

2006 APS March Meeting

Baltimore, MD

<http://www.aps.org/meet/MAR06>

Monday, March 13, 2006 11:15AM - 1:39PM —

Session B5 FPS: Nuclear Proliferation & Nuclear Terrorism Baltimore Convention Center 309

11:15AM B5.00001 Preventing Nuclear Terrorism JOSEPH CIRINCIONE, Carnegie Endowment for International Peace —

This abstract was not received electronically.

11:51AM B5.00002 National Academy of Sciences Study on Monitoring Nuclear Weapons and Materials, STEVE FETTER, University of Maryland — This abstract was not received electronically.

12:27PM B5.00003 Advances in Nuclear Monitoring Technologies, BRENT PARK, Los Alamos National Laboratory — Homeland security requires low-cost, large-area detectors for locating and identifying weapons-usable nuclear materials and monitors for radiological isotopes that are more robust than current systems. Recent advances in electronics materials and nanotechnology, specifically organic semiconductors and inorganic quantum dots, offer potential improvements. We provide an overview of the physical processes involved in radiation detection using these new materials in the design of new device structures. Examples include recent efforts on quantum dots, as well as more traditional radiation-detecting materials such as CdZnTe and high-pressure xenon. Detector improvements demand not only new materials but also enhanced data-analysis tools that reduce false alarms and thus increase the quality of decisions. Additional computing power on hand-held platforms should enable the application of advanced algorithms to radiation-detection problems in the field, reducing the need to transmit data and thus delay analysis.

1:03PM B5.00004 Monitoring Illicit Nuclear Materials, MIKE CARTER, Department of Homeland Security — This abstract was not received electronically.

Tuesday, March 14, 2006 11:15AM - 2:15PM —

Session H5 FEd FGSA FPS and CSWP: Forum: What Has Actually Changed in Physics Departments in the Situation for Women, Graduate Students and Other People? Baltimore Convention Center 309

11:15AM H5.00001 Forum: What Has Actually Changed in Physics Departments in the Situation for Women, Graduate Students and Other People?, PATRICK MULVEY, AIP, RACHEL IVIE, AIP, DAVID CAMPBELL, Boston University, MARGARET MURNANE, University of Colorado-Boulder, KATE KIRBY, Harvard-Smithsonian Center for Astrophysics, ANNE CATLLA, Duke University — The decade of the 90's was a period of intense scrutiny of climate issues in physics departments, e.g. the status of women, the job situation for new Ph.D.'s and postdocs, and the preparation of physicists for careers inside and outside of physics. There were many conference sessions on these topics, and both APS members and leadership instigated important efforts to focus on specific areas. These efforts included the program of visiting committees to departments to examine the situation for women by the Committee on the Status of Women in Physics, the AIP's various studies of a statistical nature, and the creation by the APS of a Committee on Careers and the Forum on Graduate Student Affairs, as well as the recent APS-AAPT task force on graduate education. This forum patterned after similar sessions 10 years ago - will examine how physics departments have changed as a result of such efforts. It will begin with short (12-minute) talks by a panel of experts to describe what has happened in key areas. The greater part of the session will be a period of observations, questions, and discussion from the audience and the panel together. The purpose is to have an interchange on these interrelated topics from which we can all learn. THE TOPICS TO BE INTRODUCED IN THE SHORT TALKS AT THE BEGINNING OF THE SESSION ARE: 1) changes in graduate enrollment, composition, and subsequent jobs (Patrick Mulvey); 2) women in physics and astronomy departments 2005 (Rachel Ivie); 3) changes in graduate curricula and environment (David Campbell); 4) CSWP site visits to physics departments what's been accomplished and learned (Margaret Murnane); 5) survey of ethical issues in physics departments and the physics profession: results and reactions (Kate Kirby); and (6) physics departments from the point of view of younger physicists (Anne Catlla). The bulk of the session will be a public forum, on these and related issues, among the audience and the panel.

