HPS&ST NEWSLETTER

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The HPS&ST NEWSLETTER is emailed monthly to about 9,500 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 40+ 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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HPS&ST Newsletter Assistant Editors Appointed

Pleasingly, three regional assistant editors have been appointed to join Paulo Maurício (Lisbon) and Nathan Oseroff-Spicer (London). Notices of HPS&ST related meetings, conferences, publications, website, or activities can be sent direct to relevant assistant editors whose details and emails are given below.

North America

Thomas L. Isenhour is an analytical chemist with a BS degree from the University of North Carolina and a PhD from Cornell. His expertise includes nuclear analytical chemistry, spectroscopy, and data interpretation. He is a teacher, researcher, administer, and consultant to industry and government. He has taught more than 20,000 students in chemistry, environmental science, mathematics and the history of science.

He recently completed a five-year term as Provost and Vice President for Academic Affairs at Old Dominion University, VA.

He has recently been a member of People-To-People Ambassador delegations to China, South Africa, Brazil, and India as well as traveling to meetings and excursions in about 50 other countries. A recent book he has authored is *The Evolution of Modern Science* (Bookboon 2013)

Latin America

Nathan Lima is a professor at the Federal University of Rio Grande do Sul, Porto Alegre, Brazil. He works in teacher training; has a degree in Physics and a PhD in Physics Education. He has been a teacher at Federal Center for Technological Education in Rio de Janeiro. During this period, he worked with Prof. Guerra (current president of the IHPST), learning about Cultural History of Science and is a partner in her research group.

Given the current situation in the world and especially in Brazil, he researches the relations between epistemic and political practices. First, the prob-

lem of post-truth and its implications for science education. Second the political and epistemic clashes in the management of COVID-19 in Brazil.

Asia

Huang Xiao is Associate Dean and Professor of Teachers Education College in Zhejiang Normal University, China. Her first degree is in Physics having studied quantum statistics and quantum mechanics in Department of Physics, East China Normal University. She has had visiting research appointments at Ohio State University, Cardiff University, Hong Kong Institute of Education, and the Illinois Institute of Technology (2014-15) where she worked with Judy and Norm Lederman.

Her research fields include the history and philosophy of science, scientific inquiry and nature of science, and STEM education.

She participated in one project of the National Natural Science Foundation of China and one project of philosophy and social sciences of Zhejiang Province.

She was a co-translator (with Liu Enshan and Guo Yuanlin) into Chinese of Michael Matthews' book, *Science Teaching: The Contribution of HPS* (2015).

Science & Education Journal

Science & Education journal first appeared in 1992, with four numbers per year. It was the first research journal dedicated to the application of historical, sociological and philosophical scholarship to theoretical, curricular and pedagogical problems in the teaching of science. Editors have been Michael Matthews (1992-2015), Kostas Kampourakis (2015-20), Sibel Erduran (2020-).

Contributors include a long list of major contemporary philosophers and historians, as well as philosophers of education, cognitive scientists and science educators. Due to the quantity and quality of manuscripts submitted, the journal has progressively grown to ten numbers per volume.

The journal has been, on all measures, very successful. In 2020 there were 248,479 article downloads.

The impact factor of the journal has gone up to 2.114 in 2020 from 1.266 in 2019. Other metrics include: Education & Educational Research Journal Citation Indicator: 163/722, Quartile 1, 77.49 percentile in 2020 – as compared to 163/258, Quartile 3, 37.02 percentile in 2019. History & Philosophy of Science Journal Citation Indicator: 18/104, Quartile 1,

83.17 percentile in 2020 – as compared to 19/74, Quartile 2, 75 percentile in 2019 In terms of rank by journal impact factor for Education & Educational Research, the journal went up from 179/263 to 151/264 (Q3, 42.99 JIF percentile). Overall, these trends are very promising and shows that the journal continues to be a strong platform for research in History & Philosophy of Science and continues to improve its impact in the Education & Educational Research category.

Editor-in-Chief
Sibel Erduran, University of Oxford, UK
Associate Editors: Olivia Levrini (University of Bologna), Mauricio Pietrocola (University of Saõ Paulo) Book Review Editor: Gabor Zemplen (Eötvös Loránd University)

Alison Cullinane, Department of Education, University of Oxford. Her research interests include teacher education, nature of science, practical science and assessment. She is in year two of a two-year post as Strand 13 co-ordinator for the NARST conference. She has a BSc.ED, an MSc and a PhD in Science Education all from the University of Limerick, Ireland. She is also currently involved in the Horizon 2020 project, FEDORA. This is a European project that is addressing the future needs of science education.

NARST Strand 13: History, Philosophy, Sociology, and Nature of Science

The National Association for Research in Science Teaching is holding its annual conference in Vancouver, BC, 27-30, March 2022.

For 20 years or more, Strand 13 of the NARST conference has been devoted to papers and symposia relating to 'History, Philosophy, Sociology, and Nature of Science'. Relevant papers are encouraged, and need be submitted by August 15 HERE.

Strand Coordinators

Gunkut Mesci, Department of Mathematics and

Science Education, Giresun University, Turkey. He has a PhD (2016), and an MS (2012) in Science Education both from the Western Michigan University. He was a Visiting Scholar in the Department of Mathematics and Science Education at the University of Georgia, 2019 - 2020.

He has taught a number of science education courses across different institutions in the U.S and Turkey. He is in the first year of a two-year post as Strand 13 coordinator.

Forum on the History of Physics, 2021 Essay Contest

The Forum on the History of Physics (FHP) of the American Physical Society is proud to announce the 2021 History of Physics Essay Contest.

The contest is designed to promote interest in the history of physics among those not, or not yet, professionally engaged in the subject. Entries can address the work of individual physicists, teams of physicists, physics discoveries, or other appropriate topics. Entries should not exceed 2,500 words, including notes and references. Entries should be both scholarly and generally accessible to scientists and historians.

The contest is intended for undergraduate and graduate students but is open to anyone without a Ph.D. in either physics or history. Entries with multiple authors will not be accepted. Entries will be judged on originality, clarity, and potential to contribute to the field. Previously published work, or excerpts thereof, will not be accepted. The winning essay will be published as a Back Page in APS News and its author will receive a cash award of $1,000, plus support for travel to an APS annual meeting to deliver a talk based on the essay. The judges may also designate one or more runners-up, with a cash award of $500 each.

Entries will be judged by members of the FHP Executive Committee and are **due by September 1, 2021**. They should be submitted, as Word documents or pdfs, by emailing fhp@aps.org with "Essay Contest" in the subject line. Entrants should supply their names, institutional affiliations (if any), mail and email addresses, and phone numbers. Winners will be announced by October 1, 2021.

The Forum on the History and Philosophy of Physics, established in 1980, brings together physicists, historians, and other members of APS with an interest in the history of physics and its impact on culture, education, and physics research itself. The Forum issues a semiannual Newsletter and organises and sponsors sessions at the March Meeting and April Meeting.

British Society for the History of Science, Summer Conference

The British Society for the History of Science (BSHS) is delighted to publish the full schedule for its online summer conference, running next week from 13th to 15th July. Please visit the conference website to discover the many panels, papers, discussions and social events that comprise this year's event. Last year saw 1500 people from around the world attending our festival, and we look forward to welcoming many scholars and interested parties again next week. There is no registration process and every event is **free** to attend, but you will need to sign up to access each session on the website. If you miss an event, you will

be able to catch it on demand later (provided participants have agreed to recording) via the same link. Questions about the conference may be directed to conferences@bshs.org.uk. If you enjoy the conference, the BSHS warmly invites you to become a member, to support our continuing work in supporting research, grants, outreach, prizes, conferences and more. Rates start at just £20/year.

Professor Charlotte Sleigh
President, British Society for the History of Science

First Meeting on History and Philosophy of Physics Education in Southern Brazil

The First Meeting on History and Philosophy of Physics Education in Southern Brazil ran from May 26th through May 28th, organised by the following professors from universities in Southern Brazil: Cleci da Rosa (University of Passo Fundo), Nathan Lima (Federal University of Rio Grande do Sul), João Harres (Pontifical Catholic University of Rio Grande do Sul), Marcia Saito (Federal Institute of Paraná) and Marinês Cordeiro (Federal University of Santa Catarina).

The meeting featured speeches, roundtables, and work presentations by undergraduate and graduate students. The meeting attracted 133 participants, and 48 works were presented. The speeches were given by Ricardo Karam (University of Copenhagen), Olival Freire (Federal University of Bahia), Andreia Guerra (CEFET-RJ and President of IHPST), Agustín Adúriz-Bravo (University of Buenos Aires), Ivã Gurgel (University of São Paulo) and Eduardo Barra (Federal University of Paraná). The speeches and roundtables were held in Portuguese and can be watched here.

The meeting's website is available here.

Transformational HPS Network

A new international network for historians and philosophers of science called 'Transformational HPS' has been formed.

Transformational HPS exists to support and promote research at three specific intersections with the History and Philosophy of Science:

- research queering HPS
- research decolonising or making global views of HPS
- research integrating disability studies and HPS

The range of possible activities which the network intends to participate in is quite extensive, but is primarily dedicated to making a larger number of researchers and students familiar with the possibilities for historiographical and philosophical development in these areas. A visitor to the site will find some initial resources supplied by the members, including lists of their relevant publications and topical reading lists. These resources will grow over time.

Some university departments and scholarly societies have started to increase the representation

of and support available to students and researchers belonging to marginalised groups, including people of colour, queer people, disabled people, and trans people. There are also some existing international organisations and groups working to such ends. For example, Minorities and Philosophy aims to generally secure the position of scholars from minority groups in philosophy, and in the history of science, Science Beyond the West is a focal point for those interested in globalising and/or decolonising the history of science. Transformational HPS is intended to tie together such efforts, across our three strands of interest, so that they might rise together.

