11:15AM B19.00001 The Use of Theater and the Performing Arts in Science Education and the Teaching of History

BIAN SCHWARTZ, Brooklyn College and the Graduate Center of the City University of New York — Over the past 15 years there has been a surge in the general field of the interaction of STEM and the arts including theatre, music and the visual arts leading to STEAM. There seems to be no limits to the amount of creativity and diversity of subject matter especially in areas of biography, major science events, scientific and technical innovation, the benefits and dangers of modern science, and science as metaphor. For the past 15 years, I and my colleagues have been running a science outreach series under the title Science & the Performing Arts at the Graduate Center of the City University of New York. The objective is to bring science to students and the public in ways that are engaging, instructive, and artistic always, content-driven: the medium is the arts; the message is the joy of science. This has resulted in over 120 science and performing arts programs which have been documented on the website http://sciart.commons.gc.cuny.edu/

The author co-taught a course titled Staging Science, http://sciartcommons.gc.cuny.edu/staging-science/outline-of-the-course-staging-science/ with Marvin Carlson, Professor of Theatre at CUNY. An excellent book, Science on Stage: From Doctor Faustus to Copenhagen by Kirsten Shepherd-Barr, can be used to develop a customized courses on Science, Theatre and History for both science and non-science majors. The book’s appendix includes an annotated listing of plays on such subjects as quantum mechanics, chaos theory, evolution, genetics and morality and responsibility. The talk will include many examples how courses on science and theatre can actively engage students and enhance active participation and learning.

1Supported in part by the National Science Foundation

11:51AM B19.00002 Bruno, Galileo, Einstein: The Value of Myths in Physics

ALBERTO MARTINEZ, University of Texas at Austin — Usually, historical myths are portrayed as something to be avoided in a physics classroom. Instead, I will discuss the positive function of myths and how they can be used to improve physics education. First, on the basis of historical research from primary sources and significant new findings about the Catholic Inquisition, I will discuss how to use the inspirational story of Giordano Bruno when discussing cosmology. Next, I will discuss the recurring story about Galileo and the Leaning Tower of Pisa. Finally, I will discuss how neglected stories about the young Albert Einstein can help to inspire students.

12:27PM B19.00003 Teaching Physics to Future Presidents

BOB JACOBSEN, UC Berkeley Physics — We present Berkeley’s “Physics for Future Presidents” course. Created by Prof. Richard Muller, this is an introductory course aimed at preparing our students to make decisions in a scientifical and technological world. Organized around large topical areas like “Energy,” “Gravity and Force,” “Nuclei and Radioactivity,” and “Invisible Light,” we can cover in some depth the scientific issues involved in large-scale energy production via renewable and non-renewable resources, satellites including capabilities and limitations, nuclear power production including risk and waste, UV exposure including discussion of the ozone layer and cancer risk, etc. Although only a small bit of algebra is used, it’s a deeply quantitative course. The class is structured around (1) traditional text readings and homework for basic material (2) demo- and discussion-based lectures and (3) readings and essays based on current articles and events. This third component raises student engagement and improves their reasoning & skeptical skills. It also makes the course challenging for both STEM and non-STEM students, and for future teachers.

1:03PM B19.00004 Composing Science

LESLIE ATKINS, California State University, Chico — The course Scientific Inquiry at California State University was developed by faculty in biology, physics and English to meet “writing proficiency” requirements for non-science majors. Drawing from previous work in composition studies, the position that we take in this course is that we should be engaging students in writing that replicates the work that writing does in science, rather than replicating the particular structural conventions characteristic of scientific writing. That is, scientists use writing to have, remember, share, vet, challenge, and stabilize ideas, and our course requires students use writing to achieve those aims, rather than produce writing that obeys particular conventions of scientific writing. This talk will describe how we have integrated findings from composition studies with a course on scientific inquiry, and provide examples of how scientific writing has resulted from this dialogue.

1Funding by NSF #1140860.


LOUIS BLOOMFIELD, University of Virginia — How Things Work is an unconventional introduction to physics, a course that starts with whole objects and looks inside them to see what makes them work. Effectively “case-study physics,” it is designed primarily for non-science students who are unversal of the role of physics in the world and are looking for relevance in their studies. How Things Work is essentially the generalization of context-based introductory courses (Physics of the Human Body, Physics of the Automobile, and Physics of Music) and demonstrates that when physics is taught in the context of ordinary objects; these students are enthusiastic about it, look forward to classes, ask insightful questions, experiment on their own, and find themselves explaining to friends and family how things in their world work. In this talk, I will discuss the concept and structure of a How Things Work course and look briefly at how to teach its objects and assess what students learn from it. Although this course focuses on concepts rather than on calculations, it is rich in physics and requires that students think hard about the world around them. It also teaches problem solving and logical thinking skills, and demands that students face their misconceptions and failures of intuition. Lastly, it is actually customary in many respects, though its results are usually more words than numbers: your weight, the battery’s voltage, or the acceleration due to gravity.

