

President's Council of Advisors on Science and Technology (PCAST)
SECOND MEETING
October 22-23, 2009
MINUTES

National Academy of Sciences Building
Lecture Room
2100 C Street, NW
Washington, DC

Members Present: John P. Holdren (Co-Chair), Eric Lander (Co-Chair), Harold Varmus (Co-Chair), Rosina Bierbaum, Christine Cassel, Christopher Chyba, S. James Gates Jr. , Shirley Ann Jackson, Richard C. Levin, Chad Mirkin, Ernest J. Moniz, Craig Mundie, Ed Penhoet, William Press, Maxine Savitz, Barbara Schaal, Eric Schmidt, Daniel Schrag, David E. Shaw, Ahmed Zewail

Members Absent: Mario Molina

Staff: Deborah Stine, Mary Maxon

Public Attendance: Approximately 100 observers attended.

Video Webcast Archive: The archive of the video webcast is available at <http://www.ostp.gov/cs/pcast>.

The President's Council of Advisors on Science and Technology (PCAST) convened in open session at 10:00 am with Dr. Holdren, Dr. Lander, and Dr. Varmus presiding on Thursday, October 22, 2009.

Agenda Item 1: Welcome and Overview of PCAST

Dr. Holdren, Dr. Varmus, and Dr. Lander, PCAST Co-Chairs, opened the meeting and welcomed the participants at 10:00 am.

Dr. Holdren mentioned some recent science- and technology-related events, including the awards of the National Medals of Science and National Medals of Technology at the White House, the announcement of this year's Nobel Prizes, and the recent roll-out of the President's national innovation strategy in upstate New York.

Agenda Item 2: Role of Science and Technology in Foreign Policy and Development Assistance

Harold Varmus and Ahmed Zewail moderated this session. Kerri-Ann Jones, Assistant Secretary for Oceans and International Environmental and Scientific Affairs, Department of State, spoke on the role of science and technology in foreign policy and development assistance.

Dr. Jones described general and specific State Department efforts aimed to forge international relationships through science and technology, highlighting the President's Cairo speech as a foundation

of relationship-building with the Muslim world, and a recently-initiated quadrennial diplomacy and development review as a strategic planning tool for diplomatic and development efforts.

PCAST members commented and asked questions of Dr. Jones. The discussion focused on issues such as the status of the Global Health Initiative, development programs and how they relate to science education, an IPCC-like panel for biodiversity and ecosystem services, science representation in embassies and how PCAST might help develop criteria for science diplomats, scientist-to-scientist contacts in non-governmental contexts, international disease surveillance, and a proposal to greatly expand scientific exchange programs.

Agenda Item 3: Report Briefing: National Research Council Report – *A New Biology for the 21st Century: Ensuring the United States Leads the Coming Biology Revolution*

Eric Lander and Harold Varmus moderated the session. Phillip A. Sharp, Institute Professor, The David H. Koch Institute for Integrative Cancer Research, Massachusetts Institute of Technology, and Thomas Connelly, Executive Vice President & Chief Innovation Officer, DuPont, co-chairs of the National Research Council Committee on New Biology for the 21st Century Brief PCAST, reported on the National Research Council Report entitled *A New Biology for the 21st Century: Ensuring the United States Leads the Coming Biology Revolution*.

The speakers summarized the report and suggested that biological science is now capable of addressing some of the largest societal problems – such as health, environment, energy, and food -- and that relatively small investments could solve critical problems that will broadly advance opportunities, and lead to the development of cross-cutting technologies that will leverage all biology-related science. To achieve this, a national initiative in New Biology was recommended.

PCAST members commented and asked questions of the presenters. The discussion focused on issues such as ecosystem -engineering concerns, the role of nanotechnology, catalytic agents, and biomimetic materials in the New Biology, whether environmental monitoring and vulnerability of ecosystems to climate change were considered in the New Biology study, and how to prepare new biologists for the New Biology.

The co-chairs adjourned this portion of the Open Session at 12:00 Noon.

PCAST reconvened in Open Session at 2:00 pm.