Further details about the membership, and how to become a member can be found on the network website:

http://www.transformationalhps.org/.

To contact the network please write to any of the existing members listed on the above website.

University of Pittsburgh Centre for Philosophy of Science

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Beginning July 12th!
Meet the class of 2021 and participating faculty: https://www.centerphilsci.pitt.edu/psp5-2/

VISITORS

2021-22 Senior Visiting Fellow: Heather Douglas
2021-22 Postdoctoral Fellows: Ravit Dotan and Aydin Mohseni
Fall 2021 Visiting Fellows: Brian McLoone, Matthew Parker, Hyundeuk Cheon, Anthony Beavers, and Darrell Rowbottom

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The mission of *Philosophy of Medicine* is to serve as the flagship journal for the field by advancing research in philosophy of medicine, by engaging widely with medicine, health sciences and the public, and by providing open-access content for all.
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Sponsorship for the journal is provided by the Center for Philosophy of Science.

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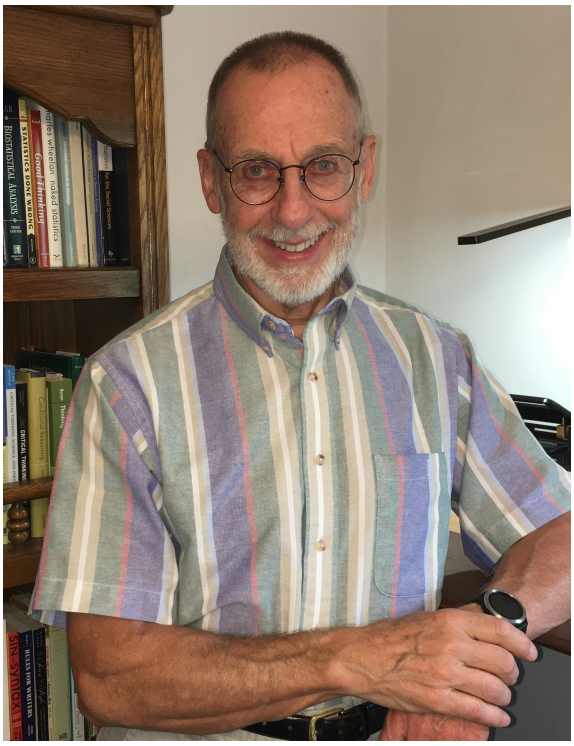

The Usefulness of Popper: A Scientist's Response to Professor Charlotte Sleigh

Bradley E. Alger, Professor Emeritus, University of Maryland School of Medicine

Bradley Alger ran a neuroscience research laboratory and taught graduate and medical students at the University of Maryland School of Medicine for over 35 years. He and his colleagues made fundamental discoveries in the neurophysiology of the mammalian brain, publishing over 100 research papers with a major focus on the regulation of inhibitory systems by natural processes, including endogenous cannabinoids, "the brain's own marijuana." He retired from active research in 2014.

Alger was educated at the University of California, Berkley and Harvard University and did his postdoctoral work with Roger A. Nicoll, at the University of California, San Francisco. His book, *Defense of the Scientific Hypothesis: From Reproducibility Crisis to Big Data*, was published by Oxford University Press in 2019.

His YouTube series of short videos on topics from the book can be found here.

Introduction

In "The Abuses of Popper," (*Aeon*, February, 2021; *hps&st*, April 2021) historian Charlotte Sleigh comprehensively dismantles the philosophy of Karl Popper. She sees Popper's foundational principle of "falsification" as a relic of a long-discredited philosophy; less than worthless, a net negative within philosophy of science, the scientific community, and in politics.

As a scientist and a Popperian, I write in response to Professor Sleigh. I argue that Sleigh's premise is flawed and hence much of her argument is misguided. I also go over some serious negative consequences that would follow if science abandoned Popper's pragmatic philosophy.

Her argument has four stages: first, the premise: long ago, Popper's principle of falsification was "quickly demolished by philosophers". This creates a mystery: how to understand its lasting popularity among scientists? Second, the "solution" of the mystery: a small cohort of influential scient-

ists and economists made anxious by unfavourable perceptions of their fields, craved public and professional respect. Popperianism was ideally suited to image rehabilitation, and they embraced the man and his program. Third, linkage of scientific and ethical concerns: the men in the cohort identified scientific practice in general with Popperian procedures. Thus, Sleigh infers, if science goes wrong, Popper is wrong: 'falsification offers moral non-accountability to its adherents'. And science goes wrong when it associates with eugenics, nuclear weapons, and especially, the collection of doctrines called *neoliberalism*. Hence, Popper is guilty of providing an intellectual smokescreen for these undesirable moral doctrines. Fourth and finally, Sleigh pinpoints falsification as the Popperian doctrine that is responsible for maiming the public's ability to understand crucial societal debates related to, e.g., social inequality, poverty, the abuse of labor, and the dangers of tobacco smoking and global climate change. These are sins for which Popperians must answer.

Professor Sleigh implies that bad societal outcomes inevitably result from Popper's scientific methodology. However, defending his scientific philosophy, as I will do, does not imply defence of the social and political movements, which I can't comment on. I will show that in her zeal to condemn neoliberalism, she condemns Popper's useful approach for conducting science. This skews her account and undermines the very causes she is most passionate about.

As everyone may not be familiar with Popper's thought, I'll briefly review two key concepts. The first is the *scientific hypothesis* (not the statistical one, which is an entirely different thing; "hypothesis," as used here, always means "scientific hypothesis"). The second is fallibilism. "Fallibilism tells us that there is no conclusive justification and no rational certainty for any of our beliefs or theses" (The Internet Encyclopedia of Philosophy).

A hypothesis is a proposed explanation for some aspect of nature (I won't distinguish among *hypotheses*, *theories*, and *laws* as they share many properties). The fundamental goal of science is to understand nature, and hypotheses are key to achieving it. A hypothesis is proposed as a true account of why things are the way they are. It must also be testable and *falsifiable*, i.e., there must be, in principle, at least one experiment or observation that would, if the results came out a certain way, imply that the hypothesis is false.

What about fallibilism? Probably all scientists and most philosophers are fallibilists. They understand that there is residual doubt about any explanation for an empirical phenomenon at some level of analysis. We can't be 100% certain that any scientific hypothesis is correct in every detail. Even cursory reflection on the many historical scientific "facts" that eventually turned out to be false conveys the fallibilistic world view. Sleigh appears to dismiss fallibilism but doesn't engage directly with it and says little about how science works.

Popperian scientific methodology – some basics

Anyone who accepts fallibilism and believes that science is intent on discovering truths about the world must say how science can make progress if everything it learns is uncertain to some degree. According to Sleigh, the Popperians' view of science "doesn't presume to provide the final answer to any question, but contents itself with trying to disprove things. Science, so the Popperians claim, is an implacable machine for destroying

falsehoods."

The first and last parts of this claim (no "final answers" and "destroying falsehoods") are accurate, but the middle—"contents itself with trying to disprove things"—is flagrantly misleading. What does it mean, exactly? That Popperians believe that disproof is all there is to science? That Popperian science is "content" with a collection of falsified hypotheses? Simply incorrect.

The Popperian approach is simple: if empirical results and a complex theoretical system, including our scientific hypothesis, contradict one another, something must be wrong, and it is the scientist's duty to locate the error; if everything remains consistent, then we could be right, but we can never know. Ordinarily, scientists deduce and empirically test predictions from a hypothesis. Disagreement between predicted and observed results suggests the hypothesis is false, whereas agreement between them means the hypothesis could be correct. This is progress and is the essence of his falsification strategy. Popperians are vitally interested in getting to the truth about nature, they want to explain and understand it and will not be content with anything less. They accept that the best that basic scientists can do is to avoid believing in falsehoods. But their process produces much more than destroyed falsehoods.

Recall that a hypothesis is proposed as a *true explanation*. A tested-and-not-falsified hypothesis then is, by supposition, true – as far as we know, and it remains a viable avenue for exploration and inquiry– and we use it to make further discoveries. Moreover, when action is called for (e.g., we must build a bridge), Popper recommends basing our actions on the most severely tested-and-not-falsified (he calls them *corroborated*) hypotheses that we have. There is a distinction between the ideal goal of ultimate truths about nature, and the functional goal of guiding real-world actions. Basic science seeks ultimate truths; applied science settles for the best hypotheses available—and we are to understand 'best' as 'surviving our most rigorous attempts to show it is false'. Thus, falsification, the acid test of all hypotheses, has both theoretical and practical applications.

Of course, science is not only about generating or testing formal hypotheses. Scientists have always gathered information and made inferences without hypotheses and Popper saw these activities as normal aspects of science. Psychological or cognitive processes, such as induction or generalisation, were outside his interests. And he recognised that the scientific community collectively judges scientific claims. None of these features contradicts or supersedes his thinking. Only when observations need explanations, when the question, "why?" must be answered, does the falsification program kick in.

Plainly, there are major differences between the goals of Popperian hypothesis-testing and its *methods* (determinedly filtering out falsehood). Failure to recognise this is a mistake. Science is possible though "proof" is impossible. It is *the fantasy of attaining certainty that must be abandoned*.

Was Popper vanquished by "philosophy?"

