collection 2

Biomedical Knowledge in a Time of Crisis: Historical and Philosophical Perspectives on COVID-19

Editors: D. Teira – S. Leonelli

Rationale: This Topical Collection brings together scholarly reflections on the COVID-19 pandemic from scholars in the history, philosophy and social studies of biology and biomedicine. Themes may include, but are not limited to, the role of modelling, data practices and uncertainty in pandemic science and policy responses; the genealogies and reconfigurations of life science expertise in the face of the pandemic; the biopolitics and governance of biological knowledge, particularly in related fields such as epidemiology and immunology; the implications for research organisations and management worldwide, including experimental practices and work with non-human organisms; the intersection between private and public research activities and services, including with regard to population monitoring and public health services, across countries; the history and implications of the specific discourse and metaphors (e.g. military) used to depict human relationships with disease; relevant conceptual un-

derpinnings and methodological questions in epidemiology, such as how to compare different populations; historical links to eugenics and racism, particularly in relation to the focus (or lack thereof) on vulnerable populations; and methodological reflections on how the pandemic may affect scholarly work in the history, philosophy and social studies of biology.

HPLS invites a diverse group of contributors representing different regions of the world, disciplines, and intersectional concerns. We hope that this collection will highlight the relevance and significance of contributions from the history and philosophy of the life sciences towards understanding the roots, unfolding and implications and of the pandemic.

Note: Titles, abstracts, and keywords, must include searchable terms like virus, SARS, coronavirus, COVID-19, SARS-COV-2, etc.

Publishing process: All papers will be peer-reviewed as soon as possible and will be published online immediately following acceptance, so as to facilitate the swift publication of research pieces of high societal and scholarly relevance.

Time window: Submissions are welcome from August 15, 2020 until May 31, 2021. This long window for submission constitutes an exception to normal HPLS practice: it is meant to account for the widely diverging effects of the pandemic on prospective authors around the world (some of whom may have had ample time to research and write due to lock-downs, while others have had to take a break from work due to illness, caring duties or abrupt shifts in their working patterns and focus).

History and Philosophy of the Life Sciences is an interdisciplinary journal committed to providing an integrative approach to understanding the life sciences. It welcomes submissions from historians, philosophers, biologists, physicians, ethicists and scholars in the social studies of science.

6th European Advanced Seminar in the Philosophy of the Life Sciences, September 7-11 2020, KLI, Klosterneuburg, Austria

Because of the COVID-19 pandemic, we decided to cancel this year's European Advanced Seminar in the Philosophy of Life Sciences with the title "Dealing with Complexity in the Life Sciences".

However, the EASPLS Consortium is committed to support early career researchers working in the philosophy of the life sciences in a different way. Between September 7 and September 11, each of the instructors will offer a mentoring session of two hours each. Priority will be given to those who have applied for EASPLS 2020. If seats are still available, it will be possible for other early career scholars to sign in. We will circulate information about the details of the mentoring sessions (exact times, topics, how to register, specific topics etc.) before June 30.

The instructors who will be offering mentoring sessions are:

- Giovanni Boniolo (University of Ferrara)
- Guido Caniglia (KLI Klosterneuburg)
- John Dupré (University of Exeter)
- Sara Green (University of Copenhagen)

- Philippe Huneman (CNRS/Paris-Sorbonne University)
- Maël Lemoine (University of Bordeaux)
- Sabina Leonelli (University of Exeter)
- Thomas Reydon (Leibniz University Hannover)
- Federica Russo (University of Amsterdam)
- Isabella Sarto-Jackson (KLI Klosterneuburg)
- Jon Umerez (University of the Basque Country)
- Marcel Weber (University of Geneva)

Ronald Giere (1938-2020)

Ron Giere died in late May at age 82. One obituary, along with comments on his life, work and influence, can be read here.

A leading contributor to the philosophy of science, Giere taught for roughly twenty years at Indiana University, Bloomington, before moving to the University of Minnesota in 1987, where he spend the remainder of his teaching career.

He was known for his work in philosophy of science, authoring many articles and books, including *Explaining Science: A Cognitive Approach* (1988), *Science Without Laws*, (1999), *Cognitive Models of Science* (1992), *Scientific Perspectivism* (2010), and *Understanding Scientific Reasoning* (1984).

Much of his work is listed here.

He contributed to the Third IHPST conference held in Minneapolis in 1995.

His work had considerable influence in science education especially his foundational work on modelling in science. He co-authored the chapter on Models in Science and in Learning Science in the International Handbook of Research in HPS and Science Teaching:

Passmore, C., Svoboda-Gouvea, J. & Giere, R.: 2014, 'Models in Science and in Learning Science: Focusing Scientific Practice on Sense-making'. In M.R. Matthews (ed.) *International*

Handbook of Research in History, Philosophy and Science Teaching, Springer, Dordrecht, pp. 1171-1202.

The subject was elaborated in nine papers in a thematic double issue of the journal *Science & Education*, 2007, 16(7-8). A five-page Introduction outlined some of the issues debated in HPS and elaborated in education.

By sad coincidence, in February this year, John Gilbert of Reading University passed away. John made substantial contributions to the better understanding and utilisation of modelling in science pedagogy and in student thinking. See for instance:

Gilbert, J.K. & Boulter, C. (eds.): 2001, Developing Models in Science Education, Kluwer Academic Publishers, Dordrecht.

An obituary for John can be read here.

Colin Howson (1945-2020)

Colin Howson died on 20 January 2020. He was a stalwart of the British Society for the Philosophy of Science who published extensively in the fields of probability, logic, and scientific reasoning.

Aside from his logic textbook, *Logic with Trees* (1997), he authored three influential books: *Scientific Reasoning: The Bayesian Approach* (with Peter Urbach), *Hume's Problem: Induction and the Justification of Belief* (2000), and *Objecting to God* (2011).

He also published more than ninety articles in leading journals, almost all of them concerned with clarifying the foundations and applications of probability theory. He continued to work on these issues until the end of his life.

An obituary and list of publications can be read here.

As well as serving as its President from 2003 to 2005, he also acted as Assistant Editor for the *BJPS*, first under Imre Lakatos and then under the co-editorship of John Watkins and John Worrall. He also published extensively within the pages of the journal, and so it is fitting that a new virtual issue containing his many *BJPS* papers, and that are freely downloadable, is devoted to this work. It can be accessed here.

Peter Urbach and John Worrall provide an Introduction to Colin's collected *BJPS* papers here.

The 16th Biennial International History and Philosophy of Science and Science Teaching Group (IHPST) Conference, Calgary, Canada, July 4-8, 2021

Conference Theme: *Energising Education with the History, Philosophy, and Sociology of Science*

The province of Alberta is the oil-sands energy centre of Canada. It has been the locale for debate about fossil fuel usage, environmental impacts, renewal energy production, First Nations relations and much else.

The concept of Energy has a long history in philosophy and science. It is a foundational understanding in all disciplines of science and technology. The conference is an occasion to develop the variety of historical, philosophical, and sociological dimensions of energy that can be brought to bear on its better and richer teaching.

Plenary Speaker: Carol Cleland

Carol Cleland is Professor of Philosophy at the University of Colorado Boulder. She arrived at CU Boulder in 1986, after having spent a year on a postdoctoral fellowship at Stanford University's Center for the Study of Language and Information (CSLI). She received a Ph.D. in philosophy from Brown University and a B.A. in mathematics from the University of California (Santa Barbara). From 1998-2008 she was a member of the NASA Institute of Astrobiology (NAI). She is currently Director of CU Boulder's Center for the Study of Origins.