Tuesday, March 14, 2006 7:30PM - 10:00PM —

Session M50 FPS: Intelligent Design: Its Impact and Responses to It Marriot Waterfront Hotel Grand Salon V

7:30PM M50.00001 Legal Perspectives on Religion in Public School Science Classes, JEREMY GUNN, American Civil Liberties Union — In the 1920s, state legislatures in the United States became involved in enacting laws prohibiting the teaching of evolution in public schools. The famous *Tennessee v. John Scopes* trial of 1925 was the most famous test case to determine the constitutionality the first phase of the laws. Scopes was convicted of violating one such law and many of these anti-evolution laws continued to be in effect for the next forty years. During the 1950s, for a number of reasons, the teaching of evolution became more common as the anti-evolution laws were either repealed or ignored. In 1968, the Supreme Court in *Epperson v. Arkansas* ruled that the prohibition of the teaching of evolution was unconstitutional. Since the *Epperson* decision, there have been several other federal court decisions that have considered the constitutionality of allowing religious theories to be taught in the science curriculum. For all practical purposes, federal courts since 1968 have prohibited the teaching of creationism. The new current battleground is on the issue of intelligent design. The first court decision on intelligent design, from Dover, Pennsylvania, is expected by January 2006. The significance of this decision, and the fallout from it, will be discussed. In many ways, the current controversy over the teaching of intelligent design may be only the tip of a far larger public controversy involving the roles of science, law, politics, and religion. Suggestions will be made as to how the scientific community can contribute to the legal and cultural issues that underlie this debate.

8:00PM M50.00002 Science and Society Under Attack: The Need for Political As Well As Scientific Responses, MARSHALL BERMAN, Sandia National Laboratory, retired, and past Vice-President of the New Mexico State Board of Education — Today science and scientists are under attack. This is not new in human history. Copernicus delayed publishing for fear of possible persecution. Bruno was burned at the stake. Galileo was forced to recant. Darwin worked for 20 years without publishing his ideas, perhaps out of fear of possible consequences. In the US today, fundamentalist evangelicals have launched an attack on science, from intelligent design creationism, to stem cell research, global warming, vaccines to prevent cervical cancer, even museums that show exhibits on evolution. In the 21st century, this medieval mentality must be strenuously resisted. Rational thought can co-exist with religious faith, unless extremism becomes the norm. Scientists have often ignored politics in their pursuit of new knowledge. But they must understand that public opinion is strongly influenced by non-scientific elements of society, from the pulpit, from politicians and bureaucrats, from a scientifically illiterate public, and from a media that frequently treats all points of view as equal, when they are most certainly not. Will science eventually be required to pass muster for religious fundamentalists in the near future?

8:30PM M50.00003 APS Activities with Other Professional Societies , FRANCIS SLAKEY, American Physical Society — In 1981, the APS Council issued a statement that opposed “equal time” presentation in public school science classes of creationism and evolution. The statement clarified that “Scientific inquiry and religious beliefs are two distinct elements of the human experience. Attempts to present them in the same context can only lead to misunderstandings of both.” The APS Council revisited the issue in 1999 when a school board in Kansas attempted to eliminate the Big Bang, among other issues, from the science curriculum. Since that time, the APS has been more directly involved in confronting efforts that would dilute the teaching of science in public school science classes. This talk will review the APS activities and describe a developing multi-science society activity.

9:00PM M50.00004 Media Coverage of Evolution and Intelligent Design , CORNELIA DEAN, New York Times — This abstract was not received electronically.