Agenda Item 4: Federal Science, Technology, Engineering, and Mathematics (STEM) Education Initiatives

Eric Lander and James Gates moderated this session. The following made presentations to PCAST:

- Kathryn Stack, Deputy Associate Director, Education and Human Resources, Office of Management and Budget (OMB), The White House

Ms. Stack's presentation described OMB's inventories and assessments of effectiveness of federal STEM education programs. She outlined the challenges of measuring effectiveness, and the importance of developing timely, integrated evaluation plans.

- Robert McGahern, Director, National Defense Education Program, Department of Defense (DoD)

Mr. McGahern mentioned the new K-12 initiative at DoD and showed an example of one (of thirty) four-minute videos designed to show students what scientists and engineers do. He also described examples of local efforts by the Army, Navy, and Air Force to provide professional development for teachers.

- Cora B. Marrett, Acting Deputy Director, National Science Foundation (NSF)

Dr. Marrett's presentation described NSF's analyses of STEM education at the undergraduate level, the reasons for attrition from STEM fields, the changing demographics of undergraduate students, and the need for research to improve STEM education.

- Joyce Winterton, Assistant Administrator for Education, National Aeronautics and Space Administration (NASA)

Dr. Winterton described NASA's three STEM outcomes: undergraduate and graduate education, K-12 education, and informal education through museums, science centers and community-based organizations. Dr. Winterton also described the metrics used to evaluate NASA's STEM investments.

- William Valdez, Director, Office of Workforce Development for Teachers and Scientists, Office of Science, Department of Energy (DoE)

Mr. Valdez outlined DoE's STEM-education pipeline and described flagship programs, which include undergraduate internships, a K-12 educators program, and the Einstein fellowship program.

- Bruce Fuchs, Director, Office of Science Education, Office of Science Policy, National Institutes of Health (NIH)

Dr. Fuchs shared perspectives of the early education systems of the United Kingdom and the United States, and highlighted early education policy decisions in the United States that were thought to be important for our economic growth. He also presented statistics of student performance based on recent education policy decisions, and underscored the need for better metrics for evaluation.

PCAST members commented and asked questions of the presenters. Questions focused on the prospects for one national entity for evaluation of federal STEM efforts, which STEM activities lead to an increase in the number of scientists, the statutory requirement of DoE for STEM education, possible

appropriations for DoE's STEM efforts, and the relative STEM expenditures of the Department of Energy, the Department of Education, and the Labor Department.

Agenda Item 5: Innovative Science, Technology, Engineering, and Mathematics Education Programs

Eric Lander and James Gates moderated this session. The following made presentations to PCAST:

- Bruce Alberts, Editor in Chief, *Science*

Dr. Alberts described a need for transforming science education in the United States. He highlighted the importance of active inquiry in science education and outlined requirements for success in a modern economy: a high capacity for abstract conceptual thinking and the ability to apply that thinking to complex real-world problems. He asked that PCAST encourage common standards for assessment, develop a science of education, and catalyze more support for programs that connect the scientific community to schools.

- Larry Rosenstock, Chief Executive Officer, High Tech High

Mr. Rosenstock described an approach to creating integrated, diverse education environments by blind lottery. Mr. Rosenstock shared statistics from the nine integrated, diverse K-12 schools he described: 100% of the children who graduated are in college, with 35% majoring in STEM fields.

- Angela Baber, Senior Policy Analyst, STEM Education Division National Governors Association Center for Best Practices

Ms. Baber described the National Governors Association interests in advancing STEM education at the state level. Highlighted were six states, Colorado, Hawaii, Minnesota, Ohio, Pennsylvania, and Virginia, that have redesigned math and science standards and that are internationally benchmarking those standards. Also mentioned was work the National Governors Association is doing in 48 states to create common core standards for math and English.

- John Winn, Chief Program Officer, National Math and Science Initiative

Mr. Winn described the objectives of the National Math and Science Initiative, which was established in response to the NRC report *Rising above the Gathering Storm*. Examples of efforts supported by the Initiative were given, one of which showed a 52% increase in one year in the number of passing scores in 67 high schools.