Wednesday, March 4, 2015 8:00AM - 11:00AM

Session L24 FHP FPS: Invited Session: Pais Prize Session: Physics at the Intersection of History, Technology and Society

8:00AM L24.00001 Abraham Pais Prize Lecture: Understanding the Impacts of Global Warming: a History

SPENCER WEART, American Institute of Physics — The idea that fossil fuel emissions might cause global warming was first proposed around the end of the 19th century, and for the following half century it sounded like a good thing. In the 1950s, confirmation that warming really might be coming led to more varied speculations. Scientists could only state possible problems in vague terms. First on the list were sea-level rise and a threat to food supplies. New items were added through the 1960s and 1970s, ranging from the degradation of natural ecosystems to threats to human health. Experts in fields from forestry to economics, even national security, pitched in to assess a variety of possible consequences. It turned out to be impossible to make solid predictions, given the differences from one region to another and the ways human society itself might try to adapt to the changes. In the 1990s, lengthy technical studies abandoned specific predictions of impacts to address “vulnerabilities” under different likely “scenarios.” Researchers also began to explore the risks and consequences of extreme weather events like droughts and floods. By around 2000 the major likely impacts were well understood. Now the task was to pin down the specific risks in each of the many different regions, ecosystems, and human systems. Meanwhile actual impacts began to appear, such as changes in species ranges and unprecedented deadly heat waves. Nearly all experts now understood that civilization faced a monumental challenge.
Also at The American Physical Society (APS).

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**9:12AM L24.00003 Optimistic Dangers: Views of Radium Therapy During the American Radium Craze**, AIMEE SLAUGHTER, Los Alamos Historical Society — 1903 marked the beginning of intense and widespread popular interest in and curiosity about the newly-discovered element radium. This American radium craze was marked by an outpouring of media attention. Radium captured the public's attention because of its strange properties, which could not be fully explained by scientists: it remained warmer than its surroundings, it glowed in the dark, and it emitted energy from an unknown internal source. The radioactivity emitted by radium also had marked effects on the body. In this talk I will focus on views of these physiological effects of radium during the height of the American radium craze, 1903–1907. Physicians experimented with radium as a therapy, and newspapers reported on radium treatments of ailments ranging from acne to nerve disorders. When applied to superficial cancers, radium seemed to melt the tumor away, to be replaced by healthy tissue. Newspapers were quick to report that radium had cured cancer. At the same time, radium was also understood to be a dangerous substance: newspapers discussed the possibility of weaponizing its internal stores of energy, patients were often burned in the course of treatment, and it was speculated that radium in large amounts might blind, maim, or kill someone exposed to it. These dangers were well known but were never mentioned in the uniformly optimistic reports on the potentials of radium therapy. The modern expectation that beneficial applications of science may have a hidden darker side was not part of American culture at the beginning of the twentieth century. The early radium clinic was a unique site where non-scientists physically experienced a new scientific discovery, an element that was both familiar and unknown. At the height of the radium craze, the dangers of radium were optimistically set aside as physicians and physicists were trusted to tame the new element.

**9:48AM L24.00004 To Rule the Waves: Cable Telegraphy and the Making of “Maxwell’s Equations”**, BRUCE HUNT, University of Texas — How and why did Maxwell’s theory of the electromagnetic field come to be cast into the now familiar form of four vector equations? In particular, how and why was this done not by James Clerk Maxwell himself, but by Oliver Heaviside in a series of articles published in a London electrical trade journal in 1885, several years after Maxwell’s death? The answer, I will argue, lies in the demands and opportunities presented by the global network of submarine telegraph cables, one of the characteristic technologies of the Victorian British Empire. Heaviside, himself a former telegrapher, was steeped in the problems confronting cable telegraphy, particularly the distortion or “retardation” that signals suffered in passing along a cable. It was Heaviside’s search for an effective tool with which to tackle such problems that led him to take up Maxwell’s theory and then to recast it into the four “Maxwell’s equations.”

