

# HPS&ST Note

April 2019

## Introduction

This HPS&ST monthly note is sent direct to about 7,600 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 international and national science teaching lists. In print or electronic form 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 pieces, etc.) are welcome and should be sent direct to the editor:

Michael R. Matthews, UNSW, [m.matthews@unsw.edu.au](mailto:m.matthews@unsw.edu.au).

The Note, along with RESOURCES, OBITUARIES, OPINION PIECES and more, are lodged at the website:

<http://www.hpsst.com/>

## Project on Teaching Argumentation in Science and Religion

The new 3-year OARS Project (Oxford Argumentation in Religion and Science Education) based at University of Oxford is investigating how arguments work in science and religion. The relevance of arguments in science education is that teachers and pupils often face difficult judgments that demand understanding of various kinds of information, opinion, values and ethical principles, and understanding of different processes of argumentation, deliberation and debate. For example, in the context of biology lessons pupils might question whether or not genes should be cloned or edited, appealing not only to scientific knowledge but also to religious and ethical values. Some teaching and learning scenarios might demand teachers and pupils to consider scientific and religious issues together. For instance, pupils might ponder about religious values related to end-of-life decisions in conjunction with scientific evidence on the sustainability of life.

Many complex everyday problems thus require cross-curricular conversations in order for teachers and pupils to make judgements about a whole range of issues that have both scientific and religious undertones. Hence, the aim of OARS Project, funded by the Templeton World Charity Foundation, is to understand how argumentation works in science and religion, and how best to support pupils in learning arguments.

Thirty science and religious education teachers are collaborating with researchers and teacher educators from Oxford in a professional development programme to develop their pupils' understanding of argumentation. Eventually the project will provide data on about 1500 pupils. Further information is available [here](#). Any interested teachers may contact the Principal Investigator, Sibel Erduran at: [Sibel.Erduran@education.ox.ac.uk](mailto:Sibel.Erduran@education.ox.ac.uk).

## **Interactive Historical Atlas of the Disciplines**

The University of Geneva has established a rich web resource: “Interactive Historical Atlas of the Disciplines”. The website is in open access here: <http://atlas-disciplines.unige.ch>.

This atlas aims at mapping the evolution of the disciplinary borders of science over time, as well as tracing back the successive redefinitions of scientific disciplines throughout the centuries. Furthermore, the project is open to scholarly (reviewed) participation: each disciplinary map comes with dedicated tools for adding content or bibliographic entries.

Further information from:

Raphaël Sandoz, University of Geneva, [sandoz.rafael@gmail.com](mailto:sandoz.rafael@gmail.com).

## **International Congress on the History of Science in Education, May 30 – June 1, 2019, Vila Real, Portugal**

The International Congress on the History of Science in Education is a joint organization of the University of Trás-os-Montes and Alto Douro (UTAD), University of Porto (UP), University of Coimbra (UC) and University of S. Paulo (USP), and it will take place on May 30, 31 and June 1, 2019, at Polo 1 of the School of Human and Social Sciences of UTAD, Portugal.

The ICHSE rises following the 1st Meeting of History of Science in Teaching and 2nd Meeting of History of Science in Teaching held at UTAD and UC, in 2015 and 2017, respectively, and it will take place every two years alternating between the universities involved.

The ICHSE aims to bring together researchers, professors and students, interested in the history and teaching of Biology, Geology, Chemistry, Physics and Mathematics, as well as Educational Sciences, Engineering, Medicine, Pharmacy, Bio-



chemistry, Anthropology, Astronomy, Psychology, Economics, Sociology, Ecology, Molecular Biology and Nanosciences, among others, in a multi-centered and multidisciplinary debate.

In addition to works focused on teaching, education, didactics and dissemination of sciences, IICHSE seeks to bring together reflections and studies of a more general, disciplinary or interdisciplinary nature, in the history of culture, technology and industry, as well as epistemological, historiographic, biographical or prosopographic. Other topics relevant to the history of science and teaching, such as gender studies, the teaching of science in a foreign language and, in general, the various aspects of the interactions between science, technology and the humanities are very important welcome to the dialogue space that IICHSE seeks to create.

Plenary Speakers:

- Carlos Fiolhais, Physics, Universidade de Coimbra
- Jorge Varanda, Anthropology, University of Coimbra
- Maria Elice Prestes, Biology, Universidade de São Paulo
- Michael Matthews, Education, University of New South Wales

Abstract submission: January 31, 2019

Full text submission; March 31, 2019

Conference Chair:

- Isilda Rodrigues, [isilda@utad.pt](mailto:isilda@utad.pt)  
Depart. Education and Psychology,  
University of Trás-os-Montes e Alto Douro, UTAD, Vila  
Real, Portugal.



Information available [here](#).

## 15th International History, Philosophy and Science Teaching Group (IHPST) Biennial Conference, Thessaloniki, July 15-19, 2019



12th Cent. White Tower



School of Education, Aristotle University

The conference will take place at the Aristotle university of Thessaloniki which was founded in 1925 and occupies an area of 33 hectares in the city centre.

The conference will open on Monday afternoon with registration, an opening session and a welcome reception. On Tuesday, Wednesday and Thursday there will be

full-day presentations. There will be scheduled opportunity to visit cultural sites and events in Thessaloniki.

Important Dates:

Abstract submission: January 20, 2019

Final paper submission: March 20, 2019

Full conference information available [here](#).

Conference Chair: A/Professor Fanny Seroglou: [ihpst2019@eled.auth.gr](mailto:ihpst2019@eled.auth.gr)

## **Springer Lecture at IHPST Thessaloniki Conference**

The Springer Lecture at the 15th IHPST Conference will be given by Professor Andrea Woody who is Department Chair and Professor of Philosophy at the University of Washington.

She is Editor-in-Chief of *Philosophy of Science* and a member of the Editorial Board of *Foundations of Chemistry*. She received her bachelor's degree, in chemistry, and certification in Theater and Dance, from Princeton. After a period of high school physics teaching she received her doctorate in history & philosophy of science, from the University of Pittsburgh.

Her research interests include philosophy of science, history of science, aesthetics, and feminist perspectives in philosophy.