When Professor Sleigh says that philosophers demolished Popper's falsification program, she alludes to the argument advanced by Pierre Duhem and W.V.O. Quine (cf. Harding, ed.). The gist of the Duhem-Quine Thesis (sometimes called "holism") is that all hypotheses depend on other auxiliary hypotheses, which in turn depend on others,

etc. As each hypothesis is entangled in a web of other hypotheses, we cannot test any one of them in isolation, let alone falsify it. Here's an example: a biologist who uses a microscope to test her biological hypothesis about a tiny organism implicitly accepts all hypotheses that make up the science of optics. These are "auxiliary" hypotheses. If an auxiliary hypothesis about how light interacted with her biological material were incorrect, then she could misinterpret what the results meant for her biological hypothesis. This very argument was made when Galileo first reported observing the moons of Jupiter – skeptics said they were artefacts of the strange new device, the telescope, that he used. In fact, any observation might have explanations not involving the original hypothesis. This means, so the argument goes, that Popperian falsification cannot work.

But the conclusion is false. First, practically speaking, it must be possible for scientists to falsify scientific hypotheses in principle since scientists have already tested and falsified countless hypotheses in practice: Galileo's observations of Jupiter's moons falsified major facets of Aristotelian cosmology, the famous Michelson-Morley experiment effectively falsified the hypothesis that light traveled through a luminiferous ether, tests of Einstein's theory of General Relativity falsified Newton's theory of gravity, etc. And these are just a few historically noteworthy cases. Every day, scientists in laboratories around the world test and falsify more mundane hypotheses. How do they do that given Duhem's insight (which is undisputed, even by Popper)?

Philosophers re-evaluate; falsification actually can work

Popper was a Duhemian holist. In fact, the first time Popper sets out his criterion for demarcation in The Logic of Scientific Discovery, he says, '…it must be possible for an *empirical scientific system* to be refuted by experience' (Popper 1959, p. 18, emphasis added).

Even critical philosophers came to agree that the principle of falsification has merit. By 1969 Quine had modified his earlier opinion that the Duhem-Quine thesis implied that "the unit of empirical significance is the whole of science" and arrived at the same position as Popper: a sufficiently tight-knit system of theoretical statements on its own can contract experience. While he still agreed with Duhem that hypotheses were inextricably embedded in webs, he now proclaimed that "theories" were valid units of empirical significance that could be tested. As Quine (1991, 286) said, focusing on the "whole of science",

> This [statement] is true enough in a legalistic sort of way, but it diverts attention from what is more to the point: the varying degrees of proximity to observation…I have invoked not the whole of science but chunks of it, clusters of sentences just inclusive enough to have critical semantic mass. But this I mean a cluster sufficient to imply an observable effect of an observable experimental condition.

A theory, one form of "cluster of sentences", is also a web of hypotheses, but the component hypotheses are taken together as a single conceptual entity. A theory makes predictions about the world, and we can test it by seeing if its predictions work out. Thus, says Quine, while no single component hypothesis can be tested in isolation, a theory can be tested and falsified wholesale (his rationale

is somewhat involved and not strictly germane). Naturally, if the theory is falsified, we won't know which of its component hypotheses to blame, as both Quine and Popper readily recognised. Nevertheless, Quine's acknowledgement that falsification is possible is a significant development that Professor Sleigh's account omits.

Next, note that Quine's revised view presupposes a sharp distinction between hypotheses and theories. Yet, the Duhem-Quine Thesis blurred the distinction. The Thesis states that a hypothesis is not a simple, unitary statement but a web of hypotheses; a central hypothesis plus auxiliary hypotheses. Thus the hypothesis, as a complex entity makes predictions and can be tested and potentially falsified if its predictions fail. As always, if the hypothesis is falsified, we won't know whether the central hypothesis or an auxiliary hypothesis is to blame. A hypothesis, in other words, is equivalent to a "mini-theory." The important point is that re-interpretation of hypothesis as suggested by the Duhem-Quine Thesis shows how to understand Popperian hypothesis-testing in a rational way.

How science deals with the problems caused by the Duhem-Quine Thesis

Although few scientists know about the Duhem-Quine Thesis, an appreciation for the difficulties it creates is baked into their bones. Their strategies for coping with it include:

1. "calibration experiments" to ensure that their instruments do what they're supposed to (Galileo's telescope worked fine when trained on familiar earthbound objects),
2. "control experiments" where experimental variables that could provide alternative explanations are systematically manipulated while the one of interest is held constant;
3. multiple kinds of experiments to test separate predictions of a given hypothesis – different instruments, chemicals, subjects, etc. Finally,
4. replication; the strength of a finding is amplified when it is independently confirmed in several laboratories.

Each technique enmeshes the central hypothesis in a different web of hypotheses. Because the central hypothesis alone remains constant, experimental conclusions that converge across varying conditions are probably attributable to it, rather than to any auxiliary hypothesis. Consistency of results justifies placing greater confidence in a central hypothesis, whether for practical or theoretical purposes.

In summary, hypothesis-testing by falsification is more complex and nuanced than we might naïvely have expected. The principle of falsification has not been demolished and remains a useful tool. Scientists understand that alternative explanations are conceivable and that "falsification is never final." Science, in Popper's world view, is a process; not a vault loaded with incontestable facts.

Are some hypotheses off-limits?

Professor Sleigh claims that the existence of "protected" hypotheses that are supposedly off-limits to questioning is another flaw in Popper's program. But there are no such hypotheses. Popper's "supreme" methodological rule (Popper, 1959, 33) is that no genuine scientific statement can be protected against falsification. Scientists do frequently find it convenient to assume, temporar-

ily, that a well-corroborated hypothesis is true to foster progress in both the laboratory and the real world. Nonetheless, all hypotheses are open to challenge.

Indeed, testing and rejecting firmly established hypotheses can lead to extraordinary advances and career rewards. Here's an example from neuroscience. Since the late 1800's, an elemental hypothesis has been that the nerve cell (neuron) alone carries out the brain's information-processing activity. All the textbooks said so. We now know this hypothesis is false. It appears that glia cells, non-neuronal cells, are vital partners in brain signalling. The neuron hypothesis was a good-enough approximation to allow many discoveries that did not hinge on recognising glial cell involvement to be made. Like Newton's law of gravity, the old idea continued to be useful even as its deeper inadequacies emerged. No matter how useful, however, the neuron hypothesis was doomed as new methods and instruments permitted it to be tested in ever finer ways. Popper would have applauded.

Scientists and their support for Popper

Sleigh associates Popper and some of his admirers with reactionary intellectual and political movements. I cannot critique her account (Shearmur, HPS&ST, May 2021, rebuts her charge of Popper's neoliberalism) beyond noting that she doesn't make a compelling case that the association between Popperianism and the movements is necessary or causal, i.e., that Popper's ideas must lead to evil societal outcomes. Her characterisation of the scientists who supported Popper is certainly misleading. Despite its including John Eccles and Peter Medawar (both Nobel Prize winners), and Herman Bondi, Sleigh sums up the group as primarily scientists whose work "could least easily be potted in an attempted laboratory disproof," and therefore "turned to Popper for vindication." In fact, Medawar's Prize was for work that critically tested, and corroborated, an important hypothesis in immunology. Similarly, Eccles was well known for having, early-on, leaned toward the electrical ("spark") hypothesis of neuronal communication, against the competing, chemical ("soup") hypothesis. When refinement of experimental techniques allowed, he directly tested his electrical hypothesis and decisively showed that it was false. He instantly abandoned the idea, joined the "soup boys," and did the research on neuronal signalling that led to his Prize. Bondi (knighted for his work) was a mathematician and theoretical physicist who advanced several testable cosmological hypotheses (the most famous of which, the Steady State Model of the universe, was falsified by evidence that led to the Big Bang Theory). Perhaps because Professor Sleigh's premise is that Popper's principle of falsification is worthless, she doesn't raise the possibility that these scientists and others found it genuinely useful and advocated Popper's program for that reason.

Does the principle of falsifiability have a moral dimension?

A major theme in Sleigh's essay is that science (and technology) and ethics are intertwined. Scientists are responsible for the societal impact of their work. In particular, they are culpable not only if they actively support immoral causes, but also if their work is used by others who do. She cites Naomi Oreskes's and Eric Conway's book, *Merchants of Doubt*, that documents the craven behaviour of a few scientific luminaries who carried water

for the fossil-fuel industry, often grossly distorting Popper's program in the process. This, she implies, proves its moral bankruptcy. I can't excuse these scientists' behaviour, but I disagree that Popper is responsible if his program is mis-applied for evil purposes.

If scientists hide behind Popperian falsification to do evil, then they're evil. But does adopting the principle automatically lead to evil deeds? On the contrary, staunch proponents of the anthropogenic hypothesis of global climate change cite Popper too (Mercer, 2016); evidence that his ideas are neither evil nor intrinsically prone to fostering evil.

Furthermore, rather than targeting Popper's fallibilism or falsifiability *per se*, Sleigh is underscoring the real dangers of simultaneously maintaining an unusually high degree of skepticism towards highly-corroborated hypotheses and credulity towards repeatedly falsified hypotheses for specific politically motivated reasons, an inversion of the entire Popperian project.

Creativity in science

Sleigh scoffs at Popper's view that scientists arrive at hypotheses through "conjecture" (guesswork), an act of creativity. To her, this was a transparent and shoddy attempt by scientists to piggyback on the respect accorded to high culture – the humanities and the arts – at a time when the public increasingly feared science as a potentially dangerous scourge. She evokes Stanley Kubrick's comically demented and malevolent "Dr. Strangelove" as the archetypal mad scientist from which the academic scientists wanted to distance themselves.

