AMERICAN ACADEMY OF ARTS & SCIENCES

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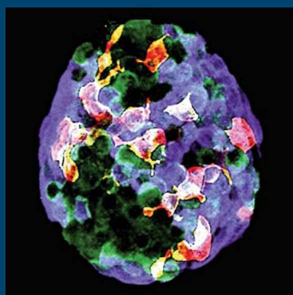
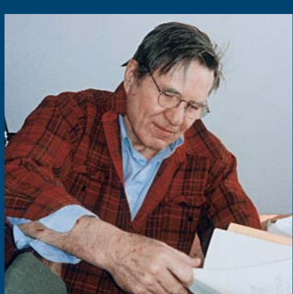
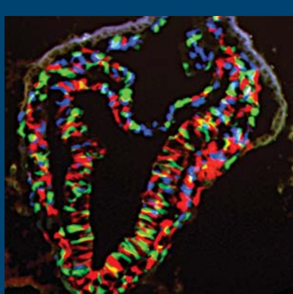
Bulletin







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AMERICAN ACADEMY
OF ARTS & SCIENCES

Calendar of Events

Saturday, October 6, 2007

Stated Meeting and Induction Ceremony – Cambridge

Location: Sanders Theatre, Harvard University

Time: 3:30 p.m.

Sunday, October 7, 2007

Stated Meeting – Cambridge

Energy and Climate Change

Speakers: Rosina M. Bierbaum (University of Michigan), **Richard A. Meserve** (Carnegie Institution of Washington), **William K. Reilly** (Aqua International Partners, LP), and **Richard L. Revesz** (New York University)

Location: House of the Academy

Time: 10:00 a.m.

Monday, October 15, 2007

Stated Meeting – Stanford

Nuclear Power without Nuclear Proliferation

Speakers: Hans Blix (Weapons of Mass Destruction Commission), **Michael M. May** (Stanford University), **William Perry** (Stanford University), and **Scott Sagan** (Stanford University)

Location: Stanford University

Time: 5:30 p.m.

Saturday, November 10, 2007

Stated Meeting – Chicago

The Disappearance of Species

Speakers: May Berenbaum (University of Illinois at Urbana-Champaign) and **Neil L. Shubin** (Field Museum and University of Chicago)

Location: The Field Museum

Time: 5:30 p.m.

Wednesday, November 14, 2007

Stated Meeting – Cambridge

Harvard University's New Allston Campus

Speakers: Stefan Behnisch (Behnisch Architekten) and **Christopher Gordon** (Allston Development Group, Harvard University)

Location: House of the Academy

Time: 5:30 p.m.

Tuesday, November 20, 2007

Stated Meeting – Berkeley

The World's Energy Problem and What We Can Do About It

Speaker: Steven Chu (Lawrence Berkeley National Laboratory)

Location: University of California, Berkeley

Time: 5:30 p.m.

Wednesday, December 12, 2007

Stated Meeting – Cambridge

Performing the Passion: J.S. Bach and the Gospel of John

Speaker: Margot Fassler (Yale University)

Location: House of the Academy

Time: 5:30 p.m.

For information and reservations, contact the Events Office (phone: 617-576-5032; email: mevents@amacad.org).

The Future of the Media in Society

The role of a free and effective press in a democracy and its impact on the formulation of public policy are at the center of two ongoing Academy studies. The first deals with how information about science and technology is diffused through the media. It is led by Donald Kennedy, former Stanford University President and Editor-in-Chief of *Science* magazine; and Geneva Overholser of the University of Missouri School of Journalism. The second examines reporting on business and the economy and includes among the project advisors Princeton University economists Alan Blinder and Alan Krueger. Both projects take into account the impact of new technologies and evolving patterns of news consumption on economic models that have long supported traditional print and broadcast media.

As Ghiglione points out, the technological revolution and market forces present traditional media with enormous challenges. Online advertising competitors devour major sources of revenue that have long been traditional media's lifeblood. With advertising and circulation revenues falling, traditional media shrink their news staffs, resulting in fewer resources for serious, investigative reporting.

Today, the future of journalism is best defined by a set of difficult questions. Who will provide the costly news analysis and worldwide coverage necessary to inform citizens? Will traditional media keep reinventing themselves to meet the demands of the economic, cultural, and technological future? How can business, government agencies, educational institutions, foundations, and other nonprofit organizations encourage needed changes in the media? Can the sense of excitement and experimentation that surrounds journalism on the web lead to new models of public-service journalism? Can traditional consumers of news become more open to quality journalism presented in online formats?