In philosophy of science, much of her research concerns explanation, modeling, and representation, with special interest in diagrammatic, graphical, and pictorial representations. She explores the roles explanatory discourse plays in scientific practice as well as the strategic and pragmatic factors that influence scientists' representational choices.

She is supervising or has supervised dissertations on science and values, theory reduction, the social nature of science, naturalizing metaphysics, and the roles of consensus in science. In addition to her work with dissertation students, she has advised MFA research in dance and honors theses for the History & Philosophy of Science undergraduate major.



As a graduate student her first publication in *Science & Education* was with her supervisor Peter Machamer:

Machamer, P. & Woody, A.: 1994, 'The Balance as a Model for Understanding the Motion of Bodies: Galileo and Classroom Physics', *Science & Education* 3(3), 215-244.

## New Editor of Science & Education Journal

A successor to Dr Kostas Kampourakis as editor of the journal *Science & Education* has been chosen by the IHPST Council and approved by Springer Publishers.

Sibel Erduran is Professor of Science Education at Oxford University. After a transition period working with Dr. Kampourakis, she will assume editorship at the beginning of 2020. Prior to her appointment at Oxford, she was the Chair of STEM Education at University of Limerick, Ireland. She held a Distinguished Chair Professor position at National Taiwan Normal University as well as Visiting Professorships at Kristianstad University, Sweden, and Bogazici University, Turkey.



She has worked at University of Pittsburgh, King's College, University of London and University of Bristol,

United Kingdom. She is an Editor for *International Journal of Science Education*, and a Section Editor for *Science Education*.

She completed her higher education in the USA at Vanderbilt (PhD Science Education & Philosophy), Cornell (MSc Food chemistry) and Northwestern (Biochemistry) Universities. She was a chemistry teacher in a high school in northern Cyprus. Her research interests focus on the applications in science education of epistemic perspectives on science in general and in chemistry in particular. Her work on argumentation has received awards from NARST and EASE.

### **Emergence of Modern Science in Colonial India Conference Proceedings**

The 3-day International Conference on ‘Emergence of Modern Science in Colonial India’ was organised by the Indian National Science Academy (INSA) between 14-16th March, 2018 at INSA, New Delhi. The Convener was Prof. Arnab Raichoudhuri of Physics Department of IISc., Bengaluru and whole activity was co-ordinated by an Organising Committee of Prof. Deepak Kumar, JNU; Prof. Suprakash Roy, Editor-in-Chief, Science and Culture; Dr. Rajinder Singh of Oldenburg University, Germany with Prof. Raichoudhuri as the Convener. He was ably assisted from the INSA side by Mr. Madhvendra Narayan, Associate Editor & Member Secretary of IJHS editorial board. The conference venue was the INSA building at Delhi with good ambience and logistics which are taken care of very professionally by Mr. Madhvendra & Prof. Roychoudhuri.

The Proceedings of the conference have now been published by *The Indian Journal for History of Science* and are available freely on line [here](#).



## University of Pittsburgh HPS Programme and Events

The Center for Philosophy of Science at the University of Pittsburgh is pleased to announce a call for applications for PSP3: A Summer Program in Philosophy of Science for Underrepresented Groups, which will be held in Pittsburgh from July 15 to July 19, 2019.

SPEAKERS this month are Peter Urbach, Mauricio Suarez, Anya Plutynski, and Chaz Firestone. See our CALENDAR for details.

Lunchtime Talks are now streaming LIVE on Facebook and Annual Lecture Series talks are recorded and available on YouTube.

“Early Career Workshop in History & Philosophy of Physics”, April 11-12,  
“Quantum Field Theory: Then & Now”, April 12-13,  
Grünbaum Memorial Event, Saturday, May 11



Center for Philosophy of Science  
University of Pittsburgh  
Edouard Machery, Director  
[pittcntr@pitt.edu](mailto:pittcntr@pitt.edu)

For details and to apply, click [here](#).

## Scientific Literacy for All, Beijing Normal University, Oct.29-30, 2019

The Collaborative Innovation Center of Assessment toward Basic Education Quality (CICA-BEQ) at Beijing Normal University will host a conference on ‘Improving Scientific Literacy for All’, Tuesday, Oct. 29 – Wednesday, Oct. 30, 2019

Scientific literacy is evolving as an essential literacy for modern citizens, due to the

rapid development of science and technology in the 21st century. To clarify this fundamental aspect of science education in this new era, we need to rethink and redefine the concept of scientific literacy. Driven by the evolution of scientific literacy, systemic reforms embedded in data-driven and technology-based approaches are needed to improve science education quality. The AISL 2019 conference examines four essential topics to guide research and practice in scientific literacy:

1. Scientific literacy in the 21st century;
2. Teaching, learning and assessment;
3. Curriculum and digital resources;
4. Science teacher professional development.

*Keynote Speakers:*

Richard A. Duschl, Lyle School of Engineering, Southern Methodist University  
Sibel Erduran Department of Education, Oxford University  
Joseph Krajcik CREATE for STEM Institute, Michigan State University

For More Information:

<http://cicabeq.bnu.edu.cn/shtml/3/news/201903/1102.shtml>

Email: [bnukxts@126.com](mailto:bnukxts@126.com).

## **Interview with Mario Bunge**

It is hoped that Mario Bunge, the Argentine/Canadian physicist and philosopher will celebrate his 100th birthday on September 21 this year. He was interviewed in 2015 by Gustavo Romero for the Spanish site 'Philosophy on the Net' [with English translation available] [here](#).

Gustavo E. Romero is Professor of Relativistic Astrophysics at the University of La Plata and Superior Researcher of the National Research Council (CONICET) of Argentina.

He is former President of the Argentine Astronomical Society and Helmholtz International Fellow.

His main current interest is on high-energy astrophysics, black hole physics and ontological problems of spacetime theories.

The interview ranges over physics, philosophy of physics, history of philosophy, philosophy of science and the social responsibility of scientists. The final question was:



Mario Bunge at 99

17. *Let me end by asking you about your aesthetic tastes. Could you mention some fiction artists and writers that you hold in esteem?*

17. 1. I do not fall asleep without first reading some pages of a novel. Great novelists inspire me with as much respect and affection as great scientists and philosophers. The same thing happens with the great playwrights and comedigraphers, such as Aristophanes, Lope, Molière and Wilde. On the other hand, tragedies and poetry leave me cold.