Cleland specialises in philosophy of science and logic. Her research focuses on issues about scientific methodology (historical science vs. experimental science, the role of anomalies in scientific discovery), biology (microbiology, origins of life, the nature of life, and astrobiology), and the theory of computation.

She has published articles in leading philosophy and science journals. She is the inventor of the term 'shadow biosphere,' a subject on which she has written and lectured extensively. Cleland is the author of *The Quest for a Universal Theory of Life: Searching for Life as We Don't Know It* (Cambridge University Press, 2019).

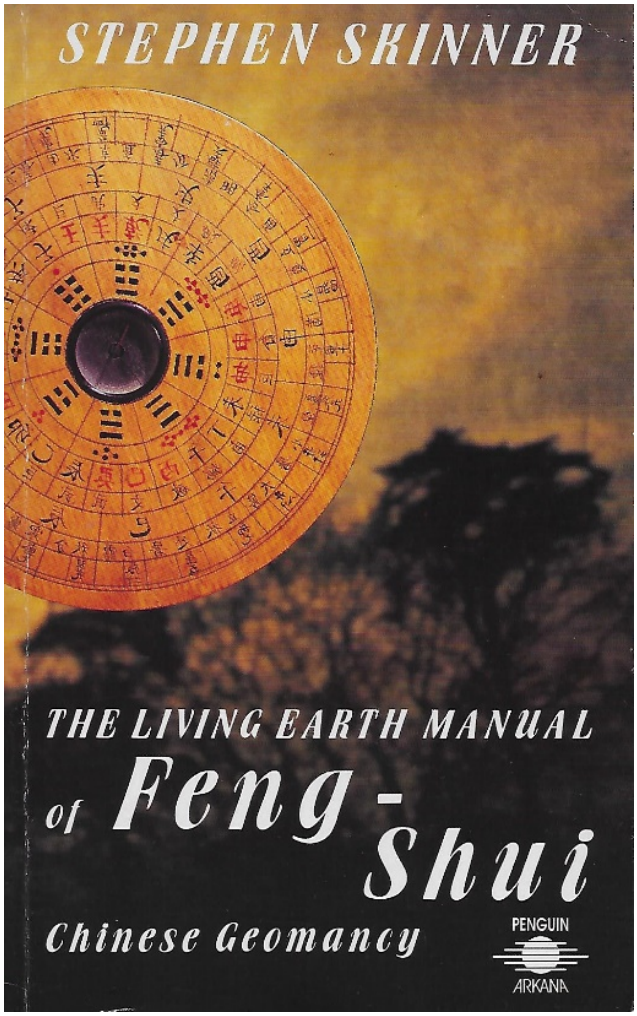
Submission, registration, accommodation details coming here.

Conference chair: Dr. Glenn Dolphin, Department of Geosciences (glenn.dolphin@ucalgary.ca).

Feng Shui Project: Historical, Philosophical, Scientific, Medical, Cultural and Educational Considerations

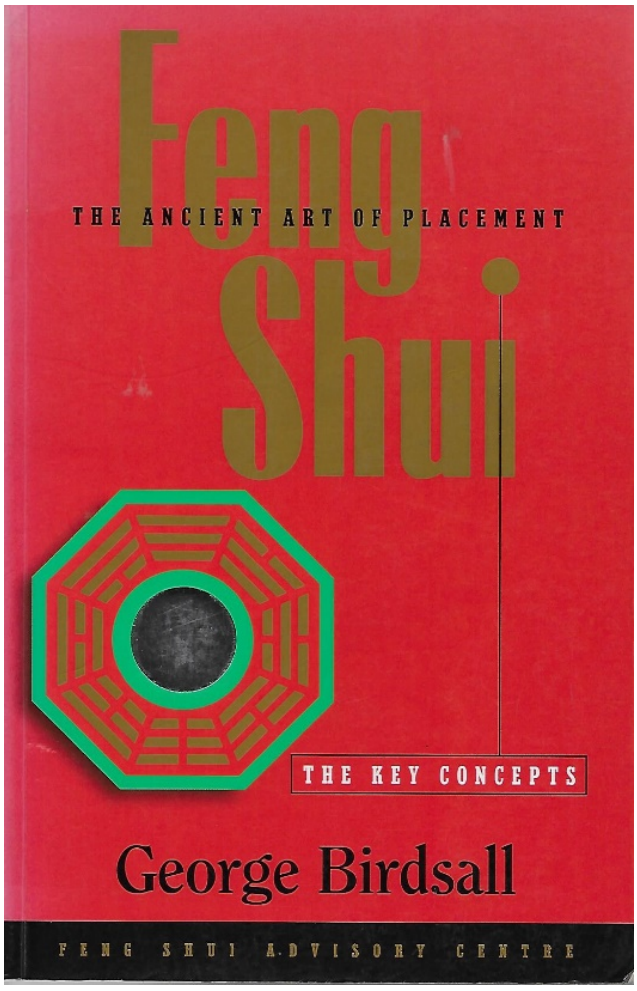
Feng shui is an internationally significant and growing body of theoretical beliefs and associated architectural, health, medicinal, astrological, divination and geomantic practices. Its origins are in ancient China, but it now has a worldwide pres-

ence. Feng shui constitutes a thoroughly naturalistic worldview in which humans, nature, our planet, and the cosmos are unified. They each share a purported 'vital energy' or 'life force' *chi* or *qi* – and the well-being of each depends upon appropriate distribution of this energy or entity. Acupuncture releases blockages in bodily *chi* flow that causes illness and pains; tai chi exercise stimulates beneficial *chi* flow through the body, it is acupuncture without the needles; *chi* is the ontological foundation of all Traditional Chinese Medicine (TCM) including herbal and animal-part remedies.



Feng shui has obvious cultural and educational ramifications, yet very little systematic attention has been paid to the educational responsibilities and opportunities feng shui provides for classroom examination by science teachers, or as a case study for historians and philosophers of science.

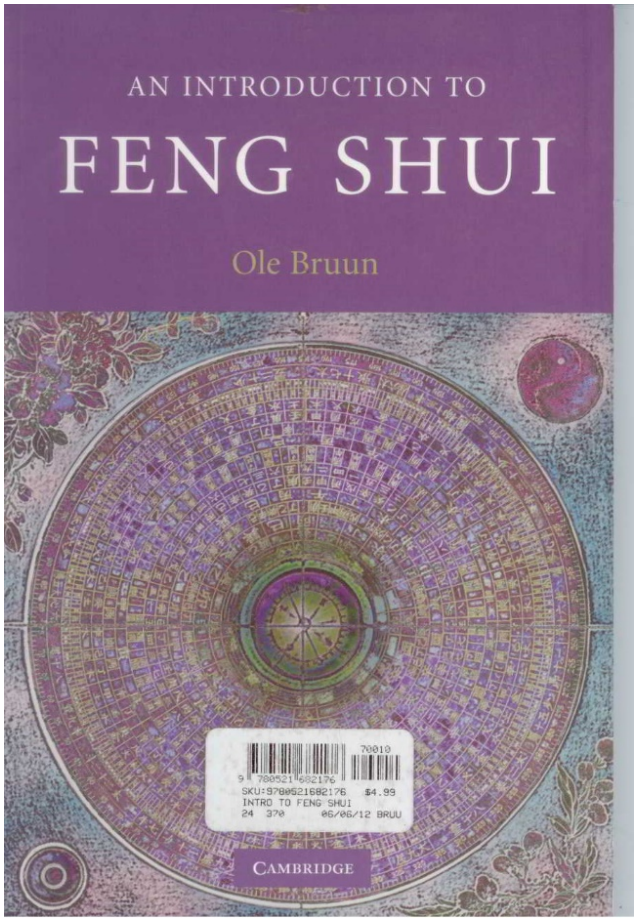
Philosophical and educational discussion of feng shui has some features in common with more common debate about astrology, about complementary or holistic medicine, arguments about treatment of special creation and evolution, and about social-psychological research on why people believe 'unusual', 'minimally-evidenced', or 'science-rejected' contentions.