Many of these questions served as the basis for discussion at an Academy meeting on the "Future of News" at the Time-Life Building in New York in December 2006. Hosted by Time, Inc. Chief Executive Officer Ann Moore and chaired by former Time, Inc. Editor-in-Chief Norman Pearlstine, the program included a panel consisting of John Carroll, former Editor of the *Los Angeles Times*; Jeff Jarvis, City University of New York journalism professor and blogger; Jill Abramson, Managing Editor of the *New York Times*; Jonathan Klein, President of CNN/US; and Geneva Overholser, Hurley Chair in Public Affairs Reporting at the University of Missouri School of Journalism.

To advance the study, the Academy will partner with universities and other institutions with established journalism programs to sponsor a series of workshops designed to assess the transformation in journalism. According to Ghiglione, the Academy's multidisciplinary membership makes it an ideal convener of this project. Scholars and practitioners in journalism, computer science, technology, business, and other fields can advance our understanding of the future of news transmission – its quality, speed, and form. The social sciences can provide guidance on how to increase the accountability of those who report and analyze the news – to make their work more professional and transparent as a way of increasing public trust. The humanities can offer insights into such unchanging human needs as community and personal contact in a world where digital-age technology may diminish as well as empower the individual. ■

Photo courtesy of Northwestern University

Loren Ghiglione

Academy Fellow Loren Ghiglione, the Richard Schwarzlose Professor of Media Ethics at Northwestern University, spent six weeks this spring as a senior visiting scholar at the Academy. He is developing plans to expand the Academy's work on the evolving role that the media are playing in our society, and especially the changing nature of journalism in today's digital world.

Elected to the Academy in 2004, Ghiglione edited and published newspapers in New England for twenty-six years before directing journalism programs at Emory University, the University of Southern California, and Northwestern University for a decade. He is former President of the American Society of Newspaper Editors and former Dean of the Medill School of Journalism at Northwestern.

Support for Academy's Research Programs

Alfred P. Sloan Foundation Awards Grant for Science Project

The Alfred P. Sloan Foundation has awarded the Academy a grant to bring together leading scientists and engineers, former public officials, policy experts, ethicists, industry executives, and others from outside the scientific community to discuss how scientists can better understand and appreciate the public's response to various aspects of their work.

Considerable attention has been focused on strengthening public education about science and technology. The communication gap between scientists and the lay public, however, remains wide, and in some quarters is growing. The two strategies that are generally offered to help close this gap are 1) raising public understanding of science by improving science education, communication, and literacy at all levels, and 2) enhancing scientists' ability to communicate the significance of their work to the general public. Both strategies are necessary and important.

The focus on science education and better communication, however, overlooks an essential dimension of the problem: the scientists' obligation to understand the broader social and cultural context in which their work is received and to accept that sometimes the public's concerns about science stem not from ignorance but from legitimate worries.

Public attitudes about science and technology are complex, informed by a variety of sources and influenced by diverse ethical, religious, and cultural values. In certain areas – for example, global warming, biomedical research, or research on dangerous pathogens – scientific progress and public policy concerns may come into conflict.

Through a series of roundtable discussions, the Academy's new study will focus on the public's attitudes about a number of issues, such as the unintended social consequences of scientific and technological advances; the short- and long-term safety of the work; and the broader ethical, religious, and social implications. Through this effort, the Academy hopes to foster a sustained and more effective dialogue between scientists and the public.

"Science communication is commonly perceived to flow in only one direction, from scientists to the public," said Neal Lane, Academy Fellow and Cochair of the Initiative for Science, Engineering, and Technology. "But if scientists can listen to the public's concerns about their work, and if they have a better understanding of the public's unease about science and technology, the social contract upon which their work depends will be strengthened. We hope this Academy project will foster needed dialogue between scientists and the public."

Fellows interested in working on this topic are encouraged to contact Academy CEO Leslie Berlowitz and Program Officer Katie Donnelly.

Fellows advising on this project include Charles Vest (National Academy of Engineering), Neal Lane (Rice University), Hunter Rawlings (Cornell University), Paul Nurse (Rockefeller University), Alan Alda (New York City), Greg Papadopoulos (Sun Microsystems), Ralph Gomory (Alfred P. Sloan Foundation), and Alan Leshner (American Association for the Advancement of Sciences).