9:30PM M50.00005 Panel Discussion —

Wednesday, March 15, 2006 2:30PM - 5:30PM —

Session R7 DBP FEd FPS: The Experimental and Theoretical Foundations of Evolution Baltimore Convention Center 307

2:30PM R7.00001 Evolutionary ecology of *E. coli* metapopulations in patchy landscapes¹ , JUAN KEYMER, Princeton University — Spatial ecology and metapopulation biology are essential features of natural populations. Extinction of local populations, the colonization of new suitable habitat patches (metapopulation dynamics) as well as the creation and destruction of local habitats (patch dynamics) are basic components of the evolutionary process shaping life-history strategies. As Darwin liked to put it “the zoology of archipelagoes”. The role of spatial structure have been shown to be important for both, persistence and coexistence. However, the spatial ecology of microbial metapopulations have rarely been observed nor exploited technologically. We use nano and micro fabrication technology to build a spatially explicit (dynamic) landscape of habitat patches (the metapopulation chip) and a (UV) laser-based disturbance regime (patch dynamics). By building upon the theory of metapopulations in dynamic landscapes, we build fitness landscapes by linking patch dynamics to fluorescent patterns coming from molecular markers in the cell culture. We use landscape ecology and metapopulation biology to generate selective forces that can be used for evolutionary design of microorganisms.

¹Thanks to Peter Galajda & Robert Austin

3:06PM R7.00002 Life has Evolved to Evolve¹ , MICHAEL DEEM, Rice University — Concomitant with the evolution of biological diversity must have been the evolution of mechanisms that facilitate evolution, due to the essentially infinite complexity of protein sequence space. We describe how evolvability can be an object of Darwinian selection, emphasizing the collective nature of the process. Rapid or dramatic environmental change leads to selection for greater evolvability. The selective pressure for large scale genetic moves, such as DNA exchange, becomes increasingly strong as the environmental conditions become more uncertain. These results demonstrate that evolvability is a selectable trait and allow for the explanation of a large body of experimental results. Many observations within evolutionary biology, heretofore considered evolutionary happenstance or accidents, are explained by selection for evolvability. As specific examples, we discuss evolution within the immune system and evolution of drug resistant microorganisms.

¹DARPA #HR00110510057

3:42PM R7.00003 Can Evolution Be Understood Quantitatively?¹ , DANIEL S. FISHER, Harvard University — Although the underlying laws and mechanisms of biological evolution have been known for a long time, little is understood about the time scales of evolutionary processes. This talk will focus on quantitative questions about evolutionary dynamics and on the potential for progress on intermediate time-scale issues via combinations of microbial experiments and theory. A recent experiment on one of these will be presented. Some basic questions about long time-scale processes will also be raised, and potential roles of abstract models in sharpening these and advancing understanding addressed briefly.

¹Supported in part by NSF via DMR0229243

4:18PM R7.00004 Genome Evolution in the 21st Century , JAMES SHAPIRO, University of Chicago — Assume no previous theories about genetics and evolution. What conclusions would we draw from molecular data (e.g. genome sequences)? We start from basic principles of cellular information processing: cells behave cognitively using signal transduction networks; signal transduction involves weak noncovalent interactions; allosteric properties of biomolecules; multivalent storage of information in DNA sequences and nucleoprotein complexes; inertness of naked DNA. Genome informatics thus requires formation of nucleoprotein complexes. Complex formation requires generic repeated signals in the DNA; repetition also permits cooperativity to stabilize weak interactions. DNA is a functional structural component of nucleoprotein complexes, not a passive data tape. Specificity in DNA nucleoprotein complex formation involves combining multiple generic signals and/or sequence recognition by small RNAs. Novel combinations of generic signals and coding sequences arise in genomes by iteration and rearrangement. Cells possess natural genetic engineering functions that actively restructure DNA molecules. These internal DNA remodeling functions act cognitively in response to internal and external inputs. They operate non-randomly with respect to (1) the types of new structures produced and (2) the regions of the genome modified. Whole genome sequence data increasingly documents the historical role of natural genetic engineering in evolutionary changes. Basic principles of cellular molecular biology and DNA function lead to a complex interactive systems view of genome organization. This view incorporates different DNA components found in sequenced genomes. Regulated cellular natural genetic engineering functions permit genomes to serve as Read-Write information storage systems, not just Read-Only memories subject to accidental change. These 21st Century conclusions are most compatible with a systems engineering view of the evolutionary process.

4:54PM R7.00005 TBD , PAUL SNIEGOWSHI, University of Pennsylvania — This abstract was not submitted electronically.