More generally in feng shui discussion there is overlap with arguments about teaching the Nature of Science (NOS), the place of multi-cultural and indigenous science in school programmes, and with proposals for international STEM education. Is feng shui theory scientific? If feng shui is embedded in a culture should it be taught or at least not criticised? Does STEM education have any re-

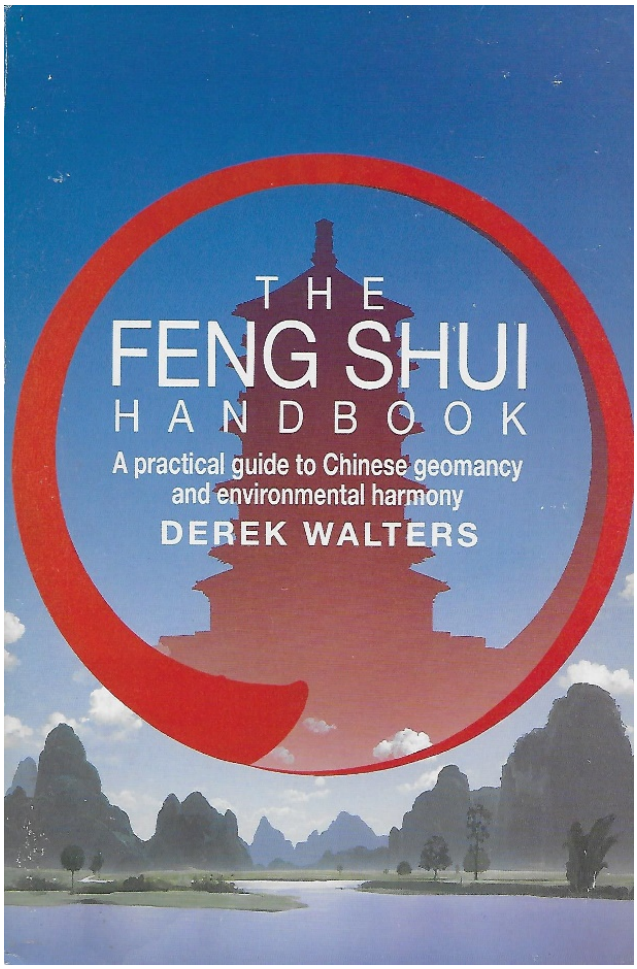
sponsibility for addressing pseudoscientific belief and is feng shui in the latter category? Ideally, the general philosophical arguments and the localised ones concerning feng shui should inform each other. But this is not much done.

This feng shui project is a contribution to the larger endeavour of demonstrating how the history and philosophy of science can illuminate theoretical, curricular and pedagogical issues in science teaching. The beginning of this HPS&ST endeavour is associated with Ernst Mach in the late 19th century, it was furthered by John Dewey in the early 20th century, and subsequently advanced by countless others including Frederick Westaway, Joseph Schwab, and Gerald Holton.



To address the shortfalls in educational discussion of feng shui a collection of research papers is being overseen and edited. Currently 15 authors from China, Hong Kong, USA, Korea, UK and Australia are contributing. Their backgrounds are education, philosophy, economics, anthropology, geology, physics, psychology and Chinese studies. The participation of other scholars is most welcome. The project has a web folder containing information and files here.

A brochure for the editor's recent book on the subject, giving its 14-chapter contents and some appraisals, can be read here. An overview of the book's argument can be read here. A 110-item select bibliography of writings on the subject is available here. A more comprehensive 840-item bibliography is available here.



A general invitation for educators, philosophers, anthropologists and historians to contribute to the project can be read here.

Project papers of 5-10,000 words need to be completed by the end of 2020, with reviews and revi-

sions completed by mid-2011.

Indication of interest and a 500-word Abstract should be conveyed to the editor (m.matthews@unsw.edu.au) by the end of June.

Opinion Page: *Science and the Desire to Understand*

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This text is based on Chapter 1 from the author's book *Understanding Scientific Understanding*, published with Oxford University Press. The material is under copyright with OUP.

Introduction

It might seem a commonplace to say that the aim of science is to provide understanding of the world around us. Scientists and laypeople alike will typically regard understanding as one of the most important and highly-valued products of scientific research and teaching. Indeed, science appears to be quite successful in achieving this aim: Who would doubt that science has given us understanding of such diverse phenomena as the motions of the heavenly bodies, the tides, the weather, earthquakes, the formation of rocks and fossils, electricity and magnetism, and the evolution of species? Climate scientists, who strive to understand the process of global warming and other climate changes, provide a contemporary example of the centrality of understanding as an aim of science. The main task of the Intergovernmental Panel on Climate Change (IPCC) is to assess progress in scientific understanding of the climate system and climate change, as can be gleaned from its 2007 report. In the one-page introduction of the technical summary of *Climate Change 2007: The Physical Science Basis* (IPCC, 2012), the terms 'understand' or 'understanding' are used nine times. Here is a typical passage:

> While this report provides new and important policy-relevant information on the *scientific understanding* of climate change, the complexity of the climate system and the multiple interactions that determine its behaviour impose limitations on our ability to *understand* fully the future course of Earth's global climate. There is still an incomplete *physical understanding* of many components of the

> climate system and their role in climate change. (IPCC, 2012; my italics).

But what does it mean to seek or to achieve such understanding? What exactly *is* scientific understanding? This is first and foremost a philosophical question, and one that has been addressed by philosophers of science in the context of the long-standing debate about scientific explanation. Wesley Salmon, one of the key figures in this debate, spent the greater part of his career developing a philosophical account of scientific explanation. As he emphasised in his essay 'The importance of scientific understanding' (Salmon 1998, pp. 79-91), the principal goal of scientific explanation is the production of *understanding* of events and phenomena. Salmon's own theory, focuses on causal explanations, highlighting the fact that understanding is often achieved by uncovering the causes of phenomena. While there are alternative philosophical views of how scientific understanding is attained through scientific explanations, most philosophers agree on the idea that understanding – whatever its precise nature – is a central aim of science.

The question of the nature of scientific understanding is also a historical question: to answer it we can do no better than look at how scientific research has actually produced understanding in the course of its historical development. Indeed, science as a historical phenomenon may be defined with reference to the notion of understanding: it is traditionally presumed that science was born in ancient Greece, when Ionian philosophers of nature – in particular Thales of Miletus and his school – first adopted what may be called a naturalistic approach to explaining natural phenomena: they abandoned the idea that nature is subject to the capricious will of supernatural gods and thereby beyond human comprehension, and instead assumed that observed phenomena can be understood in terms of natural causes and laws. This important change in the attitude towards nature has been emphasised, for instance, by the physicist Erwin Schrödinger. In his 1948 Shearman Lectures, delivered at University College, London, which were later published under the title *Nature and the Greeks*, he stated:

> The grand idea that informed these men was that the world around them was something that could be understood, if one only took the trouble to observe it properly; […]. They saw the world as a rather complicated mechanism, acting according to eternal innate laws, which they were curious to find out. This is, of course, the fundamental attitude of science up to this day" (Schrödinger, 1996, p. 57)

The prospect of understanding forms the basis of most – if not all – Greek natural philosophy since Thales. It is, for example, fundamental to Aristotle's philosophical work. "All men by nature desire to know", reads the famous opening sentence of his *Metaphysics* in the well-known translation by W.D. Ross. In his introduction to Aristotle's philosophy, however, Jonathan Lear argues that Aristotle's words are better interpreted as referring to a desire to *understand*: "To have *epistèmè* one must not only know a thing, one must also grasp its cause or explanation. This is to understand it: to know in a deep sense what it is and how it has come to be" (Lear, 1988, p. 6). It was therefore the idea that humans can understand nature that sparked the development of science.