17. 2. Since I was a teenager, I liked to explore the literatures of all countries. I think *Don Quixote*, *The Human Comedy* and *War and Peace* are the summits of the universal novel. But I have “discovered” great novelists in all the countries I have visited [...] and I am excited by some of the countries I have never visited, such as Albania (Ismail Kadaré), Trinidad and Tobago (Vidiadhar Surajprasad Naipaul), and South Africa (J.M. Coetzee). I also like Eça de Queirós, Jorge Amado, Alejo Carpentier, Gabriel Delibes, Mario Vargas Llosa, Naim Süleymanoğlu, Vonnegut, Narayan, Le

Clézio, Margaret Atwood, Peter Carey, Philip Roth, Sinclair Lewis, Anatole France,  
Italo Calvino, José Saramago, Carlos Fuentes, Orhan Pamuk and others.

## Opinion Page

### Why Science Needs Philosophy

Lucie Laplane, Paolo Mantovani, Ralph Adolphs, Hasok Chang, Alberto Mantovani, Margaret McFall-Ngai, Carlo Rovelli, Elliott Sober, and Thomas Pradeu

[From *Proceedings of the National Academy of Science*, March 5, 2019 116 (10) 3948-3952; doi:[10.1073/pnas.1900357116](https://doi.org/10.1073/pnas.1900357116); <https://www.pnas.org/content/116/10/3948>]

Despite the tight historical links between science and philosophy, present-day scientists often perceive philosophy as completely different from, and even antagonistic to, science. We argue here that, to the contrary, philosophy can have an important and productive impact on science.

We illustrate our point with three examples taken from various fields of the contemporary life sciences. Each bears on cutting-edge scientific research, and each has been explicitly acknowledged by practicing researchers as a useful contribution to science. These and other examples show that philosophy's contribution can take at least four forms: the clarification of scientific concepts, the critical assessment of scientific assumptions or methods, the formulation of new concepts and theories, and the fostering of dialogue between different sciences, as well as between science and society.

The definition of stem cells is a prime example. Philosophy has a long tradition of investigating properties, and the tools in use in this tradition have recently been applied to describe "stemness," the property that defines stem cells. One of us has shown that four different kinds of properties exist under the guise of stemness in current scientific knowledge (1). Depending on the type of tissue, stemness can be a categorical property (an intrinsic property of the stem cell, independent of its environment), a dispositional property (an intrinsic property of the stem cell that is controlled by the microenvironment), a relational property (an extrinsic property

that can be conferred to non-stem cells by the microenvironment), or a systemic property (a property that is maintained and controlled at the level of the entire cell population).

Stem cell and cancer biology researcher Hans Clevers notes that this philosophical analysis highlights important semantic and conceptual problems in oncology and stem cell biology; he also suggests this analysis is readily applicable to experimentation (2). Indeed, beyond conceptual clarification, this philosophical work has real-world applications as illustrated by the case of cancer stem cells in oncology.

Research aimed at developing drugs targeting either the cancer stem cells or their microenvironment actually rely on different kinds of stemness and are thus likely to have different rates of success depending on cancer type (1). Moreover, they might not cover all cancer types because current therapeutic strategies do not take into account the systemic definition of stemness. Determining the kind of stemness found in each tissue and cancer is thus useful to direct the development and choice of anticancer therapies. In practice, this framework has led to the investigation of cancer therapies that combine the targeting of intrinsic cancer stem cell properties, their microenvironment, and immune checkpoints to cover all possible kinds of stemness (3).

Furthermore, this philosophical framework recently has been applied to another field, the study of organoids. In a systemic review of experimental data on organoids from various sources, Picollet-D'hahan et al. (4) characterized the ability to form organoids as a dispositional property. They could then argue that to increase the efficiency and reproducibility of organoid production, a major current challenge in the field, researchers need a better understanding of the intrinsic part of the dispositional property that is influenced by the microenvironment. To discriminate the intrinsic features of cells that have such a disposition, this group is now developing high-throughput functional genomic methods, enabling an investigation of the role of virtually every human gene in organoid formation.

### **Immunogenicity and the Microbiome**

Complementary to its role in conceptual clarification, philosophy can contribute to the critique of scientific assumptions—and can even be proactive in formulating novel, testable, and predictive theories that help set new paths for empirical research.

For example, a philosophical critique of the immune self-nonsel framework (5) has led to two significant scientific contributions. First, it was the basis of the formulation of a novel theoretical framework, the discontinuity theory of immunity, which complements previous self-nonsel and danger models by proposing that the immune system responds to sudden modifications of antigenic motifs (6). This theory sheds light on many important immunological phenomena, including autoimmune disease, immune responses to tumors, and immunological tolerance to chronically expressed ligands. The discontinuity theory has been applied to a multitude of questions, helping explore the effects of chemotherapeutic agents on immunomodulation in cancer and spelling out how natural killer cells constantly modify their phenotype and functions through their interactions with their ligands in a way that ensures tolerance to bodily (self) constituents (7). The theory also helps explain the consequences of repeated vaccinations in immunocompromised individuals (8) and suggests dynamic mathematical models of immune activation. Collectively, these various empirical assessments illustrate how philosophically inspired proposals can lead to novel experiments, opening up new avenues for research.

Second, the philosophical critique contributed along with other philosophical approaches to the notion that every organism, far from being a genetically homogenous self, is a symbiotic community harboring and tolerating multiple foreign elements (including bacteria and viruses), which are recognized but not eliminated by its immune system (9). Research on symbiotic integration and immune tolerance has far-reaching consequences for our conception of what constitutes an individual organism, which is increasingly conceptualized as a complex ecosystem whose key functions, from development to defence, repair, and cognition, are affected by interactions with microbes (9).