This study is part of the Academy's Initiative on Science, Engineering, and Technology, which examines, in broad terms, how the world of science, engineering, and technology is changing; how to help the public understand those changes; and how we as a society can better adapt to those changes. More information about the Initiative on Science, Engineering, and Technology is available on the Academy's website at http://www.amacad.org/projects/initSciTech.aspx. ■

Teagle Foundation Supports Data Collection in the Humanities

With a grant from the Teagle Foundation, the Academy will advance work this fall on The Humanities Departmental Survey – The Template Project, an Academy effort to gather new information from college and university humanities departments. The data collected will become part of the Humanities Indicators Project – an ongoing effort to compile and categorize existing data in the humanities.

In awarding the grant, Teagle Foundation President and Academy Fellow W. Robert Connor noted that this project will address a "crucial need for data collection in the humanities." Humanities scholars, foundations, and educational policymakers lack important information about roughly one-third of the disciplines that form the core of a liberal arts education. The absence of basic empirical data has become a particularly urgent problem now, when new economic, curricular, and ideological pressures threaten support for the humanities.

The Template Project is a collaborative effort to collect, compare, and analyze data from humanities departments across several academic disciplines, including history, modern languages and literature, art history, religion, and linguistics. Working with national humanities organizations and disciplinary associations, such as the Modern Language Association and the American Historical Association, project participants have developed a survey instrument designed to bring consistency to already existing data collection efforts in the humanities.

Arnita Jones, Executive Director of the American Historical Association, summed up the project's importance to humanities disciplines: "With this project, the Academy has provided the humanities community an opportunity to . . . work cooperatively toward shared goals in the realm of data collection. Once the value of the departmental survey data is demonstrated, I feel certain that other disciplinary associations will be eager to participate. Its long-term implications are significant."

The survey is designed to gather data, including the number and nature of faculty in each humanities discipline (tenured versus adjunct; full-time versus part-time); the form graduate teaching takes (e.g., seminars, independent study); the distribution of teaching loads (undergraduate versus graduate); the number of majors and minors; jobs secured by graduates; and other areas of concern that can be used to produce indicators of the health of the humanities in higher education. The survey will be administered this academic year.

The Statistical Research Center, which conducts similar surveys within physics, astronomy, and allied fields, will administer the survey and compile the data. The data will be analyzed by the American Political Science Association, along with data collected independently in 2006 from political science departments. Results will be made available electronically.

The Template Project is part of a larger Humanities and Culture Initiative receiving financial support from the Andrew W. Mellon Foundation, Walter B. Hewlett, the William R. Hewlett Trust, the William and Flora Hewlett Foundation, the Rockefeller Foundation, and the Sara Lee Corporation. More information about the project is available on the Academy's website at http://www.amacad.org/projects/indicators.aspx. ■

Fellowship Programs 2008–2009

Deadline: October 15, 2007

Visiting Scholars Program

Applications are being accepted for the Visiting Scholars Program. Preference will be given to untenured junior faculty, but postdoctoral scholars are also urged to apply. Members of the Academy are encouraged to inform students and junior colleagues about this year-long, residential fellowship opportunity at the Academy.

The Academy is especially interested in applicants whose work relates to its research areas: *Science, Technology & Global Security; Social Policy & American Institutions; Humanities & Culture;* and *Education*. Projects that address American cultural, social, or political issues from the founding period to the present are welcome, as are studies that examine developments in public policy. Proposals should take into account the Academy's emphasis on interdisciplinary work, as well as its interest in broadening public understanding of important intellectual trends and contemporary policy choices. Candidates should also consider the relationship of their work to archival, library, and other intellectual resources in the Boston area.

Hellman Fellowship in Science Policy

The Hellman Fellowship is open to scientists who want to transition to a career in policy or acquire experience working on science policy issues. For more information about this fellowship opportunity, please see page 5.

All Scholars participate in conferences, seminars, and events at the Academy while advancing their independent research.

For details about the Hellman Fellowship, please contact Academy Program Officer Katie Donnelly: phone: 617-576-5008; email: kdonnelly@amacad.org. For information about the Visiting Scholars Program, please contact its Director Alexandra Oleson: phone: 617-576-5014; email: vsp@amacad.org.

University Affiliates

A growing number of colleges and universities is collaborating with the Academy by participating in its studies on higher education and by helping to support its Visiting Scholars Program. The Academy is grateful to these University Affiliates for their confidence in its efforts to support interdisciplinary research and to expand opportunities for postdoctoral scholars and junior faculty.