Even if Sleigh were right that science needed and sought the image-polishing it got from publicly associating itself with Popper's vision of science as a creative endeavour, that would not mean his vision was wrong. Besides, "creativity" is a term that often masks our ignorance of how our minds work. It refers to a mental or cognitive process that we don't know much about. Popper (and Richard Feynman among others) acknowledges ignorance of how scientists formulate hypotheses by calling it guesswork. It is hard to read anything sinister into this usage.

What would science be like in Professor Sleigh's world?

This is a tricky question. She disparages Popper and his program without offering specific suggestions for improvement. For example, she casts aspersions on the concept that all scientific facts are tested-and-not-falsified hypotheses. What is the alternative? That some facts are established beyond conceivable doubt? That confirmed truths make up the body of science? This insidious misconception contributes to public misunderstanding and mistrust of science, but she doesn't refute it.

What about the process of falsification? Should it be entirely off-limits, as Sleigh seems to imply, or only when mis-interpreted? In *Why Trust Science*, Naomi Oreskes vigorously rejects falsification as the "one true scientific method," while implicitly acknowledging its influence in science. Oreskes's overarching message is that consensus of opinion among scientific experts who have no vested interest in the matters in question is the primary basis for justified trust in science. She doesn't deny that scientists take falsifying evidence into account in arriving at consensus.

Professor Sleigh implies that doing away with Popperian thinking will be an unalloyed plus for science and society. To the contrary, taking a wrecking ball to Popper's scientific methodology would leave the public with a more inaccurate, less valid picture of science than it has. Greater public misinformation, mistrust, and skepticism about science may well lead to or exacerbate a range of societal ills.

To achieve Professor Sleigh's aims, it would seem more sensible to foster a realistic public understanding of science – its goals, methods, achievements, and weaknesses. Informed citizens are better able to appreciate and support effective, socially sensitive, and desirable actions. Science is inherently complicated and educating the public about it is no trivial task. It is also extremely important. Science will, after all, be done, whether under Popperian auspices or not.

Unanticipated negative consequences of Professor Sleigh's Approach

Although Sleigh focuses on climate change deniers' co-optation of Popper for their own ends, as noted, committed climate change believers also cite Popper. They argue that the anthropogenic climate change hypothesis is testable and has been corroborated by severe tests. Thus, presently, our best hypothesis is that the climate crisis is real, man-made, and gravely serious. It therefore can, and should, be (provisionally) accepted as true. Popper would agree that we are fully justified in taking appropriate actions even if "all the data are not in." Doing away with Popperianism would undercut these supporting arguments.

Moreover, it is climate change deniers who push the false notion of perfect, certain knowledge when "all the data are in," as the goal of science. This mis-representation is fundamental to their arguments for delaying action to mitigate climate change. Furthermore, when the hoped-for perfect knowledge is not forthcoming, its absence fosters cynicism and distrust in the whole scientific enterprise. The deniers get away with this in part because Popper's critics don't distinguish between Popperian goals – ultimate truth versus practical guidance – and between these goals and the method of falsification.

Sleigh reports that "anti-science skeptics seize upon a single anomalous piece of data to claim to have disproved the entire edifice of combined research…" Their claim is an absurd disfigurement of Popper's thinking. A single piece of anomalous data is never sufficient to disprove an edifice of research. Anti-science skeptics make such claims because they are unaware of, or assume the public is unaware of, the facts about Popper's methodology and it immense usefulness in everyday science.

In 1959, C.P. Snow presciently laid out the dangers that arise when large portions of a society are ignorant of the science and technology on which the society depends. In failing to make clear the differences between the aims of basic and applied science, in ridiculing and misrepresenting the principle and value of falsification, in appearing to deny the reality of fallibilism, Popper's critics create a knowledge vacuum that true believers and unscrupulous scientists fill with dangerous nonsense that misleads many and betrays everyone. We can and must do better.

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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/`.

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Recent HPS&ST Research Articles

Perspectives on Science (Volume 29, Issue 3, May-June 2021)

Special Issue: Logic and Methodology in the Early Modern Period
Guest Editor: Elodie Cassan

Synthese (Volume 198, supplement issue 14, June 2021) Special Issue: First Principles in Science Issue editors: Catherine Herfeld and Milena Ivanova

Ampatzidis, G., & Ergazaki, M. (2021). Can the history of the balance of nature-idea inform the design of narratives for highlighting general aspects of nature of science?. *Review of Science, Mathematics and ICT Education*, 15(1), 77-88. doi:10.26220/rev.3574

Boniolo, G., Onaga, L. (2021) Seeing clearly through COVID-19: current and future questions for the history and philosophy of the life sciences. *HPLS*, 43, 83. doi:10.1007/s40656-021-00434-2

Chacón-Díaz, L.B. (2021). A Textbook Analysis to Uncover the Hidden Contributors of Science and Mathematics. *Sci & Educ*, 1-19. doi:10.1007/s11191-021-00246-7 online first

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Kaiser, M., Buklijas, T., Gluckman, P. (2021) Models and numbers: Representing the world or imposing order? *Perspectives on Science*. doi:10.1162/posc_a_00373 Just Accepted

Larison, K.D. (2021). On Beyond Constructivism: Using Intersubjective Approaches to Promote Learning in the Science Classroom. *Sci & Educ*, 1-27. doi:10.1007/s11191-021-00237-8 online first

Lee, J. (2021). A missing piece in high school science education: Research ethics in the classroom. *International Journal of Science Education*. doi:10.1080/09500693.2021.1934602 online first

Marques, C.A., Machado, A.A.S.C. (2021). An integrated vision of the Green Chemistry evolution along 25 years. *Found Chem*. doi:10.1007/s10698-021-09396-6

Melogno, P. (2021). From Externalism to Internalism: The Historiographical Development of Thomas Kuhn. *Found Sci*. doi:10.1007/s10699-021-09801-5 online first

Morris, A. M. A. (2021). "The joint labours of ingenious men": John Smeaton's Royal Society network and the Eddystone Lighthouse. *Centaurus*, 1– 19. doi:10.1111/1600-0498.12398

Park, C., Hong, H. G. (2021). Educational Practices in Sommerfeld School: A Case of Scientist Education from the View of Nature of Science. *Sci & Educ*, 1-19. doi:10.1007/s11191-021-00212-3 online first

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Learning Environment during the COVID-19 Pandemic: University Students' Engagement and Interactions. *Sci & Educ*, 1-30. doi:10.1007/s11191-021-00234-x online first

Stanley, M. (2021). No slaves to words: S. P. Thompson's theory of history. *Centaurus*. doi:10.1111/1600-0498.12397 online first

Stein, H. (2021). Physics and Philosophy Meet: the Strange Case of Poincaré. *Found Phys*, 51, 69. doi:10.1007/s10701-021-00460-x

Velilla-Jiménez, H.E. (2021). Credibility and evidence in the handling of SARS-CoV-2. *HPLS*, 43, 79. doi:10.1007/s40656-021-00433-3

Winrich, C., Garik, P. (2021). Integrating History of Science in In-service Physics Teacher Education: Impact on Teachers' Practice. *Sci & Educ.*, 1-32. doi:10.1007/s11191-021-00219-w online first

Travassos-Britto, B., Pardini, R., El-Hani, C. N., & Prado, P. I. (2021). Towards a pragmatic view of theories in ecology. *Oikos* 130(6): 821-830 doi:10.1111/oik.07314

Recent HPS&ST Related Books

Alexandrova, Anna (2021). *A Philosophy for the Science of Well-Being*. New York, NY: Oxford university Press. ISBN: 978-0-197-59889-4 (New in Paperback)

"Well-being, happiness and quality of life are now established objects of social and medical research. Does this science produce knowledge that is properly about well-being? What sort of well-being? The definition and measurement of these objects rest on assumptions that are partly normative, partly empirical and partly pragmatic, producing a great diversity of definitions depending on the project and the discipline. This book, written from the perspective of philosophy of science, formulates principles for the responsible production and interpretation of this diverse knowledge. Traditionally, philosophers' goal has been a single concept of well-being and a single theory about what it consists in. But for science this goal is both unlikely and unnecessary. Instead the promise and authority of the science depends on it focusing on the well-being of specific kinds of people in specific contexts. Skeptical arguments notwithstanding, this contextual well-being can be measured in a valid and credible way - but only if scientists broaden their methods to make room for normative considerations and address publicly and inclusively the value-based conflicts that inevitably arise when a measure of well-being is adopted. The science of well-being can be normative, empirical and objective all at once, provided that we line up values to science and science to values." (From the Publisher)

More information available here.

Ågren, J. Arvid (2021). *The Gene's-Eye View of Evolution*. New York, NY: Oxford University Press. ISBN: 978-0-198-86226-0

"To many evolutionary biologists, the central challenge of their discipline is to explain adaptation, the appearance of design in the living world. With the theory of evolution by natural selection, Charles Darwin elegantly showed how a purely mechanistic process can achieve this striking feature of nature. Since then, the way many biologists have thought about evolution and natural selection is as a theory about individual organisms. Over a century later, a subtle but radical shift in perspective emerged with the gene's-eye view of evolution in which natural selection was conceptualised as a struggle between genes for replication and transmission to the next generation. This viewpoint culminated with the

publication of The Selfish Gene by Richard Dawkins (Oxford University Press, 1976) and is now commonly referred to as selfish gene thinking.

"The gene's-eye view has subsequently played a central role in evolutionary biology, although it continues to attract controversy. The central aim of this accessible book is to show how the gene's-eye view differs from the traditional organismal account of evolution, trace its historical origins, clarify typical misunderstandings and, by using examples from contemporary experimental work, show why so many evolutionary biologists still consider it an indispensable heuristic. The book concludes by discussing how selfish gene thinking fits into ongoing debates in evolutionary biology, and what they tell us about the future of the gene's-eye view of evolution.