### **Influencing Cognitive Science**

The study of cognition and cognitive neuroscience offers a striking illustration of the deep and long-lasting influence of philosophy on science. As with immunology, philosophers have formulated influential theories and experiments, helped initiate specific research programs, and contributed to paradigm shifts. But the scale of the influence dwarfs the immunology case. Philosophy had a part in the move from behaviorism to cognitivism and computationalism in the 1960s. Perhaps most visible has been the theory of the modularity of mind, proposed by philosopher Jerry Fodor (10). Its influence on theories of cognitive architecture can hardly be overstated. In a tribute after Fodor's passing in 2017, leading cognitive psychologist James Russell spoke in the magazine of the British Psychological Society of "cognitive developmental psychology BF (before Fodor) and AF (after Fodor)" (10\*).

Modularity refers to the idea that mental phenomena arise from the operation of multiple distinct processes, not from a single undifferentiated one. Inspired by evidence in experimental psychology, by Chomskian linguistics, and by new computational theories in philosophy of mind, Fodor theorized that human cognition is structured in a set of lower-level, domain-specific, informationally encapsulated specialized modules and a higher-level, domain-general central system for abductive reasoning with information only flowing upward vertically, not downward or horizontally (i.e., between modules). He also formulated stringent criteria for modularity. To this day, Fodor's proposal sets the terms for much empirical research and theory in many areas of cognitive science and neuroscience (11, 12), including cognitive development, evolutionary psychology, artificial intelligence, and cognitive anthropology. Although his theory has been revised and challenged, researchers continue to use, tweak, and debate his approach and basic conceptual toolkit.

The false-belief task constitutes another key instance of philosophy's impact on the cognitive sciences. Philosopher Daniel Dennett was the first to conceive the basic logic of this experiment as a revision of a test used for evaluating theory of mind, the ability to attribute mental states to oneself and others (13). The task tests the capacity to attribute others with beliefs that one considers false, the key idea being that



reasoning about others' false beliefs, as opposed to true beliefs, requires conceiving of other people as having mental representations that diverge from one's own and from the way the world actually is. Its first empirical application was in 1983 (14), in an article whose title, "Beliefs About Beliefs: Representation and Constraining Function of Wrong Beliefs in Young Children's Understanding of Deception," is in itself a direct tribute to Dennett's contribution.

The false-belief task represents a milestone experiment in various areas of cognitive science and neuroscience, with wide application and implications. They include testing for cognitive developmental stages in children, debating the architecture of human cognition and its distinct capacities, assessing theory of mind abilities in great apes, developing theories of autism as mind blindness (according to which difficulties in passing the false-belief task are associated with the condition), and determining which particular brain regions are associated with the capacity to reason about the contents of another person's mind (15).

Philosophy has also helped the field of cognitive science winnow problematic or outdated assumptions, helping drive scientific change. The concepts of mind, intelligence, consciousness, and emotion are used ubiquitously across different fields with often little agreement on their meaning (16). Engineering artificial intelligence, constructing psychological theories of mental state variables, and using neuroscience tools to investigate consciousness and emotion require the conceptual tools for self-critique and cross-disciplinary dialogue—precisely the tools that philosophy can supply.

Inspired by these examples and many others, we see philosophy and science as located on a continuum. Philosophy and science share the tools of logic, conceptual analysis, and rigorous argumentation. Yet philosophers can operate these tools with degrees of thoroughness, freedom, and theoretical abstraction that practicing researchers often cannot afford in their daily activities. Philosophers with the relevant scientific knowledge can then contribute significantly to the advancement of science at all levels of the scientific enterprise from theory to experiment as the above examples show.

But how in practice can we facilitate cooperation between researchers and philosophers? At first sight, the solution might seem obvious: each community should make a step toward the other. Yet it would be a mistake to consider this an easy task. The obstacles are many. At present, a significant number of philosophers disdain science or don't see the relevance of science to their work. Even among philosophers who favor dialogue with researchers, few have a good knowledge of the latest science. Conversely, few researchers perceive the benefits philosophical insights can bring. In the current scientific context, dominated by increasing specialization and growing demands for funding and output, only a very limited number of researchers have the time and opportunity to even be aware of the work produced by philosophers on science let alone to read it. To overcome these difficulties, we believe that a series of simple recommendations, which could be readily implemented, can help bridge the gap between science and philosophy.

### **Philosophy and Scientific Knowledge**

The above examples are far from the only ones: in the life sciences, philosophical reflection has played an important role in issues as diverse as evolutionary altruism (17), debate over units of selection (18), the construction of a "tree of life" (19), the predominance of microbes in the biosphere, the definition of the gene, and the critical examination of the concept of innateness (20). Likewise, in physics, fundamental questions such as the definition of time have been enriched by the work of philosophers. For example, the analysis of temporal irreversibility by Huw Price (21) and closed temporal curves by David Lewis (22) have helped dispel conceptual confusion in physics (23).

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To overcome these difficulties, we believe that a series of simple recommendations, which could be readily implemented, can help bridge the gap between science and philosophy. The reconnection between philosophy and science is both highly desirable and more realizable in practice than suggested by the decades of estrangement between them.

- (i) Make more room for philosophy in scientific conferences. This is a very simple mechanism for researchers to assess the potential usefulness of philosophers' insights for their own research. Reciprocally, more researchers could participate in philosophy conferences, expanding on the efforts of organizations such as the International Society for the History, Philosophy, and Social Studies of Biology; the Philosophy of Science Association; and the Society for Philosophy of Science in Practice.
- (ii) Host philosophers in scientific labs and departments. This is a powerful way (already explored by some of the authors and others) for philosophers to learn science and provide more appropriate and well-grounded analyses, and for researchers to benefit from philosophical inputs and acclimatize to philosophy more generally. This might be the most efficient way to help philosophy have a rapid and concrete impact on science.
- (iii) Co-supervise PhD students. The co-supervision of PhD students by a re-

searcher and a philosopher is an excellent opportunity to make possible the cross-feeding of the two fields. It facilitates the production of dissertations that are both experimentally rich and conceptually rigorous, and in the process, it trains the next generation of philosopher-scientists.