American University – Cornelius Kerwin, President
Boston College – William P. Leahy, S.J., President
Boston University – Robert A. Brown, President
Brandeis University – Jehuda Reinharz, President
Brown University – Ruth J. Simmons, President
The City University of New York – Matthew Goldstein, Chancellor
Columbia University – Lee C. Bollinger, President
Cornell University – David J. Skorton, President
Dartmouth College – James Wright, President
Duke University – Richard H. Brodhead, President
Emory University – James W. Wagner, President
George Washington University – Steven Knapp, President
Harvard University – Drew Gilpin Faust, President
Indiana University – Michael McRobbie, President
Johns Hopkins University – William R. Brody, President
Massachusetts Institute of Technology – Susan Hockfield, President
Michigan State University – Lou Anna K. Simon, President
New York University – John Sexton, President
Northwestern University – Henry S. Bienen, President
Ohio State University – Gordon Gee, President
Pennsylvania State University – Graham Spanier, President
Princeton University – Shirley Tilghman, President
Rice University – David W. Leebron, President
Rutgers, The State University of New Jersey – Richard L. McCormick, President
Smith College – Carol T. Christ, President
Stanford University – John L. Hennessy, President
Syracuse University – Nancy Cantor, Chancellor and President
Tufts University – Lawrence S. Bacow, President
University of California, Berkeley – Robert J. Birgeneau, Chancellor
University of California, Davis – Larry N. Vanderhoef, Chancellor
University of California, Irvine – Michael V. Drake, Chancellor
University of California, Los Angeles – Norman Abrams, Acting Chancellor
University of California, San Diego – Marye Anne Fox, Chancellor
University of Chicago – Robert J. Zimmer, President
University of Illinois at Urbana-Champaign – Richard Herman, Chancellor
University of Iowa – Sally K. Mason, President
University of Maryland – C. D. Mote, Jr., President
University of Michigan – Mary Sue Coleman, President
University of Minnesota – Robert Bruininks, President
University of North Carolina at Chapel Hill – James Moeser, Chancellor
University of Notre Dame – Rev. John Jenkins, President
University of Pennsylvania – Amy Gutmann, President
University of Pittsburgh – Mark A. Nordenberg, Chancellor
University of Southern California – Steven B. Sample, President
University of Texas at Austin – William Powers, Jr., President
University of Virginia – John T. Casteen III, President
University of Wisconsin-Madison – John D. Wiley, Chancellor
Virginia Polytechnic Institute and State University – Charles W. Steger, President
Wellesley College – Kim Bottomly, President
Yale University – Richard C. Levin, President

Hellman Fellowship in Science Policy

The Academy is pleased to announce a $1 million grant from the Hellman Family Foundation to establish the Hellman Fellowship in Science and Technology Policy. The fellowship will be open to scientists who want to transition to a career in policy or to acquire experience working on science policy issues. While in residence at the Academy in Cambridge, the Hellman Fellow will work with senior scientists and policy experts on critical national and international policy issues related to science, engineering, and technology.

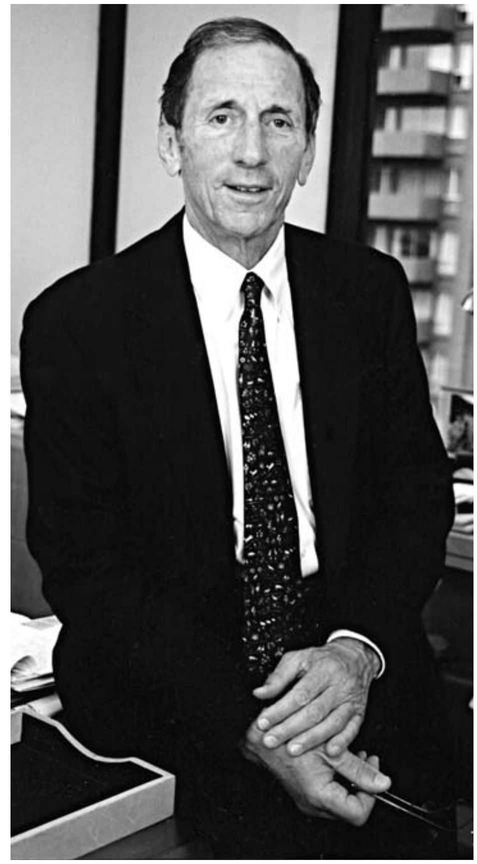
In establishing this new opportunity at the Academy, Warren Hellman observed, "Through the Hellman Fellows program, our family for many years has supported young scholars at various universities. Supporting scholarship on science policy at the Academy is to be encouraged, bringing the knowledge of leading scientists to bear on the process of policymaking at both the national and international level."