Scientific understanding: diversity and disagreement

In a word, science is the fruit of our desire to understand. But we need to investigate and explicate

the nature of the understanding that science can provide. A first question that may be asked in this context is: Are there universal, timeless criteria for scientific understanding? Even a cursory look at the history of science suggests that the answer is: no. As an illustration, I will sketch an episode from the history of physics in which discussions about understanding played a crucial role: the genesis of quantum mechanics in the 1920s, which involved heated debates about the intelligibility of this theory and the related question of whether it can provide understanding of the phenomena in the domain of atomic physics. This case shows that scientists' standards of intelligibility and understanding vary strongly – not only diachronically but also synchronically.

The first quantum theory of atomic structure was developed by Niels Bohr, who presented it in his famous papers of 1913 and 1918. It included an atomic model that was problematic in various respects – both empirically and conceptually – and in the early 1920s many physicists attempted to improve Bohr's theory. After a number of years when not much progress was made, two new, rival quantum theories of the atom appeared on the scene: in July 1925 Werner Heisenberg submitted a paper which contained the foundations of 'matrix mechanics', and in early 1926 Erwin Schrödinger published a series of papers in which he presented 'wave mechanics' as an alternative to matrix mechanics.

Heisenberg's theory was intended to describe only relations between observable quantities, such as the frequencies and intensities of spectral lines emitted by atoms; it did not provide a concrete picture or model of the internal structure of atoms. Thus, it was a highly abstract theory which, moreover, was based on a type of mathematics – matrix theory – that most physicists were unfamiliar with at the time. Schrödinger's wave mechanics, by contrast, suggested the possibility of a visualising atomic structure: his theory described the atom in terms of wave phenomena. Also, the mathematics of his theory was simpler and more familiar to physicists than that of matrix mechanics: it was based on wave equations, which were part and parcel of university physics teaching.

Immediately, proponents of the two theories engaged in intense, sometimes even emotional discussions on the question of which theory was superior. It was Schrödinger who brought the notions of understanding and intelligibility to the centre of the debate, claiming that his wave mechanics was much better in providing true understanding of the phenomena, over and above mere description and prediction. Schrödinger expressed a strong commitment to the view that visualisation is a necessary condition for scientific understanding: "We cannot really alter our manner of thinking in space and time, and what we cannot comprehend within it we cannot understand at all" (Schrödinger, 1928, p. 27). Accordingly, he argued, only theories that are visualisable in space and time are intelligible and can give us understanding of phenomena.

Schrödinger was not alone in this respect: many physicists supported the idea that understanding requires visualisation and space-time description. Therefore, according to Schrödinger, visualisability is a necessary condition for the intelligibility of a scientific theory. Wave mechanics is visualisable (or so Schrödinger suggested) and thereby intelligible. Matrix mechanics, by contrast, is not visualisable, and accordingly unintelligible. This was not merely a philosophical point: Schrödinger also argued that visualisable theories are more fruitful. Because of its visualisability and its mathematical structure, wave mechanics was more eas-

ily applicable to a great variety of physical problem situations. It was therefore more favourably received and – at least initially – empirically more successful than matrix mechanics.

The advocates of matrix mechanics maintained, however, that their theory could yield understanding as well, and they tried to refute Schrödinger's line of reasoning by arguing that intelligibility is not necessarily associated with visualisability. Wolfgang Pauli, who like Heisenberg was a member of Bohr's group, admitted that matrix mechanics was an unusual theory that might indeed appear less intelligible than wave mechanics. However, he claimed that understanding it was merely a question of becoming familiar with the new conceptual system of the theory. Pauli admitted that the demand for intelligibility is legitimate, but he stated: "it should never count in physics as an argument for the retention of fixed conceptual systems. Once the new conceptual systems are settled, they will also be intelligible" (Pauli, 1979, p. 188). In other words, when future generations of physicists are used to quantum mechanics, they will find it intelligible even though it is not visualisable.

The competition between the two theories ultimately led to their synthesis. On the one hand, Schrödinger's hope for a visualisable interpretation of quantum mechanics was not fulfilled: the visualisability of his model is limited because it does not represent atoms as waves in ordinary three-dimensional space but in a multidimensional Hilbert space. Heisenberg, on the other hand, abandoned his radically abstract approach and re-introduced visualisable notions, such as position and momentum of electrons, at the atomic level. The combination of matrix and wave mechanics led to quantum mechanics as it is accepted and taught today. With hindsight it is clear that Schrödinger's thesis that visualisability is a necessary condition for intelligibility must be rejected – there is no *a priori* relation between understanding and visualisation. Still, it does not follow that his ideas were completely misguided and worthless. History only shows that standards of intelligibility and understanding may vary and change. Moreover, the history of quantum mechanics shows that debates about understanding and intelligibility often stimulate scientific development.

Almost every physicist will agree that understanding is a key aim of science, but there appears to be strong variation in views about what is required for such understanding. The case of quantum theory illustrates this nicely. Even today physicists and philosophers debate the question of whether – and if so, how – quantum mechanics can provide understanding (the many different interpretations of the theory can be seen in this light). Of course, one might think that quantum theory is an exceptional case, being an esoteric, counterintuitive theory that applies to a remote domain of reality. Thus, Richard Feynman famously stated that nobody understands quantum mechanics. Of atomic behaviour he said: "Even the experts do not understand it the way they would like to, and it is perfectly reasonable that they should not, because all of direct, human experience and of human intuition applies to large objects" (Feynman, Leighton, & Sands, 1963-1965, vol. 3, p. 1-1). While quantum theory surely is a strange theory, the fact that scientists disagree about its intelligibility is not exceptional: the history of physics abounds with debates about the intelligibility of theories and criteria for scientific understanding.

Conclusion: Lessons from the history of science

Historical case studies can illustrate various aspects of scientific understanding and inform a philosophical analysis of it. For instance, the relation between metaphysical worldviews and scientific understanding emerges clearly in the seventeenth-century debate about the intelligibility of Newton's theory of universal gravitation, and the subsequent development of physicists' views on contact action versus action at a distance in the eighteenth and nineteenth centuries. This case nicely illustrates how criteria for understanding may change in time, and how they interact with metaphysics.

Initially, Newton's theory was criticised because it failed to conform to the Cartesian intelligibility ideal of contact action; the idea of forces acting at a distance was unacceptable to most seventeenth-century physicists. The main reason was that it did not fit into the generally accepted metaphysical worldview of Descartes, which assumed that matter is passive and can affect other matter only by means of direct impact. But between 1700 and 1850 action at a distance rather than contact action and causal chains dominated the scientific scene and attempts to formulate theories of gravitation based on contact action were ignored. Only in the second half of the nineteenth century did contact action again become an acceptable explanatory resource (see De Regt 2017, Chapter 5, for a detailed analysis).

I conclude that philosophy of science should take the history and practice of science seriously, and should accordingly acknowledge the contextual nature of scientific understanding. As the physicist and philosopher Carl Friedrich von Weizsäcker observed in a conversation with Grete Hermann and Werner Heisenberg:

> One should remember that with the historical development of science the structure of human thinking also changes. Scientific progress does not only consist in our discovering and understanding of new facts, but also in that, again and again, we learn new possible meanings of the word 'understanding' itself. (Heisenberg 1969, p. 173).