- (iv) Create curricula balanced in science and philosophy that foster a genuine dialogue between them. Some such curricula already exist in some countries, but expanding them should be a high priority. They can provide students in science with a perspective that better empowers them for the conceptual challenges of modern science and provide philosophers with a solid basis for the scientific knowledge that will maximize their impact on science. Science curricula might include a class in the history of science and in the philosophy of science. Philosophy curricula might include a science module.
- (v) Read science and philosophy. Reading science is indispensable for the practice of philosophy of science, but reading philosophy can also constitute a great source of inspiration for researchers as illustrated by some of the examples above. For example, journal clubs where both science and philosophy contributions are discussed constitute an efficient way to integrate philosophy and science.
- (vi) Open new sections devoted to philosophical and conceptual issues in science journals. This strategy would be an appropriate and compelling way to suggest that the philosophical and conceptual work is continuous with the experimental work, in so far as it is inspired by it, and can inspire it in return. It would also make philosophical reflections about a particular scientific domain much more visible to the relevant scientific community than when they are published in philosophy journals, which are rarely read by scientists.

We hope that the practical steps set out above will encourage a renaissance in the integration of science and philosophy. Furthermore, we argue that maintaining a close allegiance with philosophy will enhance the vitality of science. Modern science without philosophy will run up against a wall: the deluge of data within each field will make interpretation more and more difficult, neglect of breadth and his-

tory will further splinter and separate scientific subdisciplines, and the emphasis on methods and empirical results will drive shallower and shallower training of students. As Carl Woese wrote: “a society that permits biology to become an engineering discipline, that allows science to slip into the role of changing the living world without trying to understand it, is a danger to itself.” We need a reinvigoration of science at all levels, one that returns to us the benefits of close ties with philosophy.

For Authors’ institutions, Acknowledgements, Footnotes and References see [here](#).  
Inquiries to Thomas Pradeu: [thomas.pradeu@u-bordeaux.fr](mailto:thomas.pradeu@u-bordeaux.fr).

## Invitation to Submit Opinion Piece

In order to make better educational use of the wide geographical and disciplinary reach of this HPS&ST Note, 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 editor. 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 Note.

They will be archived in the OPINION folder at the HPS&ST web site:

<http://www.hpsst.com/>.

Previous HPS&ST Note Opinion Pieces at <http://www.hpsst.com/>

Thomas J.J. McCloughlin, School of STEM Education, Innovation & Global Studies, Dublin City University, Ireland, [Beware the Greeks: Sources for the History of Gravity in Science Teaching](#) (March 2019)

Bettina Bussmann, University of Salzburg, Austria & Mario Kötter, University of Muenster, Germany [Between Scientism and Relativism: Epistemic Competence as an Important Aim in Science and Philosophy Education](#) (February 2019)

Robin Attfield, Philosophy Department, Cardiff University, [Climate Change and Philosophy](#) (January 2019)

Dhyaneswaran Palanichamy & Bruce V. Lewenstein, School of Integrative Plant Science, Cornell University, [How History can Enable Better Teaching of Statistics in Introductory Biology Courses](#) (December 2018)

Frederick Grinnell, Biology Department, University of Texas, [Teaching research integrity – Using history and philosophy of science to introduce ideas about the ambiguity of research practice](#) (November 2018)

New York Times, [Creeping Bias in Research: Negative Results Are Glossed Over](#) (October 2018)

Michael Matthews, School of Education, UNSW, [An Occasion to Celebrate: Mario Bunge's 99th Birthday](#) (September 2018)

Cormac Ó Raifeartaigh, Waterford Institute of Technology, Ireland, [History of Science in Schools](#) (July 2018)

Hugh Lacey, Philosophy Department, Swarthmore College, [Appropriate Roles for Ethics and Social Values in Scientific Activity](#) (June 2018)

Gerald Holton, Physics Department, Harvard University, [Tracing Tom Kuhn's Evolution: A Personal Perspective](#) (April/May 2018)

Monica H. Green, History Department, Arizona State University, [On Learning How to Teach the Black Death](#) (March 2018).

Stephen Pinker, Psychology Department, Harvard University, [The Intellectual War on Science](#) (February 2018).

Michael Ruse, Philosophy Department, Florida State University, [Does Life Have Meaning? Or is it Self-Deception at Best and Terrifyingly Absurd at Worst?](#) (January 2018).

Mario Bunge, Philosophy Department, McGill University, [In Defence of Scientism](#) (December 2017).

Susan Haack, Philosophy and Law Departments, University of Miami, [The Future of Philosophy, the Seduction of Scientism](#) (November 2017).

Nicholas Maxwell, University College London, [What's Wrong with HPS and What Needs be Done to Put it Right?](#) (June 2017).

Heinz W. Drodste, [An Interview with Mario Bunge](#) (May 2017).

Nicholas Maxwell, University College London, [The Crisis of Our Times and What to do About It](#) (April 2017).

Eric Scerri, UCLA, [Bringing Science Down to Earth](#) (March 2017).

Robert Nola, University of Auckland, [Fake News in the Post-Truth World](#), (February 2017).

Michael D. Higgins, President of Ireland, [The Need to Teach Philosophy in Schools](#) (December 2016).

Philip A. Sullivan, University of Toronto, [What is wrong with Mathematics Teaching in Ontario?](#) (July 2016).

Gregory Radick, Leeds University, [How Mendel's legacy holds back the teaching of science](#) (June 2016).

Matthew Stanley, New York University, [Why Should Physicists Study History?](#)

## PhD Theses in HPS&ST Domain

This is a new section of the monthly HPS&ST Note. The Note is the ideal medium for publicizing 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](mailto: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.