The Hellman Fellowship Program will provide a setting and resources for an individual with training in science and engineering to develop expertise on issues of science, engineering, and technology policy; increase the cadre of science policy professionals who are engaged in substantive discussion of science and engineering research questions, with a broad understanding of their social implications; and expand the Academy's capacity to conduct projects and studies focused on the challenges facing scientific research and science education.

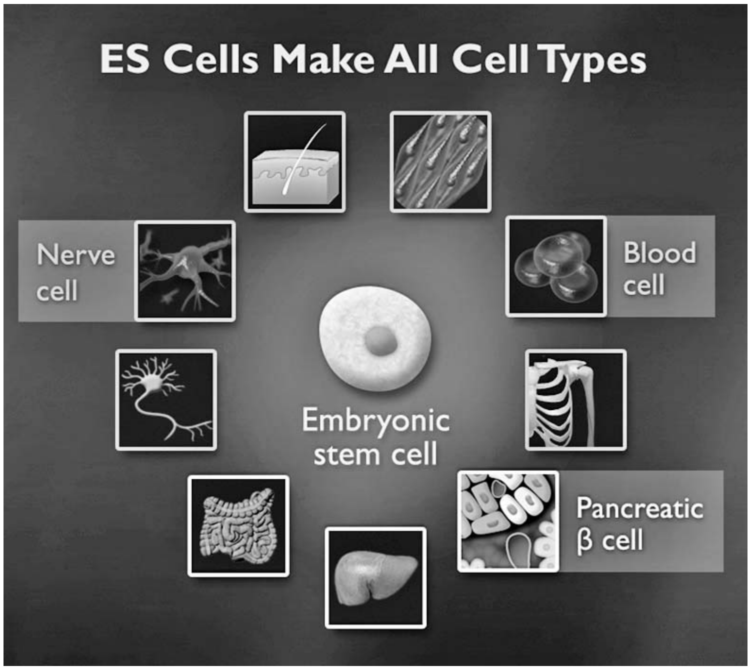
Hellman Fellows will be assigned to one or more of the ongoing research projects of the Initiative for Science, Engineering, and Technology. The mission of the Initiative is to examine, in broad terms, how the world of science and technology is evolving, how to help the public understand these changes, and how society can better adapt to these developments. The topics of projects currently underway include 1) alternative models for the federal funding of science, 2) scientists' understanding of the public, 3) science in the liberal arts curriculum, 4) stemming nuclear proliferation, and alternative paths to a more secure nuclear future, and 5) the social and technical requirements for Internet security.

In acknowledging the award, Leslie Berlowitz, Academy CEO, noted, "This generous gift will enable the Academy to advance the discussion of the vital role science and technology play in society today. The Academy is extremely grateful to the Hellman Family Foundation and to Warren Hellman, Fellow of the Academy, member of the Academy Trust, and a director of the Hellman Family Foundation, for this grant."

Hellman Fellows will be appointed for a one-year term (with the possibility of a one-year renewal), with the first appointment to begin on September 1, 2008. The deadline for applications is October 15, 2007. We encourage Fellows of the Academy to recommend candidates for this fellowship. A description of the fellowship, eligibility, and application procedures are on the Academy website at http://www.amacad.org/hellman.aspx. ■



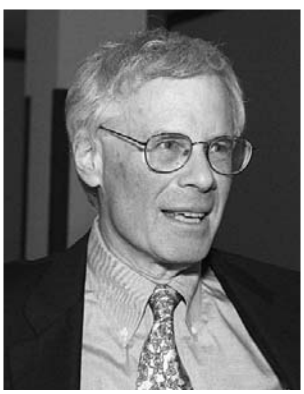
F. Warren Hellman (Hellman & Friedman LLC)



Stem Cell Challenges in Biology and Public Policy

Douglas A. Melton
Introduction by Harvey F. Lodish

This presentation was given at the 1910th Stated Meeting, held at the House of the Academy in Cambridge on February 7, 2007.



Harvey F. Lodish

Harvey F. Lodish is Professor of Biology and Bioengineering at the Massachusetts Institute of Technology and Member of the Whitehead Institute for Biomedical Research. He has been a Fellow of the American Academy since 1999.