10:24AM L24.00005 The Social Appropriation of Quantum Language and Imagery, ROBERT CREASE, Stony Brook University — Planck introduced ‘quantum’ as a technical term in 1900 in connection with studies of the emission and absorption of light. Following the development of quantum mechanics in 1925–1927, quantum terminology and imagery – including ‘quantum leap,’ ‘Heisenberg’s Uncertainty Principle,’ and ‘complementarity’ – began appearing in ever-widening cultural spheres, including journalism, literature, philosophy, television, and coffee cups and t-shirts. Later, these terms and images were joined by others, including ‘Schrodinger’s Cat’ and ‘parallel worlds.’ As a result, numerous quantum terms and images have become popular and powerful metaphors in the public imagination. Each of these new terms and images followed a different trajectory in moving from their original scientific context into popular culture. This talk explores the trajectories and popular meanings of these terms, as well as their uses and misuses.

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**Wednesday, March 4, 2015 8:00PM - 10:00PM – Session R54 FHP: Staged Reading of the Play: Background** Grand Hyatt Lone Star BC -

8:00PM R54.00001 A Staged Reading of the Play: Background —The play is based on the true story of New York Cosmologist Dr. Ralph Alpher. The play moves backwards, as does the study of the origins of the universe, to trace the path of the forgotten and unaccredited scientist, who before the technology was capable, provided the mathematical proof of the existence of Cosmic Background Radiation. Twenty years later after two other scientists found the actual radiation and received Nobel Prizes for their accidental discovery, Ralph suffers a heart attack due to the stress of being snubbed. It is from this moment he traces backwards through his life and, ultimately, to the beginning of time. The play relies on silence, pace, and metaphor to deliver a striking, sometimes mystical look into the science of behind humans, and the humanity behind a scientist. Join us for a dramatic staged reading of Background, a play by Lauren Gunderson (http://laurengunderson.com/) performed by The Overtime Theater of San Antonio. Arranged by special permission of The Gersh Agency. After the performance, the director and actors will be available for a talk-back audience discussion.

**Thursday, March 5, 2015 8:00AM - 10:24AM – Session S3 FHP: Invited Session: Why Peer Review**

8:00AM S3.00001 There is no “I” in referee: Why referees should be anonymous, DANIEL UCKO1, Department of Philosophy, Stony Brook University, Stony Brook, NY — From the early days of modern science, it has been recognized that scientific claims must be verified by someone who is not the maker of those claims, and who furthermore has no stake in the matter. In other words, claims need to be evaluated objectively, by the community. The way in which this tends to be done is by peer review conducted by journals. Peer review as currently practiced touches on the themes of trust, where the trust is in institutions and procedures that emerge from expert communities. The practice of peer review is viewed as a citizen duty of scientists in the scientific community, because all scientists take turns serving either as authors, referees, and editors in the peer review process. We lack the resources to have a work evaluated by the entire community, so we substitute with a representative. Yet, in most examples of scientific review, the referee or referees are anonymous. This question is particularly important when the peer review process is brought to bear in order to evaluate matters beyond scientific validity, more “subjective” criteria such as relative importance, broadness of interest – criteria that do not appear to have an objective standard of comparison and validation. I will show that the anonymity of referees, far from endangering this trust, actually strengthens it. I will show that this anonymity is crucial in order to maintain any objectivity in scientific peer review, and why authors should not try to unmask the referee.

1Also at The American Physical Society (APS).
8:36AM S3.00002 Validity, not Dissemination. SAMINDRANATH MITRA, American Physical Society APS — Science journals have been transformed by the internet. In particular, increasingly their role appears to be to validate research, not to disseminate it. How are journals, and the communities they interact with, adapting? In this context, are alternatives to peer review on the horizon? Are these challenges unique to physics journals, or also seen in other publication scenarios?

9:12AM S3.00003 Peer-review: An IOP Publishing Perspective. TIMOTHY SMITH, IOP Publishing, Bristol, UK — Online publishing is challenging, and potentially changing, the role of publishers in both managing the peer-review process and disseminating the work that they publish in meeting contrasting needs from diverse groups of research communities. Recognizing the value of peer-review as a fundamental service to authors and the research community, the underlying principles of managing the process for journals published by IOP Publishing remain unchanged and yet the potential and demand for alternative models exists. This talk will discuss the traditional approach to peer-review placed in the context of this changing demand.

9:48AM S3.00004 Inside Nature. ANDREA TARONI, Nature Physics — Since its launch in 1869, Nature has seen its mission as two-fold: facilitating the prompt communication of the most important scientific developments to the relevant research communities, while at the same time fostering a greater appreciation of these great works of science amongst the wider public. Although the publishing landscape for scientific research is currently undergoing a period of rapid change, these core principles remain largely unchanged. In this talk, I will endeavour to explain how Nature editors — in particular those based at Nature Physics — apply these principles in practice, and so determine which few of the many excellent research submissions that we receive make it through to publication.