"*The Gene's-Eye View of Evolution* is suitable for graduate-level students taking courses in evolutionary biology, behavioural ecology, and evolutionary genetics, as well as professional researchers in these fields. It will also appeal to a broader, interdisciplinary audience from the social sciences and humanities including philosophers and historians of science." (From the Publisher)

More information available here.

Caneva, Kenneth L. (2021). *Helmholtz and the Conservation of Energy: Contexts of Creation and Reception*. Cambridge, MA: The MIT Press. ISBN: 978-0-262-04573-5

"In 1847, Herman Helmholtz, arguably the most important German physicist of the nineteenth century, published his formulation of what became known as the conservation of energy—unarguably the most important single development in physics of that century, transforming what had been a conglomeration of separate topics into a coherent field unified by the concept of energy. In Helmholtz and the Conservation of Energy, Kenneth Caneva offers a detailed account of Helmholtz's work on the subject, the sources that he drew upon, the varying responses to his work from scientists of the era, and the impact on physics as a discipline.

"Caneva describes the set of abiding concerns that prompted Helmholtz's work, including his rejection of the idea of a work-performing vital force, and investigates Helmholtz's relationship to both an older generation of physicists and an emerging community of reformist physiologists. He analyses Helmholtz's indebtedness to Johannes Müller and Justus Liebig and discusses Helmholtz's tense and ambivalent relationship to the work of Robert Mayer, who had earlier proposed the uncreatability, indestructibility, and transformability of "force." Caneva examines Helmholtz's continued engagement with the subject, his role in the acceptance of the conservation of energy as the central principle of physics, and the eventual incorporation of the principle in textbooks as established science." (From the Publisher)

More information available here.

Carrier, M., Mertens, R., & Reinhardt, C. (2021). *Narratives and Comparisons Adversaries or Allies in Understanding Science?* Bielefeld: Bielefeld University Press, transcript. doi:10.14361/9783839454152 [Open Access]

"As a powerful tool in the production of knowledge, comparing plays a crucial part in the sciences and the humanities. This volume explores the relationship between comparing and narrating in epistemic practices and clarifies the ways in which narratives enable or impede practices of comparing. It takes into account related activities, such as measuring and classifying, modelling, establishing norms and categories, as well as organising and popularising knowledge, to analyse the ambivalent relationship

between narratives, scientific explanation, and understanding. The contributions bring out the epistemic role of narratives, and elucidate how narratives are connected to comparisons and scientific explanations." (From the Publisher)

More information is available
doi:10.14361/9783839454152/html

Cavicchi, Elizabeth & Heering, Peter (Eds.) (2021). *Historical Scientific Instruments in Contemporary Education* (Scientific Instruments and Collections, Volume: 9). Leiden: Brill.
ISBN: 978-9-004-49967-6

"These essays draw on recent and versatile work by museum staff, science educators, and teachers, showing what can be done with historical scientific instruments or replicas. Varied audiences - with members just like you - can be made aware of exciting aspects of history, observation, problem-solving, restoration, and scientific understanding, by the projects outlined here by professional practitioners. These interdisciplinary case studies, ranging from the cinematic to the hands-on, show how inspiration concerning science and the past can give intellectual pleasure as well as authentic learning to new participants, who might include people like you: students, teachers, curators, and the interested and engaged public.

"Contributors are Dominique Bernard, Paolo Brenni, Roland Carchon, Elizabeth Cavicchi, Stéphane Fischer, Peter Heering, J.W. Huisman, Françoise Khantine-Langlois, Alistair M. Kwan, Janet Laidla, Pierre Lauginie, Panagiotis Lazos, Pietro Milici, Flora Paparou, Frédérique Plantevin, Julie Priser, Alfonso San-Miguel, Danny Segers, Constantine (Kostas) Skordoulis, Trienke M. van der Spek, Constantina Stefanidou, and Giorgio Strano." (From the Publisher)

More information available here.

Clayton, Aubrey (2021). *Bernoulli's Fallacy: Statistical Illogic and the Crisis of Modern Science*. New York, NY: Columbia University Press.
ISBN: 978-0-231-19994-0

"There is a logical flaw in the statistical methods used across experimental science. This fault is not a minor academic quibble: it underlies a reproducibility crisis now threatening entire disciplines. In an increasingly statistics-reliant society, this same deeply rooted error shapes decisions in medicine, law, and public policy with profound consequences. The foundation of the problem is a misunderstanding of probability and its role in making inferences from observations.

"Aubrey Clayton traces the history of how statistics went astray, beginning with the groundbreaking work of the seventeenth-century mathematician Jacob Bernoulli and winding through gambling, astronomy, and genetics. Clayton recounts the feuds among rival schools of statistics, exploring the surprisingly human problems that gave rise to the discipline and the all-too-human shortcomings that derailed it. He highlights how influential nineteenth- and twentieth-century figures developed a statistical methodology they claimed was purely objective in order to silence critics of their political agendas, including eugenics.

"Clayton provides a clear account of the mathematics and logic of probability, conveying complex concepts accessibly for readers interested in the statistical methods that frame our understanding of the world. He contends that we need to take a Bayesian approach—that is, to incorporate prior knowledge when reasoning with incomplete information—in order to resolve the crisis. Ranging across math, philosophy, and culture, Bernoulli's Fallacy explains why something has gone wrong with how we use data—and how to fix it." (From the Publisher)

More information available here.

Domski, Mary (2021). *Newton's Third Rule and the Experimental Argument for Universal Gravity*. Abingdon: Routledge. ISBN: 978-1-032-02036-5

> "This book provides a reading of Newton's argument for universal gravity that is focused on the evidence-based, "experimental" reasoning that Newton associates with his program of experimental philosophy. It highlights the richness and complexity of the Principia and also draws important lessons about how to situate Newton in his natural philosophical context.
>
> "The book has two primary objectives. First, it defends a novel interpretation of the third of Newton's four Rules for the Study of Natural Philosophy—what the author terms the Two-Set Reading of Rule 3. Second, it argues that this novel interpretation of Rule 3 sheds additional light on the differences between Newton's experimental philosophy and Descartes's "hypothetical philosophy," and that it also illuminates how the practice of experimental philosophy allowed Newton to make a universal force of gravity the centerpiece of his explanation of the system of the world.
>
> "Newton's Third Rule and the Experimental Argument for Universal Gravity will be of interest to researchers and advanced students working on Newton's natural philosophy, early modern philosophy, and the history of science." (From the Publisher)

More information available here.

Grunwald, Armin (2021). *Living Technology: Philosophy and Ethics at the Crossroads Between Life and Technology*. Abingdon: Routledge. ISBN: 978-9-814-87770-1

> "The boundaries between inanimate technology and the realm of the living become increasingly blurred. Deeper and deeper technological interventions into living organisms are possible, covering the entire spectrum of life from bacteria to humans. Simultaneously, digitalisation and artificial intelligence (AI) enable increasingly autonomous technologies. Inanimate technologies such as robots begin to show characteristics of life. Contested issues pop up, such as the dignity of life, the enhancement of animals for human purposes, the creation of designer babies, and the granting of robot rights.
>
> "The book addresses the understanding of the ongoing dissolution of the life/technology borders, the provision of ethical guidance for navigating research and innovation responsibly, and the philosophical reflection on the meaning of the current shifts. It offers three specific perspectives for understanding the challenges and providing orientation. First, the dissolution of the boundaries between technology and life is analysed and reflected from both sides. Second, the search for orientation is not restricted to ethics but also involves philosophy of technology and of nature, as well as anthropology. Finally, instead of restricting the analysis to specific areas of life, e.g., bacteria or animals, the book presents a comprehensive look at the entire spectrum of living organisms—bacteria and viruses, plants, animals and humans—and robots as possible early forms of emerging technical life."

More information available here.

Heath, Joseph (2021). *Philosophical Foundations of Climate Change Policy*. New York, NY: Oxford University Press. ISBN: 9780-1-975-6798-2

> "There is widespread agreement that something must be done to combat anthropogenic climate change. And yet what is the extent of our obligations? It would clearly be unjust for us to allow global warming to reach dangerous levels. But what is the nature of this injustice? Providing a plausible philosophical specification of the wrongness of

our present inaction has proven surprisingly difficult. Much of this is due to the temporal structure of the problem, or the fact that there is such a significant delay between our actions and the effects that they produce. Many normative theories that sound plausible when applied to contemporaneous problems generate surprising or perverse results when applied to problems that extend over long periods of time, involving effects on individuals who have not yet been born. So while states have a range of sensible climate change policies at their disposal, the philosophical foundations of these policies remains indeterminate.

"By far the most influential philosophical position has been the variant of utilitarianism most popular among economists, which maintains that we have an obligation to maximise the well-being of all people, from now until the end of time. Climate change represents an obvious failure of maximisation. Many environmental philosophers, however, find this argument unpersuasive, because it also implies that we have an obligation to maximise economic growth. Yet their attempts to provide alternative foundations for policy have proven unpersuasive. Joseph Heath presents an approach to thinking about climate change policy grounded in social contract theory, which focuses on the fairness of existing institutions, not the welfare of future generations, in order to generate a set of plausible policy prescriptions." (From the Publisher)

More information available here.