## Recent HPS&ST Research Articles

Anguera, A., Lara, J.A., Lizcano, D. et al. (2019) Turing: The Great Unknown. *Foundations of Science*, 1-23. doi:[10.1007/s10699-019-09596-6](https://doi.org/10.1007/s10699-019-09596-6) online first

Antink-Meyer, A. & Brown, R.A. (2019) Nature of Engineering Knowledge: An Articulation for Science Learners with Nature of Science Understandings. *Science & Education*, 1-21. doi:[10.1007/s11191-019-00038-0](https://doi.org/10.1007/s11191-019-00038-0) online first

Becker, S. & Jacobsen, M. (2019) "How Can I Build a Model if I Don't Know the Answer to the Question?": Developing Student and Teacher Sky Scientist Ontologies Through Making. *International Journal of Science and Mathematics Education*, 1-18. doi:[10.1007/s10763-019-09953-8](https://doi.org/10.1007/s10763-019-09953-8) online first



- Brunner, J.L. (2019) Teachers' Use of Educative Features in Guides for Nature of Science Read-Alouds. *Science & Education*, 1-25. doi:[10.1007/s11191-019-00039-z](https://doi.org/10.1007/s11191-019-00039-z) online first
- de Boer, B. (2019) Gaston Bachelard's philosophy of science: between project and practice. *Parrhesia: A Journal of Critical Philosophy*, 31, 154-173  
<http://www.parrhesiajournal.org/index.html>.
- Donovan, B.M, et al. (2019) Toward a more humane genetics education: Learning about the social and quantitative complexities of human genetic variation research could reduce racial bias in adolescent and adult populations. *Science Education*, 1-32. doi:[10.1002/sci.21506](https://doi.org/10.1002/sci.21506) online first
- Joaquim, L. M., Freire Jr., O. & El-Hani, C. N. (2019). From Physics to Biology: Physicists in the Search for Systemic Biological Explanations. *European Journal for Philosophy of Science* 9(2): 30. doi:[10.1007/s13194-019-0254-8](https://doi.org/10.1007/s13194-019-0254-8) online first
- Khishfe, R. (2019) The transfer of nature of science understandings: a question of similarity and familiarity of contexts. *International Journal of Science Education*, 1-23. doi:[10.1080/09500693.2019.1596329](https://doi.org/10.1080/09500693.2019.1596329) online first
- Moura, B.A. (2018) Newtonian optics and the historiography of light in the 18th century: A critical analysis of Joseph Priestley's *The History of Optics*. *Transversal - International Journal for the Historiography of Science*, (5): 157-170.  
doi:[10.24117/10.24117/2526-2270.2018.i5.12](https://doi.org/10.24117/10.24117/2526-2270.2018.i5.12)
- Schubbach, A. (2019) Judging machines: philosophical aspects of deep learning. *Synthese*, 1- 21. doi:[10.1007/s11229-019-02167-z](https://doi.org/10.1007/s11229-019-02167-z) online first

## Recent HPS&ST Related Books

Asma, Stephen T., & Gabriel, Rami (2019) *The Emotional Mind: The Affective Roots of Culture and Cognition*. Cambridge, MA: Harvard University Press. ISBN 9780674980556

“With impressive mastery of the scientific and philosophical literature, *The Emotional Mind* is an ambitious work with sweeping scope and multidisciplinary character. Asma and Gabriel have written an impressively thorough volume, pulling together work in a variety of disciplines to present a detailed picture of the fundamental role of affective systems and processes in perception, cognition, decision-making, and social behavior.” – David Livingstone Smith, author of *Less than Human: Why We Demean, Enslave, and Exterminate Others*

“The power of the emotions in our lives is obvious, yet many people prefer to stress the intellectual side of our species. When philosophers turn to the emotions, as in this fascinating book, something magical happens. We get a far more realistic view of human affairs by grounding our psychology in age-old impulses and strivings.” – Frans de Waal, author of *Mama’s Last Hug: Animal Emotions and What They Tell Us about Ourselves*

“In *The Emotional Mind*, Asma and Gabriel have produced a scholarly work that adds significantly to the current literature. It uses cognitive science to show that affect is the neglected partner when it comes to imagining the construction of the modern human mind. This is a much-needed contribution.” – Antonio Damasio, author of *The Strange Order of Things: Life, Feeling, and the Making of Cultures*

More information available [here](#).

Auxier, Randall E., & Herstein, Gary L. (2019) *The Quantum of Explanation Whitehead’s Radical Empiricism*. Milton Park, UK: Routledge ISBN: 9780367258498

“*The Quantum of Explanation* advances a bold new theory of how explanation ought to be understood in philosophical and cosmological inquiries. Using a complete interpretation of Alfred North Whitehead’s philosophical and mathematical writings and an interpretive

structure that is essentially new, Auxier and Herstein argue that Whitehead has never been properly understood, nor has the depth and breadth of his contribution to the human search for knowledge been assimilated by his successors. This important book effectively applies Whitehead's philosophy to problems in the interpretation of science, empirical knowledge, and nature. It develops a new account of philosophical naturalism that will contribute to the current naturalism debate in both Analytic and Continental philosophy. Auxier and Herstein also draw attention to some of the most important differences between the process theology tradition and Whitehead's thought, arguing in favor of a Whiteheadian naturalism that is more or less independent of theological concerns. This book offers a clear and comprehensive introduction to Whitehead's philosophy and is an essential resource for students and scholars interested in American philosophy, the philosophy of mathematics and physics, and issues associated with naturalism, explanation and radical empiricism." (From the Publisher)

More information available [here](#).

Dardashti, Radin, Dawid, Richard, & Thébault, Karim (Eds.) (2019) *Why Trust a Theory? Epistemology of Fundamental Physics*. Cambridge, UK: Cambridge University Press. ISBN: 9781108470957

"Do we need to reconsider scientific methodology in light of modern physics? Has the traditional scientific method become outdated, does it need to be defended against dangerous incursions, or has it always been different from what the canonical view suggests? To what extent should we accept non-empirical strategies for scientific theory assessment? Many core aspects of contemporary fundamental physics are far from empirically well-confirmed. There is controversy on the epistemic status of the corresponding theories, in particular cosmic inflation, the multiverse, and string theory. This collection of es-

says is based on the high profile workshop ‘Why Trust a Theory?’ and provides interdisciplinary perspectives on empirical testing in fundamental physics from leading physicists, philosophers and historians of science. Integrating different contemporary and historical positions, it will be of interest to philosophers of science and physicists, as well as anyone interested in the foundations of contemporary science.” (From the Publisher)

More information available [here](#).