References

De Regt, Henk W. (2017). *Understanding Scientific Understanding*. New York: Oxford University Press.

Feynman, Richard P., Robert B. Leighton, and Matthew Sands (1963-1965). *The Feynman Lectures on Physics*. 3 vols. Reading, MA: Addison-Wesley.

Heisenberg, Werner. 1969. *Der Teil und das Ganze: Gespräche im Umkreis der Atomphysik*. München: R. Piper & Co. Verlag.

IPCC. 2012. *Climate Change 2007 – The Physical Science Basis, Working Group I Contribution to the Fourth Assessment Report of the IPCC*. Cambridge: Cambridge University Press.

Lear, Jonathan (1988). *The Desire to Understand*. Cambridge: Cambridge University Press.

Pauli, Wolfgang (1979). *Wissenschaftlicher Briefwechsel, Band I: 1919-1929*. New York: Springer-Verlag.

Salmon, Wesley C. (1998). *Causality and Explanation*. New York: Oxford University Press.

Schrödinger, Erwin (1928). *Collected Papers on Wave Mechanics*. London: Blackie.

Schrödinger, Erwin (1996). *Nature and the Greeks*. Cambridge: Cambridge University Press.

Invitation to Submit Opinion Piece

In order to make better educational use of the wide geographical and disciplinary reach of this HPS&ST NEWSLETTER, invitations are extended for readers to contribute opinion or position pieces or suggestions about any aspect of the past, present or future of HPS&ST studies.

Contributions can be sent direct to Michael Matthews or Nathan Oseroff-Spicer.

Ideally, they might be pieces that are already on the web, in which case a few paragraphs introduction, with link to web site can be sent, or else the pieces will be put on the web with a link given in the NEWSLETTER.

They will be archived in the OPINION folder at the HPS&ST web site: http://www.hpsst.com/.

PhD Theses in HPS&ST Domain

The HPS&ST NEWSLETTER is the ideal medium for publicising and making known submitted and awarded doctoral theses in the HPS&ST domain.

The following details should be submitted to the editor at m.matthews@unsw.edu.au:

- Candidate's name and email
- Institution
- Supervisor
- Thesis title
- Abstract of 100-300 words
- Web link when theses are required to be submitted for open search on web.

From Aeon Newsletter: Martin Rees 'The Good Scientist'

"The Good Scientist" by Martin Rees, England's Astronomer Royal, is a 5/20/20 Aeon essay that stresses the need for more scientists who can communicate effectively with the general public. He uses Carl Sagan as an example of a scientist who was highly effective at this. Rees observes that "science is the one culture that all humans can share" and science should strive for "peaceful coexistence" with all faiths. He goes on to say science advances through open debate and international collaboration is needed today more than ever if we are to avoid the dangers of misusing science.

The essay can be read here.

Symposium on the History, Philosophy & Sociology of School Biology, Dublin City University, 11 - 12 December 2020

Under the aegis of The International Society for the History, Philosophy & Social Studies of Biology (IHSPSSB)

New curricular developments in biology across the educational spectrum are resulting in the re-evaluation of practical biology and the unexpected outcome of reducing practical work in biology.

The mission of this symposium will be to enhance the HPS of Biology by examining the relationship between Biology as a discipline and how it is presented in schools.

The vision of the symposium will be to explore traditional historical approaches in practical workshops with historic equipment and re-evaluate them in light of new pedagogies and curricular reform, can school biology be called experimental science any longer? To ask, and answer, what is the purpose of school biology?

Some suggested threads of interest:

- The relationship between biology and school biology
- Historical approaches to teaching biology
- Experimental History of biology
- Methodologies and philosophies of instruction in biology
- The use of natural history collections in biology
- Gender balance and diversity in biology uptake at the second level
- The nature of biology, whether an experimental science?
- The purpose of school biology in society in general
- Mayr's Philosophy of Biology and its application to school biology

Symposiarch : Dr. Thomas McCloughlin, tom.mccloughlin@dcu.ie,
School of STEM Education

Symposium website:
https://sites.google.com/dcu.ie/ishpssb2020/home

'History, Philosophy and Science Teaching: A Personal Story' Michael R. Matthews

Michael Matthews has contributed to HPS&ST research, and associated institutional initiatives such as the International History Philosophy and Science Teaching Group (IHPST) and the Inter Divisional Teaching Commission of the DLMPS and DHST over the past 30+ years. He has written articles and books, editing anthologies, handbooks, and journal special issues, given lectures in scores of international universities, and has presented papers and lectures at numerous academic conferences. He founded, and for 25 years edited, the Springer journal *Science & Education: Contributions from HPS*.

He has now written an intellectual autobiography that details something of his own Irish-Catholic childhood and schooling, his science studies and teacher education at Sydney University in the mid-1960s, his science teaching years, his early studies, research and teaching in philosophy of education, his University of Sydney honours degrees in philosophy, psychology and HPS, his connection with Sydney theological studies, his period lecturing at Sydney Teachers College, appointment to University of New South Wales, and his time as Foundation Professor Science Education at University of Auckland. Also discussed is his five-year sojourn as an alderman on Sydney City Council, the first independent alderman to be elected to the council.

The personal story elaborates a little on a number of the issues and debates in philosophy of education, philosophy, HPS, and science education to

which Matthews has contributed. It is not a general account of HPS&ST but rather a personal story of how he became involved with HPS&ST questions, research, and institutions and how he sees that past and future.

The essay can be read, and downloaded as a pdf file here.

Recent HPS&ST Research Articles

Centaurus (Volume 61, Issue 4)

Special Issue: The Periodic System: The (Multiple) Values of an Icon

Editors: Annette Lykknes Brigitte Van Tiggelen

Archila, P.A., Molina, J. & Truscott de Mejía, A. (2020). Using Historical Scientific Controversies to Promote Undergraduates' Argumentation. *Science & Education*, 1-25. doi:10.1007/s11191-020-00126-6 online first

Bensaude-Vincent, B. (2020). Festschrift: At the Boundary between Science and Industrial Practices: Applied Science, Arts, and Technique in France, 13. *Science Museum Group Journal*. doi:10.15180/201309

Cheung, K. (2020). Exploring the Inclusion of Nature of Science in Biology Curriculum and High-Stakes Assessments in Hong Kong. *Science & Education*, 1-22. doi:10.1007/s11191-020-00113-x online first

Coelho, R. L. (2020) On the Energy Concept Problem: Experiments and Interpretations. *Foundations of Science*, 1-18. doi:10.1007/s10699-020-09675-z online first

de Carvalho, Í.N., El-Hani, C.N. & Nunes-Neto, N. (2020). How Should We Select Conceptual Content for Biology High School Curricula? *Science & Education*, 1-35. doi:10.1007/s11191-020-00115-9 online first

de Waal, E., ten Hagen, S.L. (2020). The Concept of Fact in German Physics around 1900: A Comparison between Mach and Einstein. *Physics in Perspective*, 1-26. doi:10.1007/s00016-020-00256-y online first

Emden, M., Gerwig, M. (2020). Can Faraday's The Chemical History of a Candle Inform the Teaching of Experimentation? *Science & Education*, 1-28. doi:10.1007/s11191-020-00119-5 online first

Gilissen, M. R., Knippels, M.-C. & van Joolingen, W.R. (2020). Bringing systems thinking into the classroom. *International Journal of Science Education*, 1-29. doi:10.1080/09500693.2020.1755741 online first

Giri, V., Paily, M.U. (2020). Effect of Scientific Argumentation on the Development of Critical Thinking. *Science & Education*, 1-18. doi:10.1007/s11191-020-00120-y online first