Horwitz, Allan V. (2021). *DSM: A History of Psychiatry's Bible*. Baltimore, MD: Johns Hopkins University Press. ISBN: 978-1-421-44069-9

"Over the past seventy years, the *Diagnostic and Statistical Manual of Mental Disorders*, or DSM, has evolved from a virtually unknown and little-used pamphlet to an imposing and comprehensive compendium of mental disorder. Its nearly 300 conditions have become the touchstones for the diagnoses that patients receive, students are taught, researchers study, insurers reimburse, and drug companies promote. Although the manual is portrayed as an authoritative corpus of psychiatric knowledge, it is a product of intense political conflicts, dissension, and factionalism. The manual results from struggles among psychiatric researchers and clinicians, different mental health professions, and a variety of patient, familial, feminist, gay, and veterans' interest groups. The DSM is fundamentally a social document that both reflects and shapes the professional, economic, and cultural forces associated with its use.

"In *DSM*, Allan V. Horwitz examines how the manual, known colloquially as "psychiatry's bible," has been at the centre of thinking about mental health in the United States since its original publication in 1952. The first book to examine its entire history, this volume draws on both archival sources and the literature on modern psychiatry to show how the history of the DSM is more a story of the growing social importance of psychiatric diagnoses than of increasing knowledge about the nature of mental disorder. Despite attempts to replace it, Horwitz argues that the DSM persists because its diagnostic entities are closely intertwined with too many interests that benefit from them.

"This comprehensive treatment should appeal to not only specialists but also anyone "who is interested in how diagnoses of mental illness have evolved over the past seven decades—from unwanted and often imposed labels to resources that lead to valued mental health treatments and social services." (From the Publisher)

More information available here.

Inuzuka, Takaaki (2021). *Alexander Williamson: A Victorian chemist and the making of modern Japan*. (Haruko Laurie, Tran.) London: UCL Press. ISBN: 978-1-787-35931-4

"Alexander Williamson was professor of chemistry at UCL (1849–87) and a leading scientist of his time. He taught and cared for visiting Japanese students, thereby assisting them with their goal of modernising Japan. This short, accessible biography explores his contribution to nineteenth-century science as well as his lasting impact on Japanese society.

"In 1863 five students from the Chōshū clan, with a desperate desire to learn from the West, made their way to England. They were put in the care of Williamson and his wife. Their mission was to learn about cutting-edge Western technology, science, economics and politics. When they returned home they rapidly became leading figures in Japanese life at a particularly turbulent time, one of them serving as the country's first prime minister. Subsequently many other Japanese students followed in their footsteps and studied at UCL.

"The remarkable story of the part Williamson and UCL played in the modernisation of Japan is little known today. This biography will promote a deeper understanding of Williamson's scientific innovations and his legacy for Anglo-Japanese relations. An Afterword briefly outlines the extraordinary careers of the pioneering students after they left Britain." (From the Publisher)

More information available here.

Kampourakis, K. (2021). *Understanding Genes (Understanding Life)*. Cambridge: Cambridge University Press. ISBN: 978-1-108-88415-0

"What are genes? What do genes do? These questions are not simple and straightforward to answer; at the same time, simplistic answers are quite prevalent and are taken for granted. This book aims to explain the origin of the gene concept, its various meanings both within and outside science, as well as to debunk the intuitive view of the existence of 'genes for' characteristics and disease. Drawing on contemporary research in genetics and genomics, as well as on ideas from history of science, philosophy of science, psychology and science education, it explains what genes are and what they can and cannot do. By presenting complex concepts and research in a comprehensible and rigorous manner, it examines the potential impact of research in genetics and genomics and how important genes actually are for our lives. Understanding Genes is an accessible and engaging introduction to genes for any interested reader." (From the Publisher)

More information available here.

Mendonça, Diana, Curado, Manuel, & Gouveia, Steven S. (Eds.) (2020). *The Philosophy and Science of Predictive Processing*. London: Bloomsbury Academic. ISBN: 978-1-350-09975-3

"This book explores how predictive processing, which argues that our brains are constantly generating and updating hypotheses about our external conditions, sheds new light on the nature of the mind. It shows how it is similar to and expands other theoretical approaches that emphasise the active role of the mind and its dynamic function.

"Offering a complete guide to the philosophical and empirical implications of predictive processing, contributors bring perspectives from philosophy, neuroscience, and psychology. Together, they explore the many philosophical applications of predictive processing and its exciting potential across mental health, cognitive science, neuroscience, and robotics.

"Presenting an extensive and balanced overview of the subject, *The Philosophy and Science of Predictive Processing* is a landmark volume within philosophy of mind." (From the Publisher)

More information available here.

Meyns, Chris (Ed.) (2021). *Information and the History of Philosophy*. Abingdon: Routledge. ISBN: 978-0-815-35500-7

"In recent years the philosophy of information has emerged as an important area of research in philosophy. However, until now information's philosophical history has been largely overlooked.

" *Information and the History of Philosophy* is the first comprehensive investigation of the history of philosophical questions around information, including work from before the Common Era to the twenty-first century. It covers scientific and technology-centred notions of information, views of human information processing, as well as sociopolitical topics such as the control and use of information in societies.

"Organised into five parts, 19 chapters by an international team of contributors cover the following topics and more:

- Information before 500 CE, including ancient Chinese, Greek and Roman approaches to information;
- Early theories of information processing, sources of information and cognition;
- Information and computation in Leibniz, visualised scientific information, copyright and social reform;
- The nineteenth century, including biological information, knowledge economies and - information's role in empire and eugenics;
- Recent and contemporary philosophy of information, including racialised information, Shannon information and the very idea of an information revolution.

" *Information and the History of Philosophy* is a landmark publication in this emerging field. As such, it is essential reading for students and researchers in the history of philosophy, philosophy of science and technology, and library and information studies. It is also a valuable resource for those working in subjects such as the history of science, media and communication studies and intellectual history." (From the Publisher)

More information available here.

Miret, M. J., & Puig, A. P. (2021). *Science, Culture and National Identity in Francoist Spain, 1939–1959*. Cham: Springer. ISBN: 978-3-030-58646-1

"This book examines the role that science and culture held as instruments of nationalisation policies during the first phase of the Franco regime in Spain. It considers the reciprocal relationship between political legitimacy and developments in science and culture, and explores the 'nationalisation' efforts in Spain in the 1940s and 1950s, via the complex process of transmitting narratives of national identity, through ideas, representations and homogenising practices. Taking an interdisciplinary approach, the volume features insights into how scientific and cultural language and symbols were used to formulate national identity, through institutions, resource distribution and specific national policies. Split into five parts, the collection considers policies in the Francoist 'New State', the role of women in these debates, and perspectives on the nationalisation and internationalisation efforts that made use of scientific and cultural spheres. Chapters also feature insights into cinema, literature, cultural diplomacy, mathematics and technology in debates on Catalonia, the Nuclear Energy Board, the Spanish National Research Council, and how scientific tools in Spain in this era fed into wider geopolitics with America and onto the UNESCO stage." (From the publishers)

More information available here.

Musgrave, Toby (2021). *The Multifarious Mr. Banks: From Botany Bay to Kew: The Natural Historian Who Shaped the World*. New Haven, CT: Yale University Press. ISBN: 978-0-300-25920-9

> "As official botanist on James Cook's first circumnavigation, the longest-serving president of the Royal Society, advisor to King George III, the 'father of Australia', and the man who established Kew as the world's leading botanical garden, Sir Joseph Banks was integral to the English Enlightenment. Yet he has not received the recognition that his multifarious achievements deserve.
>
> "In this engaging account, Toby Musgrave reveals the true extent of Banks's contributions to science and Britain. From an early age Banks pursued his passion for natural history through study and extensive travel, most famously on the HMS Endeavour. He went on to become a pivotal figure in the advancement of British scientific, economic, and colonial interests. With his enquiring, enterprising mind and extensive network of correspondents, Banks's reputation and influence were global. Drawing widely on Banks's writings, Musgrave sheds light on Banks's profound impact on British science and empire in an age of rapid advancement." (From the Publisher)

More information available here.

Nelson, William Max (2021). *The Time of Enlightenment: Constructing the Future in France, 1750 to Year One*. Toronto: University of Toronto Press. ISBN: 978-1-487-50770-1

> "A new idea of the future emerged in eighteenth-century France. With the development of modern biological, economic, and social engineering, the future transformed from being predetermined and beyond significant human intervention into something that could be dramatically affected through actions in the present.
>
> " *The Time of Enlightenment* argues that specific mechanisms for constructing the future first arose through the development of practices and instruments aimed at countering degeneration. In their attempts to regenerate a healthy natural state, Enlightenment philosophies created the means to exceed previously recognised limits and build a future that was not merely a recuperation of the past, but fundamentally different from it. A theoretically inflected work combining intellectual history and the history of science, this book will appeal to anyone interested in European history and the history of science, as well as the history of France, the Enlightenment, and the French Revolution." (From the Publisher)

More information available here.

Pacey, Arnold & Bray, Francesca (2021) *Technology in World Civilization: A Thousand-Year History*. (Revised and Expanded Edition). Cambridge, MA: The MIT Press.
ISBN: 978-0-262-54246-3

> "This milestone history of technology, first published in 1990 and now revised and expanded in light of recent research, broke new ground by taking a global view, avoiding the conventional Eurocentric perspective and placing the development of technology squarely in the context of a "world civilisation." Case studies include "technological dialogues" between China and West Asia in the eleventh century, medieval African states and the Islamic world, and the United States and Japan post-1950. It examines railway empires through the examples of Russia and Japan and explores current synergies of innovation in energy supply and smartphone technology through African cases.
>
> "The book uses the term "technological dialogue" to challenge the top-down concept of "technology transfer," showing instead that technologies are typically modified to fit local needs and conditions,

> often triggering further innovation. The authors trace these encounters and exchanges over a thousand years, examining changes in such technologies as agriculture, firearms, printing, electricity, and railroads. A new chapter brings the narrative into the twenty-first century, discussing technological developments including petrochemicals, aerospace, and digitalisation from often unexpected global viewpoints and asking what new kind of industrial revolution is needed to meet the challenges of the Anthropocene." (From the Publisher)

More information available here.