Lemons, Don S. (2019) *Thermodynamic Weirdness: From Fahrenheit to Clausius*. Cambridge, MA: MIT University Press. ISBN: 9780262039390

“Students of physics, chemistry, and engineering are taught classical thermodynamics through its methods—a “problems first” approach that neglects the subject’s concepts and intellectual structure. In *Thermodynamic Weirdness*, Don Lemons fills this gap, offering a nonmathematical account of the ideas of classical thermodynamics in all its non-Newtonian “weirdness.” By emphasizing the ideas and their relationship to one another, Lemons reveals the simplicity and coherence of classical thermodynamics.

“Lemons presents concepts in an order that is both chronological and logical, mapping the rise and fall of ideas in such a way that the ideas that were abandoned illuminate the ideas that took their place. Selections from primary sources, including writings by Daniel Fahrenheit, Antoine Lavoisier, James Joule, and others, appear at the end of most chapters. Lemons covers the invention of temperature; heat as a form of motion or as a material fluid; Carnot’s analysis of heat engines; William Thomson (later Lord Kelvin) and his two definitions of absolute temperature; and energy as the mechanical equivalent of heat. He explains early versions of the first and second laws of thermodynamics; entropy and the law of entropy non-decrease; the differing views

of Lord Kelvin and Rudolf Clausius on the fate of the universe; the zeroth and third laws of thermodynamics; and Einstein's assessment of classical thermodynamics as "the only physical theory of universal content which I am convinced will never be overthrown." (From the Publisher)

More information available [here](#).

Lenhard, Johannes (2019) *Calculated Surprises: A Philosophy of Computer Simulation*. Oxford, UK: Oxford University Press. ISBN: 9780190873288

"If all philosophy starts with wondering, then *Calculated Surprises* starts with wondering about how computers are changing the face and inner workings of science. In this book, Lenhard concentrates on the ways in which computers and simulation are transforming the established conception of mathematical modeling. His core thesis is that simulation modeling constitutes a new mode of mathematical modeling that rearranges and inverts key features of the established conception. Although most of these new key features—such as experimentation, exploration, or epistemic opacity—have their precursors, the new ways in which they are being combined is generating a distinctive style of scientific reasoning. Lenhard also documents how simulation is affecting fundamental concepts of solution, understanding, and validation. He feeds these transformations back into philosophy of science, thereby opening up new perspectives on longstanding oppositions.

"By combining historical investigations with practical aspects, *Calculated Surprises* is accessible for a broad audience of readers. Numerous case studies covering a wide range of simulation techniques are balanced with broad reflections on science and technology.

"Initially, what computers are good at is calculating with a speed and accuracy far beyond human capabilities. Lenhard goes further and

investigates the emerging characteristics of computer-based modeling, showing how this simple observation is creating a number of surprising challenges for the methodology and epistemology of science. These calculated surprises will attract both philosophers and scientific practitioners who are interested in reflecting on recent developments in science and technology”. (From the Publisher)

More information available [here](#).

Levere, Trevor H. (2019) *Transforming Matter: A History of Chemistry from Alchemy to the Buckyball*. Baltimore, MD: Johns Hopkins University Press. ISBN: 9780801866104

“Chemistry explores the way atoms interact, the constitution of the stars, and the human genome. Knowledge of chemistry makes it possible for us to manufacture dyes and antibiotics, metallic alloys, and other materials that contribute to the necessities and luxuries of human life. In *Transforming Matter*, noted historian Trevor H. Levere emphasizes that understanding the history of these developments helps us to appreciate the achievements of generations of chemists.

“Levere examines the dynamic rise of chemistry from the study of alchemy in the seventeenth century to the development of organic and inorganic chemistry in the age of government-funded research and corporate giants. In the past two centuries, he points out, the number of known elements has quadrupled. And because of synthesis, chemistry has increasingly become a science that creates much of what it studies.

“Throughout the book, Levere follows a number of recurring themes: theories about the elements, the need for classification, the status of chemical science, and the relationship between practice and theory. He illustrates these themes by concentrating on some of chemistry’s

most influential and innovative practitioners. *Transforming Matter* provides an accessible and clearly written introduction to the history of chemistry, telling the story of how the discipline has developed over the years.” (From the Publishers)

More information available [here](#).

Malabou, Catherine (2019) *Morphing Intelligence: From IQ Measurement to Artificial Brains* (Carolyn Shread, Trans.) New York, NY: Columbia University Press. ISBN: 9780231187367

“In this remarkable book Catherine Malabou focuses on the transformations of “intelligence” as it moves from genetics to epigenetics to automatism. Historically grounded, philosophically astute, and engagingly written, this book is highly recommended for anyone interested in intelligence–artificial and natural–and in contemporary configurations of what counts as human.” – N. Katherine Hayles, author of *Unthought: The Power of the Cognitive Nonconscious*

“Catherine Malabou is one of the rare philosophers who seriously engages contemporary biological research in her explorations of human experience. In this book, she turns her attention to the core question of intelligence, and with spectacular results. At stake is the very future of human thought, and Malabou is led to reflect on machine intelligence for the first time, generating singular insights. As ever, Malabou’s prose is precise and elegant, deftly expressed in Carolyn Shread’s fluid translation.” – David Bates, author of *Plasticity and Pathology: On the Formation of the Neural Subject*

“Morphing Intelligence contains significant new developments in Malabou’s ongoing work at the intersections of philosophy and the sciences. She moves from her groundbreaking theoretical reflections on neuroplasticity and epigenetics to a philosophical confrontation with the vari-

ous challenges posed by today's emerging forms of artificial intelligence. Malabou, with her characteristic clarity and insight, radically redraws the lines between humans and machines, brains and computers. *Morphing Intelligence* is a major achievement and not to be missed.” – Adrian Johnston, author of *A New German Idealism Hegel, Žižek, and Dialectical Materialism*

More information available [here](#).

Mantzavinos, Chrysostomos (2018) *A Dialogue on Explanation*. Dordrecht: Springer. ISBN 978-3-030-05834-0

“This book introduces a panorama of the philosophical theory of explanation. Written as a philosophical dialogue between two interlocutors, Philip and a student, it presents a defense of the position of explanatory pluralism.

“The fictional dialogue takes place on Cape Sounion, near Athens, where the two interlocutors are enjoying the view over the Aegean Sea. An initial exchange of arguments leads to a dialogue unfolding the development of the contemporary philosophical theory of explanation. The second part of the dialogue is devoted to an exchange of arguments on explanatory pluralism as a novel approach to the philosophical theory of explanation. The two also discuss historical cases as well as the ways of achieving explanatory progress in science.