Grinnell, F. (2020). "Reinventing Science Fairs." *Issues in Science and Technology*, 36(3), 23–25. https://issues.org/reinventing-science-fairs/

Karam, R. (2020). Schrödinger's original struggles with a complex wave function. *American Journal of Physics*, 88, 433. doi:10.1119/10.0000852

Klein, U. (2020). Science, industry, and the German Bildungsbürgertum. *Annals of Science*, 1-12. doi:10.1080/00033790.2020.1748228 online first

Machery, E. (2020). What is a Replication? *Philosophy of Science*, 1-42. doi:10.1086/709701 just accepted

Mohan, A.K. (2020). Philosophical Standpoints of Textbooks in Quantum Mechanics. *Science & Education*, 1-21. doi:10.1007/s11191-020-00128-4 online first

Pleasants, J. (2020). Inquiring into the Nature of STEM Problems. *Science & Education*, 1-25. doi:10.1007/s11191-020-00135-5 online first

Sharon, AJ, Baram-Tsabari, A. (2020). Can science literacy help individuals identify misinformation in everyday life? *Science Education*. 1– 22. doi:10.1002/sce.21581 online first

Silva, H.M., Mortimer, E.F. (2020). Teachers' Conceptions about the Origin of Humans in the Context of Three Latin American Countries with Different Forms and Degrees of Secularism. *Science & Education*, 1-21. doi:10.1007/s11191-020-00124-8 online first

Tawa, J. (2020). Does Social Constructionist Curricula Both Decrease Essentialist and Increase Nominalist Beliefs About Race? *Science & Education*, 1-28. doi:10.1007/s11191-020-00125-7 online first

Walmsley, L.D. (2020). The strategy of model building in climate science. *Synthese*, 1-21. doi:10.1007/s11229-020-02707-y online first

Recent HPS&ST Related Books

Armstrong, Paul B. (2020). *Stories and the Brain: The Neuroscience of Narrative*. Baltimore, MD: John Hopkins University Press. ISBN: 978-1-421-43775-0

"How do our brains enable us to tell and follow stories? And how do stories affect our minds? In Stories and the Brain, Paul B. Armstrong analyses the cognitive processes involved in constructing and exchanging stories, exploring their role in the neurobiology of mental functioning.

"Armstrong argues that the ways in which stories order events in time, imitate actions, and relate our experiences to others' lives are correlated to cortical processes of temporal binding, the circuit between action and perception, and the mirroring operations underlying embodied intersubjectivity. He reveals how recent neuroscientific findings about how the brain works–how it assembles neuronal syntheses without a central controller–illuminate cognitive processes involving time, action, and self-other relations that are central to narrative.

"An extension of his previous book, *How Literature Plays with the Brain*, this new study applies Armstrong's analysis of the cognitive value of aesthetic harmony and dissonance to narrative. Armstrong explains how narratives help the brain negotiate the never-ending conflict between its need for pattern, synthesis, and constancy and its need for flexibility, adaptability, and openness to change. The neuroscience of these interactions is part of the reason stories give shape to our lives even as our lives give rise to stories.

"Taking up the age-old question of what our ability to tell stories reveals about language and the mind, this truly interdisciplinary project should be of interest to humanists and cognitive scientists alike." (From the Publisher)

More information available here.

Banerjee, Somaditya (2020). *The Making of Modern Physics in Colonial India*. Abingdon, UK: Routledge. ISBN: 978-1-315-55579-9

"This monograph offers a cultural history of the de-

velopment of physics in India during the first half of the twentieth century, focusing on Indian physicists Satyendranath Bose (1894-1974), Chandrasekhara Venkata Raman (1888-1970) and Meghnad Saha (1893-1956). The analytical category "bhadralok physics" is introduced to explore how it became possible for a highly successful brand of modern science to develop in a country that was still under colonial domination. The term Bhadralok refers to the then emerging group of native intelligentsia, who were identified by academic pursuits and manners. Exploring the forms of life of this social group allows a better understanding of the specific character of Indian modernity that, as exemplified by the work of bhadralok physicists, combined modern science with indigenous knowledge in an original program of scientific research.

"The three scientists achieved the most significant scientific successes in the new revolutionary field of quantum physics, with such internationally recognised accomplishments as the Saha ionisation equation (1921), the famous Bose-Einstein statistics (1924), and the Raman Effect (1928), the latter discovery having led to the first ever Nobel Prize awarded to a scientist from Asia. This book analyses the responses by Indian scientists to the radical concept of the light quantum, and their further development of this approach outside the purview of European authorities. The outlook of bhadralok physicists is characterised here as "cosmopolitan nationalism," which allows us to analyse how the group pursued modern science in conjunction with, and as an instrument of Indian national liberation." (From the Publishers)

More information available here.

Cordes, Eugene, H. (2020). *Hallelujah Moments: Tales of Drug Discovery* (2nd Ed.). Oxford, UK: Oxford University Press.
ISBN: 978-0-190-08045-7

"The discovery of novel drugs that fill unmet medical needs is important for the health and well-being of people everywhere. However, the general public knows too little about the pathways through which basic research discoveries are translated into products that protect or restore human health. In the second edition of *Hallelujah Moments*, Eugene H. Cordes reveals the processes and pitfalls on the route from the laboratory bench to the bedside. These are adventure stories in which wit and grit created several of the most important drugs in human medicine.

"This new edition adds four new tales of drug discovery: for therapy of cancer, hepatitis C, HIV/AIDS, and for weight control. The stories emphasise the integration of basic research in academe and applied research in the pharmaceutical industry and introduce the key scientists. In each case, success resulted from imagination, risk-taking, problem solving, and perseverance.

"Cordes shares his firsthand knowledge of the drug-discovery world, having spent a long and distinguished career in both academic and industrial settings. The eleven drug discovery tales take the reader from concept to clinic for some of the most important drugs in human health including the statins, ACE inhibitors, antibiotics, avermectins, Januvia, and Taxol. These stories offer exciting insights into the fascinating world of drug discovery." (From the Publisher)

More information available here.

Fara, Patricia (2020). *Erasmus Darwin: Sex, Science, and Serendipity*. Oxford, UK: Oxford University Press. ISBN: 978-0-198-84854-7 (New in Paperback)

"Dr Erasmus Darwin seemed an innocuous Midlands physician, a respectable stalwart of eighteenth-century society. But there was another side to him.

"Botanist, physician, Lunar inventor and popular poet, Darwin was internationally renowned for extraordinary poems explaining his theories about sex and science. Yet he became a target for the political classes, the victim of a sustained and vitriolic character assassination by London's most savage satirists.

"Intrigued, prize-winning historian Patricia Fara set out to investigate why Darwin had provoked such fierce intellectual and political reaction. Inviting her readers to accompany her, she embarked on what turned out to be a circuitous and serendipitous journey.

"Her research led her to discover a man who possessed, according to Samuel Taylor Coleridge, 'perhaps a greater range of knowledge than any other man in Europe.' His evolutionary ideas influenced his grandson Charles, were banned by the Vatican, and scandalised his reactionary critics. But for modern readers he shines out as an impassioned Enlightenment reformer who championed the abolition of slavery, the education of women, and the optimistic ideals of the French Revolution.

"As she tracks down her quarry, Patricia Fara uncovers a ferment of dangerous ideas that terrified the establishment, inspired the Romantics, and laid the ground for Victorian battles between faith and science." (From the Publisher)

More information available here.