- Linda Katehi, Chancellor, University of California, Davis, and Chair, National Academy of Engineering/National Research Council Committee on Understanding and Improving K-12 Engineering Education in the United States

Dr. Katehi described a recent study aimed to produce guidance for the creation and implementation of K-12 engineering curricula. She described evidence that shows the benefit of inquiry-based learning, and stated a need to diversify the engineering workforce.

- Carl Wieman, Director, Carl Wieman Science Education Initiative, University of British Columbia, and Science Education Initiative, University of Colorado

Dr. Wieman described an effort to transform STEM education based on identification of cognitive components of desired STEM thinking, mental practice of the cognitive components, and feedback guidance to ensure transformation in STEM thinking. Examples using cognitive psychological approaches and assessments were provided.

PCAST members commented and asked questions of the presenters, including whether data exist for developing appropriate assessments for programs that specialize in socioeconomic mixes of students and the scalability of some successful examples of STEM education transformation.

The co-chairs adjourned this portion of the Open Session at 6:00 pm.



October 23, 2009

PCAST reconvened its open session at 10:00 am.

Agenda Item 6: Role of Science and Technology in Foreign Policy and Development Assistance

Harold Varmus and Ahmed Zewail moderated this session. Nina V. Fedoroff, Science and Technology Adviser, Department of State spoke on the role of science and technology in foreign policy and development assistance.

Dr. Federoff outlined the mission of science advisors in the State Department and described key examples of science diplomacy, such as the Jefferson Fellows Program . She stated that science diplomacy in the United States is moving away from an early focus on weapons and moving towards developing partnerships and collaboration between scientists. Dr. Federoff also focused some of her remarks on the implications of climate change on future food production.

PCAST members commented and asked questions of Dr. Federoff. The discussion focused on issues such as the possible expansion of the Jefferson Fellows program, the status of biotechnology and future food production, prospects for drought and temperature tolerance in plants, and the fraction of foreign aid that is spent on science and technology initiatives.

Agenda Item 7: Science, Technology, Engineering, and Mathematics Education

Eric Lander and James Gates moderated this session. Secretary Arne Duncan spoke on the topic of STEM Education.

Secretary Duncan underscored the need for transformation in STEM education in the United States to increase national performance in international education comparisons, and in economic competitiveness. Secretary Duncan called for the creation of a national STEM innovation agenda,

encouraged efforts to develop common math standards and described the role of the Race to the Top Fund in accelerating STEM education.

PCAST members asked questions of Secretary Duncan, including those focused on the role of the No Child Left Behind Act in future STEM education efforts, on new ways of evaluating learning in science classes, and on incentives for science and math teachers.

Agenda Item 8: Public Comment Session

PCAST heard from members of the public in person, via the web, and through written comments read by a staff member during this session. The following individuals provided oral comments to PCAST

- Francis Eberle , Executive Director, National Science Teachers Association
- Philip Hammer, Associate Executive Officer, American Association of Physics Teachers
- Howard Gobstein, Executive Officer and Vice President, Research; Innovation and STEM Education; Co-Director, Science and Mathematics Teacher Imperative; A.P.L.U. -- Association of Public and Land-grant Universities
- Ed Potosnak, Legislative Assistant , Office of Congressman Mike Honda
- Karl M. Glasener, Director of Science Policy, American Society of Agronomy/Crop Science Society of America/Soil Science Society of America
- Caron Gala, Agriculture and Food Research Initiative Coalition
- Robert Gropp, Director of Public Policy, American Institute of Biological Sciences
- Najmedin Meshkati, Professor, Department of Civil/Environmental Engineering Department of Industrial and Systems Engineering , University of Southern California
- Gerry Meisels, Professor of Chemistry and Director, Coalition for Science Literacy, University of South Florida
- Patti Curtis, Managing Director, Washington Office, Museum of Science, Boston, National Center for Technological Literacy
- Dmitry Novik, DIMAGE Inc.