Solovey, Mark & Dayé, Christian (Eds.) (2021). *Cold War Social Science: Transnational Entanglements*. Cham: Springer. ISBN: 978-3-030-70246-5

> "This book explores how the social sciences became entangled with the global Cold War. While duly recognising the realities of nation states, national power, and national aspirations, the studies gathered here open up new lines of transnational investigation. Considering developments in a wide array of fields – anthropology, development studies, economics, education, political science, psychology, science studies, and sociology – that involved the movement of people, projects, funding, and ideas across diverse national contexts, this volume pushes scholars to rethink certain fundamental points about how we should understand – and thus how we should study – Cold War social science itself." (From the Publisher)

More information available here.

Stearns, J. (2021). *Revealed Sciences: The Natural Sciences in Islam in Seventeenth-Century Morocco* (Cambridge Studies in Islamic Civilisation). Cambridge: Cambridge University Press. ISBN: 978-1-107-58852-3

> "Demonstrating the vibrancy of an Early Modern Muslim society through a study of the natural sciences in seventeenth-century Morocco, Revealed Sciences examines how the natural sciences flourished during this period, without developing in a similar way to the natural sciences in Europe. Offering an innovative analysis of the relationship between religious thought and the natural sciences, Justin K. Stearns shows how nineteenth and twentieth-century European and Middle Eastern scholars jointly developed a narrative of the decline of post-formative Islamic thought, including the fate of the natural sciences in the Muslim world. Challenging these depictions of the natural sciences in the Muslim world, Stearns uses numerous close readings of works in the natural sciences to a detailed overview of the place of the natural sciences in scholarly and educational landscapes of the Early Modern Magreb, and considers non-teleological possibilities for understanding a persistent engagement with the natural sciences in Early Modern Morocco." (From the Publisher)

More information available here.

Watters, Audrey (2021). *Teaching Machines: The History of Personalized Learning*. Cambridge, MA: The MIT Press. ISBN: 978-0-262-04569-8

> "Contrary to popular belief, ed tech did not begin with videos on the internet. The idea of technology that would allow students to "go at their own pace" did not originate in Silicon Valley. In Teaching Machines, education writer Audrey Watters offers a lively history of predigital educational technology, from Sidney Pressey's mechanised positive-reinforcement provider to B. F. Skinner's behaviourist bell-ringing box. Watters shows that these machines and the pedagogy that accompanied them sprang from ideas—bite-sized content, individualised instruction—that had legs and were later

picked up by textbook publishers and early advocates for computerised learning.

"Watters pays particular attention to the role of the media—newspapers, magazines, television, and film—in shaping people's perceptions of teaching machines as well as the psychological theories underpinning them. She considers these machines in the context of education reform, the political reverberations of Sputnik, and the rise of the testing and textbook industries. She chronicles Skinner's attempts to bring his teaching machines to market, culminating in the famous behaviourist's efforts to launch Didak 101, the "pre-verbal" machine that taught spelling. (Alternate names proposed by Skinner include "Autodidak," "Instructomat," and "Autostructor.") Telling these somewhat cautionary tales, Watters challenges what she calls "the teleology of ed tech"—the idea that not only is computerised education inevitable, but technological progress is the sole driver of events." (From the Publishers)

"Teaching Machines weaves together a riveting set of histories that offer a careful look at the past, but also an insightful and prescient examination of the present and future of ed tech. Watters is an incisive writer and an insistent scholar, always asking hard questions of technology. This book will change the way we talk about education." Jesse Stommel, Associate Professor, Athabasca University; Executive Director, Hybrid Pedagogy

"Audrey Watters proves that there is very little that is groundbreaking or innovative about the 'new' technologies of the 2020s. She provokes us to ask why ed tech learns so little from its past failures. A much-needed book!" – Neil Selwyn, Distinguished Research Professor, Monash University

More information available here.

White, R., Hodge, M., & Radick, G. (2021). *Darwin's Argument by Analogy: From Artificial to Natural Selection*. Cambridge: Cambridge University Press. ISBN: 978-1-108-76951-8

"In *On the Origin of Species* (1859), Charles Darwin put forward his theory of natural selection. Conventionally, Darwin's argument for this theory has been understood as based on an analogy with artificial selection. But there has been no consensus on how, exactly, this analogical argument is supposed to work – and some suspicion too that analogical arguments on the whole are embarrassingly weak. Drawing on new insights into the history of analogical argumentation from the ancient Greeks onward, as well as on in-depth studies of Darwin's public and private writings, this book offers an original perspective on Darwin's argument, restoring to view the intellectual traditions which Darwin took for granted in arguing as he did. From this perspective come new appreciations not only of Darwin's argument but of the metaphors based on it, the range of wider traditions the argument touched upon, and its legacies for science after the Origin." (From the Publisher)

More information available here.

Winther, Rasmus G. (2021). *When Maps Become the World*. Chicago IL: Chicago University Press. ISBN: 978-0-226-67472-8

"Map making and, ultimately, map thinking is ubiquitous across literature, cosmology, mathematics, psychology, and genetics. We partition, summarise, organise, and clarify our world *via* spatialised representations. Our maps and, more generally, our representations seduce and persuade; they build and destroy. They are the ultimate record of empires and of our evolving comprehension of our world.

"This book is about the promises and perils of map thinking. Maps are purpose-driven abstractions, discarding detail to highlight only particular features of a territory. By preserving certain features

at the expense of others, they can be used to reinforce a privileged position.

"*When Maps Become the World* shows us how the scientific theories, models, and concepts we use to intervene in the world function as maps, and explores the consequences of this, both good and bad. We increasingly understand the world around us in terms of models, to the extent that we often take the models for reality. Winther explains how in time, our historical representations in science, in cartography, and in our stories about ourselves replace individual memories and become dominant social narratives—they become reality, and they can remake the world." (From the Publisher)

"A *tour de force*. Philosophers of science have increasingly resorted to analogies with maps and mapping in thinking about the relation of scientific theories and models to the world(s) they are about. Winther interrogates this usage in multiple ways: a historical overview of map-making in the West, a philosophical examination of the assumptions and commitments of map language, and in-depth studies of mapping practices in sciences from cosmology to neuroscience to genetics. Wonderfully enhanced by reproductions of maps from the many domains in which they are used, this book gives welcome philosophical substance to a widely used and increasingly central concept in studies of science." – Helen Longino, Stanford University

More information available here.

Rice, Collin (2021). *Leveraging Distortions: Explanation, Idealization, and Universality in Science*. Cambridge, MA: The MIT Press.
ISBN: 978-0-262-54261-6

"A fundamental rule of logic is that in order for an argument to provide good reasons for its conclusion, the premises of the argument must be true. In this book, Collin Rice shows how the practice of science repeatedly, pervasively, and deliberately violates this principle. Rice argues that scientists strategically use distortions that misrepresent relevant features of natural phenomena in order to explain and understand—and that they use these distortions deliberately and justifiably in order to discover truths that would be otherwise inaccessible.

"Countering the standard emphasis on causation, accurate representation, and decomposition of science into its accurate and inaccurate parts, Rice shows that science's epistemic achievements can still be factive despite their being produced through the use of holistically distorted scientific representations. Indeed, he argues, this distortion is one of the most widely employed and fruitful tools used in scientific theorising. Marshalling a range of case studies, Rice contends that many explanations in science are noncausal, and he presents an alternate view of explanation that captures the variety of noncausal explanations found across the sciences. He proposes an alternative holistic distortion view of idealised models, connecting it to physicists' concept of a universality class; shows how universality classes can overcome some of the challenges of multiscale modeling; and offers accounts of explanation, idealisation, modelling, and understanding." (From the Publisher)

More information available here.

Scerri, Eric (2020. *The Periodic Table, Its Story and Its Significance* (2nd edition.). New York, NY: Oxford University Press. ISBN: 978-0-190-91436-3

"This second edition comprises 14 chapters, four of them new or modified versions of chapters in the first edition. The periodic table has evolved over the last 150 years, even over the last decade, so both editions of this book are valuable." – R. E. Buntrock, Choice

"As a whole, this book is not highly technical, and it has the attractiveness of providing material that

doesn't appear in typical school textbooks. Generally, those textbooks present the last triumphant version, not the unsuccessful episodes' history and context. Only a few experts know the "dark side" of the story, so this book fills in many useful parts of that bigger picture. This book will appeal to scholars and science readers alike, especially those interested in history of science, chemistry, physics, and philosophy." – Maria Elvira Callapez, ChemTexts

"The periodic table continues to generate new thoughts as the list of elements grows, its foundations are refined, and new portrayals are developed. Eric Scerri captures all these innovations in this timely updating of his very readable account of the origin, structure, and interpretation of the table." – Peter Atkins, University of Oxford

"The 2nd edition of Eric's Scerri's journey through the periodic table is up-to-date, readable, and intellectually enticing. This icon of chemistry has never had a better expositor!" – Roald Hoffmann, Cornell University

"This second edition is a revised and expanded take on the philosophical and historical aspects of the periodic table that made his first edition such a worthy successor to van Spronsen's classic history." – Carmen Giunta, Le Moyne College

"Written to a high standard of scholarship, The Periodic Table is the best book on this subject currently available. It gives both an historical and philosophical perspective to the development of this key to the elements, as well as including all the recent additions to the table." – John Emsley, author of *Nature's Building Blocks*

"Since Eric Scerri's *The Periodic Table* was the definitive book on the topic when it first appeared, it is wonderful to see that status claimed anew by this second edition during the International Year of the Periodic Table. The story is still unfolding, thanks in large part to the ingenuity of today's element-makers, and the additions bring this volume right up to date. It remains as clear, balanced and thoughtful as ever, and is the best guide to this iconic formulation of nature's atomic building blocks." - Philip Ball, author of *Elements: A Very Short Introduction*

More information available here.