Fulford, Tim, & Ruston, Sharon (Eds.) (2020). *The Collected Letters of Sir Humphry Davy*. Oxford, UK: Oxford University Press.
ISBN: 978-0-198-70586-4

"This is the first collected edition of the letters of Humphry Davy. Davy is a significant figure in both the history of science and literary history. One of the foremost chemists of the early nineteenth century, he was the first person to inhale nitrous oxide. He pioneered electrochemistry, using the Voltaic pile to isolate more chemical elements than any other scientist; and he invented the miners' safety lamp that came to be known as the 'Davy lamp'. His lectures and papers played a key part in the professionalisation of science, in the growth of scientific institutions, and in the emergence of scientific disciplines. He was the protégé of Thomas Beddoes and Joseph Banks, and the mentor of Michael Faraday. He was also a poet, and a friend of poets, including Wordsworth, Southey, Scott, and Byron.

"The edition contains fully annotated transcriptions of correspondence (much previously unpublished) with such figures as Joseph Banks, Thomas Beddoes, Jöns Jacob Berzelius, Samuel Taylor Coleridge, Michael Faraday, Joseph Louis Gay-Lussac, the Herschels, the Marcets, Marc-Auguste Pictet, Nicolas-Théodore de Saussure, James Watt, Josiah Wedgwood, William Hyde Wollaston, and Thomas Young.

"The edition throws new light on Davy, on the histories of science and literature, and on the social history of the early nineteenth century. It illuminates scientific controversies over the safety lamp, the Board of Longitude, the Geological Society, and the Royal Society. It offers new perspectives on the 1790s poetry of Wordsworth, Coleridge, and Southey. It illuminates women's literary networks, reveals the links between science and government, and casts light on provincial and dissenting intellectual networks, among Quakers and Unitarians." (From the Publisher)

More information available here.

Leng, Gareth & Leng, Rhodri Ivor (2020). *The Matter of Facts: Skepticism, Persuasion, and Evidence in Science*. Cambridge, MA: The MIT Press.
ISBN: 978-0-262-04388-5

"Modern science is built on experimental evidence,

yet scientists are often very selective in deciding what evidence to use and tend to disagree about how to interpret it. In The Matter of Facts, Gareth and Rhodri Leng explore how scientists produce and use evidence. They do so to contextualise an array of problems confronting modern science that have raised concerns about its reliability: the widespread use of inappropriate statistical tests, a shortage of replication studies, and a bias in both publishing and citing "positive" results. Before these problems can be addressed meaningfully, the authors argue, we must understand what makes science work and what leads it astray.

"The myth of science is that scientists constantly challenge their own thinking. But in reality, all scientists are in the business of persuading other scientists of the importance of their own ideas, and they do so by combining reason with rhetoric. Often, they look for evidence that will support their ideas, not for evidence that might contradict them; often, they present evidence in a way that makes it appear to be supportive; and often, they ignore inconvenient evidence.

"In a series of essays focusing on controversies, disputes, and discoveries, the authors vividly portray science as a human activity, driven by passion as well as by reason. By analysing the fluidity of scientific concepts and the dynamic and unpredictable development of scientific fields, the authors paint a picture of modern science and the pressures it faces." (From the Publishers)

More information available here.

Maxwell, Nicholas (2020) *Our Fundamental Problem: A Revolutionary Approach to Philosophy*, McGill-Queen's University Press.

"How can the world we live in and see, touch, hear, and smell, the world of living things, people, consciousness, free will, meaning, and value - how can all of this exist and flourish embedded as it is in the physical universe, made up of nothing but physical entities such as electrons and quarks? How can anything be of value if everything in the universe is, ultimately, just physics? In Our Fundamental Problem Nicholas Maxwell argues that this problem of reconciling the human and physical worlds needs to take centre stage in our thinking, so that our best ideas about it interact with our attempts to solve even more important specialised problems of thought and life. When we explore this fundamental problem, Maxwell argues, revolutionary answers emerge for a wide range of questions arising in philosophy, science, social inquiry, academic inquiry as a whole, and - most important of all - our capacity to solve the global problems that threaten our future: climate change, habitat destruction, extinction of species, inequality, war, pollution of earth, sea, and air. An unorthodox introduction to philosophy, Our Fundamental Problem brings philosophy down to earth and demonstrates its vital importance for science, scholarship, education, life, and the fate of the world.

Details available here.

Richmond, Sheldon (2020), *A Way Through the Global Techno-Scientific Culture*, Cambridge Scholars Publishing,

Computers are supposed to be smart, yet they frustrate both ordinary users and computer technologists. Why are people frustrated by smart machines? Computers don't fit people. People think in terms of comparisons, stories, and analogies, and seek feedback, whereas computers are based on a fundamental design that does not fit with analogical and feedback thinking. They impose a binary, an all-or-nothing, approach to everything. Moreover, the social world and institutions that have developed around computer technology hide and reinforce the lack of alignment between com-

puters and people. This book suggests a solution: we do not have to accept the way things are now and work around the bad social and technical design of computers. Rather, it proposes a diverse, distributed, critical discussion of how to design and build both computer technology and its social institutions.

Details available here.

Morange, Michael (2020). *The Black Box of Biology: A History of the Molecular Revolution*. (Trans. Matthew Cobb). Cambridge, MA: Harvard University Press. ISBN: 978-0-674-28136-3

"Morange's re-elaboration of his 1998 masterpiece, *A History of Molecular Biology*, is a gift. Compelling and masterful in its command of contemporary biology, history, and philosophy, The Black Box of Biology is a key reference for grasping the scope and roots of human interventions in the biological world." – Sabina Leonelli, University of Exeter

"An original and expansive analysis of the history of molecular biology, from its origins to the rise of genomics and epigenetics. Unparalleled in its scope and insight, *The Black Box of Biology* should be required reading for historians and biologists seeking to understand the molecular transformation of modern biology." – Michael Dietrich, University of Pittsburgh

"Written by a historian of science trained in François Jacob's laboratory, *The Black Box of Biology* weaves together the social, political, and scientific dimensions of the 'molecular revolution' into a compelling narrative and a fascinating read." – Pierre-Olivier Méthot, Laval University

"Since the 1930s, a molecular vision has been transforming biology. Michel Morange provides an incisive and overarching history of this transformation, from the early attempts to explain organisms by the structure of their chemical components, to the birth and consolidation of genetics, to the latest technologies and discoveries enabled by the new science of life. Morange revisits *A History of Molecular Biology* and offers new insights from the past twenty years into his analysis.

"*The Black Box of Biology* shows that what led to the incredible transformation of biology was not a simple accumulation of new results, but the molecularisation of a large part of biology. In fact, Morange argues, the greatest biological achievements of the past few decades should still be understood within the molecular paradigm. What has happened is not the displacement of molecular biology by other techniques and avenues of research, but rather the fusion of molecular principles and concepts with those of other disciplines, including genetics, physics, structural chemistry, and computational biology. This has produced decisive changes, including the discoveries of regulatory RNAs, the development of massive scientific programs such as human genome sequencing, and the emergence of synthetic biology, systems biology, and epigenetics.

"Original, persuasive, and breathtaking in its scope, The Black Box of Biology sets a new standard for the history of the ongoing molecular revolution." (From the Publisher)

More information available here.

Ramirez, Ainissa (2020). *The Alchemy of Us: How Humans and Matter Transformed One Another*. Cambridge, MA: The MIT Press.
ISBN: 978-0-262-54226-5

"In *The Alchemy of Us*, scientist and science writer Ainissa Ramirez examines eight inventions–clocks, steel rails, copper communication cables, photographic film, light bulbs, hard disks, scientific labware, and silicon chips–and reveals how they shaped the human experience. Ramirez tells the stories of the woman who sold time, the inventor

who inspired Edison, and the hotheaded undertaker whose invention pointed the way to the computer. She describes, among other things, how our pursuit of precision in timepieces changed how we sleep; how the railroad helped commercialise Christmas; how the necessary brevity of the telegram influenced Hemingway's writing style; and how a young chemist exposed the use of Polaroid's cameras to create passbooks to track black citizens in apartheid South Africa. These fascinating and inspiring stories offer new perspectives on our relationships with technologies.