Numerous individuals provided written comments to PCAST that are posted on the PCAST website. Two of these comments were read aloud at the meeting: Jim Brazell, Consultant, Innovation Creativity and Capital Institute (IC2), University of Texas, and the Schriever Institute, and Mark Christensen. Additional public comments were provided through the White House Facebook and Twitter webpages and read aloud at the meeting.

Agenda Item 7: Subcommittee Reports

Each subcommittee discussed activities PCAST might undertake. This included reports from the following subcommittees:

- Health and Life Sciences Subcommittee
- STEM Education Subcommittee
- Interdisciplinary Subcommittee
- Energy, Climate Change, and Environment Subcommittee

- Innovation and Technology Subcommittee
- Economic Development Subcommittee
- International Security Subcommittee

Harold Varmus and Eric Lander moderated the report of the Health and Life Sciences Subcommittee.

Dr. Varmus mentioned the two studies that the Subcommittee has taken on, H1N1 and health information. He briefly reviewed the findings of the H1N1 study (completed in August, 2009), and turned to the co-chairs of the health information study, Christine Cassel and Craig Mundie, for an update on the second study. Dr. Cassel described the focus of the study, and Mr. Mundie added detail on features of the study.

James Gates, Rosina Bierbaum, and Ahmed Zewail provided the report of the Science, Technology, Engineering, and Mathematics (STEM) Education Subcommittee. Dr. Gates and Dr. Lander deferred additional comment, citing the six hours of the October PCAST meeting that were dedicated to the topic.

Harold Varmus and Ahmed Zewail described a possible International Science and Technology study in the report for the Interdisciplinary Aspects of Science and Technology Subcommittee. Dr. Varmus highlighted the President's Cairo speech as indicative of the President's interest in how science and technology can be more effectively coordinated in the nation's efforts to work with international partners.

Daniel Schrag, Ernest Moniz, and Rosina Bierbaum provided the Energy and Environment Subcommittee report along with Rick Levin of the Economic Development Subcommittee. Carbon offsets were described as a focus of these Subcommittees and of an upcoming meeting in December. Additional efforts focused on energy research and development were also mentioned.

Shirley Jackson, Eric Schmidt, and Chad Mirkin provided the Innovation and Technology Subcommittee Report. Dr. Jackson stated that the Subcommittee's efforts are aimed to expedite innovation and create new industries. Maxine Savitz presented a summary of work underway to review the National Nanotechnology Initiative, and Ed Penhoet added that environmental health and safety would be a focus of that review.

William Press and Christopher Chyba provided the International Security Subcommittee Report. Dr. Chyba stated that three studies were under consideration for future investigation by the Subcommittee.

Dr. Holdren, Dr. Lander, and Dr. Varmus adjourned the meeting at 1:00 pm.

Respectfully Submitted:

[signed]

Deborah D. Stine
Executive Director
President's Council of Advisors on Science and Technology

[signed]

Mary E. Maxon
Deputy Executive Director
President's Council of Advisors on Science and Technology

Approved:

[signed]

John P. Holdren
President's Council of Advisors on Science and Technology

[signed]
Eric Lander
Co-Chair
President's Council of Advisors on Science and Technology

[signed]
Harold Varmus
Co-Chair
President's Council of Advisors on Science and Technology

Attachments:

Appendix A: Powerpoint presentations from [Bruce Alberts](#), [Angela Baber](#), [Nina Fedoroff](#), [Bruce Fuchs](#), [Linda Katehi](#), [Cora Marrett](#), [Bob McGahern](#), [Phillip Sharp](#), [Bill Valdez](#), [Carl Wieman](#), and [Joyce Winterton](#). The powerpoint presentations are available by clicking on each name above or at the www.ostp.gov/pcast.

Appendix B: Written Comments Received from Ioannis Miaoulis, Dmitry Novik, Karl Glasener, Gerry G. Meisels, Patti Curtis, Howard Gobstein, Francis Eberle, Jim Brazell, and Mark Christensen. These comments are available at www.ostp.gov/pcast or directly via the following link: <http://www.ostp.gov/galleries/PCAST/aggregateoralcomments2.pdf>.