Scerri, Eric, & Ghibaudi, Elena (eds.) (2020). *What is a Chemical Element?* New York, NY: 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."

More information available here.

Thomas, John Meurig (2021). *Albemarle Street: Portraits, Personalities and Presentations at The Royal Institution*. New York, NY: Oxford University Press. ISBN: 978-0-192-89800-5

"The Royal Institution of Great Britain is renowned the world over, first, because it is a premier arena for the advancement of new scientific and technological knowledge; and second because it highlights the advance of knowledge of all kinds. It bridges the sciences and the humanities, and as much publicity is given to advances in the arts, archaeology, architecture, drama and literature as to the pure and applied sciences. More famous scientists have lived and worked in the Royal Institution than in any other laboratory in the world. A roll-call includes Rumford, Davy, Faraday, Tyndall, Dewar, Rayleigh, W. H. Bragg, W. L. Bragg and George Porter. Not is it only the home of continuous electricity, it is also the birthplace of many aspects of molecular biology and viruses and enzymology. Some fifteen scientists who have won the Nobel Prize have, at one time or another, worked or lectured at the RI. And eminent individuals, like Howard Carter and Coleridge, have lectured there.

"Albemarle Street - Portraits, Personalities and Presentations at The Royal institution is a lively and compelling personal selection of the remarkable personalities and achievements of some of the extraordinary scientists and individuals who, during the nineteenth and twentieth centuries, worked or lectured at 21 Albemarle Street in Mayfair, central London. John Meurig Thomas offers a unique and valuable insight into the history of this prestigious address, having himself lived and worked at the Royal Institution for some twenty years." (From the Publisher)

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.

Varia

1. The Forum on History of Physics of the American Physical Society has changed its name and remit to the Forum on History and Philosophy of Physics.

2. The International Astronomical Union Commission on History of Astronomy (C-3) has just announced its new elected leadership for the 2021-2024 triennium:

   - President: Christian Sterken (BE)
   - Vice President: Sara Schechner (US)
   - Organising committee new members: David Baneke (NL), Thomas Hockey (US), Ionnis Litvitzis (GR), Virginia Trimble (US)
   - Organising committee continuing members: Ileanna Chinnici (IT), Eun Hee Lee (ROK), P.C. van der Kruit (NL)
   - Advisor & Past President, Wayne Orchiston

3. The latest double issue of *Ambix*, the journal of the Society for the History of Alchemy and Chemistry has been published. This special issue on "Alchemy and the Early Modern University" is free access through Taylor & Francis online here.

Charles Darwin: Justice of the Peace Book File

Charles Darwin: Justice of the peace. The complete records (1857-1882)

Darwin has long been one of the most intensively studied men of science in history. One might easily assume that there were no significant aspects of his life that had not already been revealed. And yet there is a fascinating side to Darwin's public life that has remained almost completely unknown. From July 1857 until he died in April 1882, Darwin was a justice of the peace. Although the bare fact that he was one has been known and mentioned in the literature on Darwin from the very beginning, so far only brief mentions have ever appeared. The reason for this brevity is that the official case records are lost.

But newspaper reports have been found that enable us to reconstruct the full story of Darwin as a justice of the peace. This lost record reveals that Darwin was fully engaged with a very different activity and community than we could have known just at the time when he wrote, published and saw his Origin of species first read by the world. This lost record contains many surprises and not a few amusing episodes with which the great naturalist was involved in his local community.

For example, the very day that Origin of species was published on 24 November 1859, a crime and "riot" occurred in his own sleepy village of Downe that he would later pass judgement on from the bench. It will come as a surprise to any reader interested in Darwin to discover just how much his life was taken up with acting as a justice of the peace at one of the most important and analysed parts of his life.

In addition, new research reveals that many of the details about what a justice of the peace (or magistrate) actually did and even what oath they swore, were mistaken in the existing literature on Darwin. Focusing on his neighbours, a fascinating private diary reaction to reading Origin of species is published here for the first time. This book reveals a whole new chapter of Darwin's life.

Only 103 pages long, it is available on Amazon as a paperback $(11.49) or kindle (0.99)$ and as a free PDF HERE

Dr John van Wyhe FLS
Department of Biological Sciences,
National University of Singapore
Director of Darwin Online
http://darwin-online.org.uk/people/van_wyhe.html

Michael R. Matthews: History, Philosophy and Science Teaching: A Personal Story, Springer, 2021

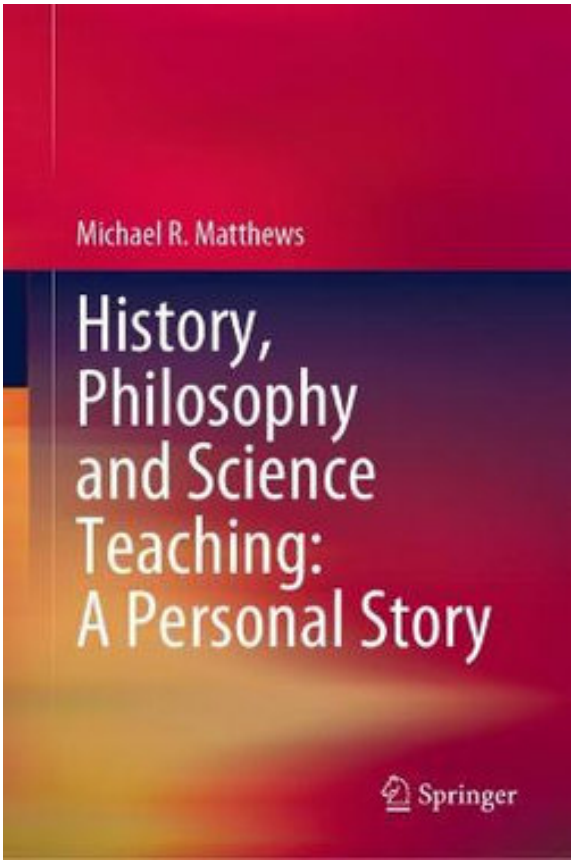
This book of ten chapters, 298 + xxv pages and 800 references is an historical narrative of the author's academic appointments, his significant research and publication endeavours, important editorial and institutional engagements, and appraisals of many important debates and contributors in science education.

The author is Honorary Associate Professor in the School of Education at the University of New South Wales. He has degrees in Geology, Psychology, Philosophy, History and Philosophy of Science, and Philosophy of Education.

He has taught in high school, teachers' college

and university; was Foundation Professor of Science Education at the University of Auckland; was Foundation President of the International History, Philosophy and Science Teaching Group; was Foundation President of the Inter-Divisional Teaching Commission of the DHST and DLMPS; and is a Fellow of the Royal Society (New South Wales).

The ten chapters begin with his Australian-Irish family life, his Catholic school education, his rich undergraduate education, then further degrees at Sydney University whilst school teaching, then range over a number of the central theoretical, curricular and pedagogical issues in science education to which he has contributed. The final chapter is a proposal for HPS-informed science teacher education.



The book gives accounts of philosophers who greatly influenced his own thinking and who also were personal friends – Wallis Suchting, Abner Shimony, Robert Cohen, Marx Wartofsky, Israel Scheffler, Michael Martin and Mario Bunge.

The book, throughout, advocates the importance of clear writing and avoidance of faddism in both philosophy and in education. It documents, disturbingly, many examples of the latter.

Positive reviews by Michael Reiss (Science Education, University College London), Eric Scerri (Chemistry Department, University of California Los Angeles) and Roland Schulz (Education, Simon Fraser University) are available here.

Book details, chapter titles and previews, and purchasing information can be seen here.

The book is available in print copy and eBook. From June 20 to July 18 there is a 20% discount available by using the following Springer token when purchasing from the Springer site: **xRMtG7SJe4B2Ddd**. This token is part of the above web address.

The book is available to individuals as a MyCopy for EUR/USD25. This is simply a paperback version of the print hardcover book. Obtaining a MyCopy requires first that an individual's institution has purchased the eBook. It does not apply when the hardcover alone has been purchased, though the eBook alone suffices to make the MyCopy available. This often happens automatically as the eBook will be part of a Springer package bought by institutions. If not, the institution needs to independently purchase the eBook. Librarians can advise through which channels the MyCopy is then purchased. This is a most suitable arrangement for instructors wishing to use the book as a course text.

Springer are facilitating reviews of the book in relevant HPS, Philosophy, Education and Science

Education journals and newsletters. Review editors should send reviewer's name and email, along with journal/newsletter name and website to:

Nick Melchior Nick.Melchior@springer.com

Reviewers are initially provided with the eBook, and upon publication of the review, are mailed the print version.

Coming HPS&ST Related Conferences

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

September 8-10, 2021 Conference, *Société de philosophie des sciences* University of Mons, Belgium
Details: https://www.sps-philoscience.org/

March 27-30, 2022, NARST Annual Conference, Vancouver, BC
Details: here.

July 3rd-7th, 2022, IHPST 16th International Conference, University of Calgary, Canada
Details from Glenn Dolphin: glenn.dolphin@ucalgary.ca.

July 18-22, 2022, 'Objects of Understanding: Historical Perspectives on Material Artefacts in Science Education', Europa-Universität Flensburg, Germany
Details: Roland Wittje, roland.wittje@gmail.com and here.

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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