“We are all philosophers and we develop our own philosophy by exchanging views and arguments. The dialogue form is and should remain the principal form of philosophizing, since ideas do not merely exist – they develop. This is certainly the case in real-world philosophical interaction, and as this book aptly demonstrates, it can also be the case in written philosophical exposition.” (From the Publisher)



More information available [here](#).

Mindell, David A. (2019) *Between Human and Machine: Feedback, Control, and Computing before Cybernetics*. Baltimore, MD: Johns Hopkins University Press. ISBN: 9780801880575

“This is a terrific book, well written and distinguished for its solid scholarship, technical expertise, and historical sophistication.” – Michael S. Mahoney, Princeton University

“David Mindell’s *Between Human and Machine* successfully takes on the daunting task of exploring the machines behind the cybernetic decades of mid-century. It is a book of range and depth, moving from the sophisticated new weapons systems of World War II to the technologies, including the computer, that so marked the postwar era. By digging deep into the machines themselves, into the problems of feedback and stability—but also into management and political context—Mindell brings us a real sense of this transformative moment in the history of technical culture. The implications of this alteration in the concept of a machine will be with us for a long time to come, and this book is a first-rate place to understand its origins.” – Peter L. Galison, Harvard University

“Mindell’s authoritative mastery of the disparate technologies he traces will secure this book an influential place in the historiography of science and technology in World War II.” – Alex Roland, Duke University

“Masterful! *Between Human and Machine* is an insightful and highly readable account of the people and the ideas that paved the way for modern computing.” – M. Mitchell Waldrop, author of *Dream Machine: J.C.R. Licklider and the Revolution that Made Computing Personal*

More information available [here](#).

Rowbottom, Darrell P. (2019) *The Instrument of Science: Scientific Anti-Realism Revitalised*. Milton Park, UK: Routledge. ISBN: 9780367077457

“This accessible and engaging defence of instrumentalism is essential reading for all those interested in the debate between realism and instrumentalism in the philosophy of science.” – Jon Williamson, University of Kent, UK

“Analyzing fascinating examples from the history of science, this book builds a compelling and carefully argued case for cognitive instrumentalism: that is, for a philosophy of science that takes seriously what we can understand, and do, with science in the world as we experience it.” – Axel Gelfert, Technical University of Berlin, Germany

More information available [here](#).

Ruse, Michael (2019) *The Darwinian Revolution*. Cambridge, UK: Cambridge University Press. ISBN: 9781108727839

“What is the Darwinian revolution and why is it important for philosophers? These are the questions tackled in this Element. In four sections, the topics covered are the story of the revolution, the question of whether it really was a revolution, the nature of the revolution, and the implications for philosophy, both epistemology and ethics.” (From the Publishers)

More information available [here](#).

Authors of HPS&ST-related papers and books are invited to bring them to attention of the Note’s assistant editors, Paulo Maurício at [paulo.asterix@gmail.com](mailto:paulo.asterix@gmail.com) or Nathan Oseroff-Spicer at [nathanoserooff@gmail.com](mailto:nathanoserooff@gmail.com) for inclusion in these sections.

## Coming HPS&ST Related Conferences

April 11-13, 2019, Formal Methods and Science in Philosophy III, Dubrovnik, Croatia

Details at: <https://www.iuc.hr/conference-details.php?id=326>

April 24-26, 2019, British Society for the History of Philosophy Annual Conference, King's College London. Strand Campus, London, UK.

Details available [here](#).

May 13-16, 2019, Second Hermann Minkowski Meeting on the Foundations of Spacetime Physics, Albena, Bulgaria

Details available [here](#)

May 27-29, 2019, Eddington Conference, Paris, France.

Details at: <https://www.eddingtonstudies.org/>

May 29-31, 2019, Plastics Heritage: History, Limits and Possibilities. Museu da Farmácia (Pharmacy Museum) in Lisbon, Portugal

Details available [here](#)

July 7-12, 2019, International Society for the History, Philosophy and Social Studies of Biology meeting (ISHPSSB), Oslo, Norway.

Abstracts deadline: 18 January 2019

Details available [here](#)

July 10-13, 2019, British Society for the History of Science meeting, Edinburgh, UK.

Details at: <http://www.bshs.org.uk>

July 15-19, 2019, International History, Philosophy and Science Teaching Group, Biennial Conference, Thessaloniki, Greece.

Details from conference chair, Fanny Seroglou, [fannyseroglou@gmail.com](mailto:fannyseroglou@gmail.com)

July 25-27, 2019, Learning From Empirical Approaches to HPS 2019 (LEAHPS 2019),

Leibniz University, Hannover, Germany  
Details at: <https://leaphs2019.wordpress.com/>

July 22-26, 2019, The 46th Annual Hume Society Conference, University of Nevada, Reno, NV, USA.  
Details available [here](#).

July 26-28, 2019, 4th International Periodic Table Conference: 'Mendeleev 150', ITMO University, St Petersburg, Russia  
Details available [here](#).

August 5-10, 2019, 16th Congress of Logic, Methodology and Philosophy of Science and Technology (CLMPST), Prague, Czech Republic.  
For updates and details see [here](#).

August 27-30, 2019, 12th International Whitehead Conference, University of Brasilia, Brazil.  
Details at: <https://www.whitehead2019.org/>

September 2-4, 2019. European Conference for Cognitive Science (EuroCogSci 2019), Ruhr-Universität Bochum, Germany.  
More information: [EuroCogSci2019@rub.de](mailto:EuroCogSci2019@rub.de).

September 19-21, 2019, Experimental Philosophy Conference, University of Bern, Switzerland.  
More information available [here](#).

October 29-30, 2019, 'Scientific Literacy for All' Conference, Beijing Normal University, China.  
More information available [here](#).  
Email: [bnukxts@126.com](mailto:bnukxts@126.com).

December 7-11, 2019, Philosophy of Education Society of Australasia (PESA) Annual Conference, University of Hong Kong.  
More information: <https://pesa.org.au/conference>