"Ramirez shows not only how materials were shaped by inventors but also how those materials shaped culture, chronicling each invention and its consequences–intended and unintended. Filling in the gaps left by other books about technology, Ramirez showcases little-known inventors–particularly people of colour and women–who had a significant impact but whose accomplishments have been hidden by myth-making, bias, and convention. Doing so, she shows us the power of telling inclusive stories about technology. She also shows that innovation is universal–whether it's splicing beats with two turntables and a microphone or splicing genes with two test tubes and CRISPR." (From the Publisher)

More information available here.

Scerri, Eric, & Ghibaudi, Elena (Eds.) (2020). *What Is A Chemical Element? A Collection of Essays by Chemists, Philosophers, Historians, and Educators*. Oxford, UK: Oxford University Press. ISBN: 978-0-190-93378-4

"The concept of a chemical element is foundational within the field of chemistry, but there is wide disagreement over its definition. Even the International Union for Pure and Applied Chemistry (IUPAC) claims two distinct definitions: a species of atoms versus one which identifies chemical elements with the simple substances bearing their names. The double definition of elements proposed by the International Union for Pure and Applied Chemistry contrasts an abstract meaning and an operational one. Nevertheless, the philosophical aspects of this notion are not fully captured by the IUPAC definitions, despite the fact that they were crucial for the construction of the Periodic Table. Although rich scientific literature on the element and the periodic table exists as well as a recent growth in the philosophy of chemistry, scholars are still searching for a definitive answer to this important question: What is an element?

"Eric Scerri and Elena Ghibaudi have teamed up to assemble a group of scholars to provide readers an overview of the current state of the debate on chemical elements from epistemological, historical, and educational perspectives. *What Is A Chemical Element?* fills a gap for the benefit of the whole chemistry community-experimental researchers, philosophers, chemistry educators, and anyone looking to learn more about the elements of the periodic table." (From the Publishers)

More information available here.

Authors of HPS&ST-related papers and books are invited to bring them to attention of Paulo Maurício or Nathan Oseroff-Spicer for inclusion in these sections.

Coming HPS&ST Related Conferences

June 8-12, 2020, Philosophy of Biology at the Mountains (POBAM), Workshop, University of Utah.
Details available here.

June 16-17, 2020, International Workshop on Disciplinary Identity: Insights from the History and Philosophy of Chemistry. Hebrew University of Jerusalem, Israel.
Details available here.

June 17-19, 2020, Fourth International History of Physics Conference, Trinity College Dublin
Details available here.

June 29 – July 3, 2020, Objects of Understanding: Historical Perspectives on Material Artefacts and Practices in Science Education. Europa-Universität, Flensburg, Germany. POSTPONED TO 2021
Inquiries at OoU-conference@uni-flensburg.de

June 29 – July 1, 2020, Measurement at the Crossroads 2020 – Measuring and Modeling. Milan, Italy.
More information available here.

June 30 – July 2, 2020, 7th annual conference of the International Association for Philosophy of Time. Barcelona, Spain.
Inquiries at iapt7barcelona@gmail.com

July 1-3, 2020, 'STEMM and Belief in Diverse Contexts: Publics, Praxis, Policy and Pluralism', Stellenbosch, South Africa
Details available here.

July 2-4, 2020, 4th International Conference on Science and Literature, University of Girona, Spain.
Details at: http://icscienceandliterature.com/

July 7-10, 2020, Society for Philosophy of Science in Practice (SPSP) Eighth Biennial Conference, Michigan State University, USA
Details available here.

July 8-11, 2020, British Society for History of Science Annual Conference, Aberystwyth University, Wales.
Information at: http://bshsaberystwyth2020.info/

July 9-11, 2020, 6th International STEM in Education Conference, Vancouver, Canada.
Details at: www.stem2020.ubc.ca

July 15-17, 2020, 8th Integrated History and Philosophy of Science Conference (&HPS8). Virginia Tech, Blacksburg VA.
Information: Lydia Patton (critique@vt.edu) or Jutta Schickore (jschicko@indiana.edu)

July 21-23, 2020, 24th Conference of the International Society for the Philosophy of Chemistry. Buenos Aires, Argentina.
More information available here.

July 27-31, 2020, Summer School on "Open science": ambivalences and tensions – New borderlands between science, technology and society (Donostia-San Sebastian, Spain.
Details available here or
Lilia Bolz (lilia.bolz@humtec.rwth-aachen.de).

August 10-14, 2020, Bayesian Epistemology: Perspectives and Challenges. MCMP, LMU Munich.
Details available here.

August 18-21, 2020, EASST + 4S Joint Conference, Prague
Details available here.

August 31 – September 3, 2020, European Society for History of Science Biennial Conference, Bologna
Details available here.

September 9-11, 2020. The 8th Congress of the Society for the Philosophy of Science. University of Mons, Belgium.
Details available here.

September 14-19, 2020, 39th annual symposium of the Scientific Instrument Commission, London
Details available here.

October 8-9, 2020 Conference on Science & Technology Education, Porto, Portugal
Details available here.

October 8-11, 2020, History of Science Society Annual Conference, New Orleans
Details available here.

November 19-22, 2020, Twenty-Seventh Biennial Meeting of the PSA. Baltimore, Maryland
Details available here.

July 4-8, 2021, IHPST 16th International Conference, University of Calgary, Canada
Details from Glenn Dolphin:
glenn.dolphin@ucalgary.ca.

July 25-31, 2021, 26th International Congress of History of Science and Technology (DHST), Prague
Information: https://www.ichst2021.org/

September 20-22, 2021, 'Developing Mario Bunge's Scientific-Philosophical Programme', Huaguang Academy of Information Science, Wuhan, China
Details from Zongrong LI 2320129239@qq.com.

July 24-29, 2023, 17th DLMPST Congress, University of Buenos Aires Information: Pablo Lorenzano, pablo@unq.edu.ar.

HPS&ST Related Organisations and Websites

IUHPST – International Union of History, Philosophy, Science, and Technology

DLMPST – Division of Logic, Mathematics, Philosophy, Science, and Technology

DHST – Division of History, Science, and Technology

IHPST – International History, Philosophy, and Science Teaching Group

NARST – National Association for Research in Science Teaching

ESERA – European Science Education Research Association

ASERA – Australasian Science Education Research Association

ICASE – International Council of Associations for Science Education

UNESCO – Education

HSS – History of Science Society

ESHS – European Society for the History of Science

AHA – American History Association

ISHEASTME – International Society for the History of East Asian History of Science Technology and Medicine

BSHS – British Society for History of Science

EPSA – European Philosophy of Science Association

AAHPSSS - The Australasian Association for the History, Philosophy, and Social Studies of Science

HOPOS – International Society for the History of Philosophy of Science

PSA – Philosophy of Science Association

BSPS – The British Society for the Philosophy of Science

SPSP – The Society for Philosophy of Science in Practice

ISHPSB – The International Society for the History, Philosophy, and Social Studies of Biology

PES – The Philosophy of Education Society (USA)

The above list is updated and kept on the HPS&ST website HERE.

HPS&ST-related organisations wishing their web page to be added to the list should contact assistant editor Paulo Maurício (paulo.asterix@gmail.com)

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