Introduction

It is a great personal and professional pleasure to introduce Douglas Melton. Doug is an Investigator at the Howard Hughes Medical Institute, the Thomas Dudley Cabot Professor of the Natural Sciences at Harvard University, and a founding Codirector of the Harvard Stem Cell Institute. He is uniquely qualified to talk to us this evening about stem cell challenges in biology and public policy. Being an Investigator at the Howard Hughes Medical Institute means that he has access to private funds and can work on human embryonic stem cells despite the prohibitions that our government has placed on this research.

Doug grew up in Chicago, the son of a grocery-store manager, and earned his undergraduate degree in biology from the University of Illinois at Urbana-Champaign. He received a Marshall Scholarship to study at Cambridge University in England, earning an A.B. in the history and philosophy of science. Doug went on to take his Ph.D. in molecular biology at both Trinity College and at the Medical Research Council Laboratory of Molecular Biology with Sir John Gurdon, the first person to create an adult animal by nuclear transfer – that is, by cloning. One of the pioneers in early embryonic development, Gurdon showed that, in frogs, it is possible to remove the DNA from an egg, replace it with the DNA from an adult frog cell, and have an egg that develops into a genetic duplicate of the frog from which the donor DNA came. In a sense, this was the first highly controversial experiment in developmental biology, presaging all the current discussions about embryonic stem cell research and cloning.

But more important, in that laboratory Doug did some fundamental work on the development of the early frog embryo. It was inquiries into that basic science question that dominated his work when he moved to Harvard as an assistant professor in biochemistry and molecular biology. There, he did some wonderful experiments on frog development. When the frog egg, which is very large, divides, the two daughter cells have very different fates: their descendents become very different kinds of cells in the embryo and the adult frog. A fundamental question in developmental biology is why?

What Doug showed is that a certain part of the egg contains a high concentration of a messenger RNA called Vegi, which is not found in other parts of the egg. When the cell divides, Vegi messenger RNA goes into one of the cells but not the other. That messenger RNA, in turn, encodes a secreted hormone in the TGF beta family, which specifies parts of the body axis in the frog embryo. In particular, it induces formation of the dorsal mesoderm. Doug also uncovered the segment of the messenger RNA that caused it to be localized in this section of the egg.

This research occupied him until the mid-1990s, when personal reasons made him change the direction of his research toward pancreas development, particularly the development of the insulin-secreting cells in the pancreatic islets. He recognized, far before any of us did, that the only rational way to treat juvenile diabetes, where the immune system destroys normal islet cells, is by islet transplantation. This, in turn, requires a source of islets that we can only obtain in large numbers by developing embryonic stem cells.

Thus Doug embarked on a very impressive series of studies concerning how the pancreas is normally formed during development and how the body produces more islet cells during adult life. Many body tissues have stem cells; for example, there are stem cells in the blood that make more blood cells; there are stem cells in the liver that make liver cells. But rather strikingly, and just in the past few years, Doug showed that the insulin-secreting cells in the pancreas do not seem to be formed from stem cells. Rather, they reproduce by dividing: one insulin-producing cell divides into two, and so forth. This is an example of the kind of important fundamental science that Doug carries out to understand the genes, the cells, and the tissues that direct organ formation.

In his talk, Doug will consider the practical implications of his work: how one can coax undifferentiated embryonic stem cells into forming insulin-secreting cells. This application is important not only to understand all the genes and the extracellular factors that catalyze this process, which is of interest to the basic scientist, but also for potential therapeutic purposes. For example, Doug has done some fundamental studies to try to grow embryonic stem cells into insulin-secreting cells that will respond to a rise in blood sugar as they normally should: by secreting insulin. He is not there yet, but he is getting close.

What is fascinating about Doug is apparent by just looking at his lab website. If you look at the keywords for his research interests, you will find the expected terms: "pancreas," "diabetes," "cell biology," "chemical biology," "developmental biology," "human embryonic stem cells," and "transgenic mice." But you will also find "bioethics" and "law and public policy." I think that reflects Doug's leadership in explaining the importance of research on human embryonic stem cells to the general public and to lawmakers. He does this privately and without a lot of flair. He has spoken to former Massachusetts Governor Mitt Romney, to President George Bush, and to Vice President Cheney – all, I am sorry to say, with little effect, but I give him enormous credit for trying. He is an editor of *Science* and has received many honors for his work, including election to this Academy, the National Academy of Sciences, and the Institute of Medicine.

Douglas A. Melton

Douglas A. Melton is Thomas Dudley Cabot Professor of the Natural Sciences at Harvard University and Investigator at the Howard Hughes Medical Institute. He has been a Fellow of the American Academy since 1995.

Presentation

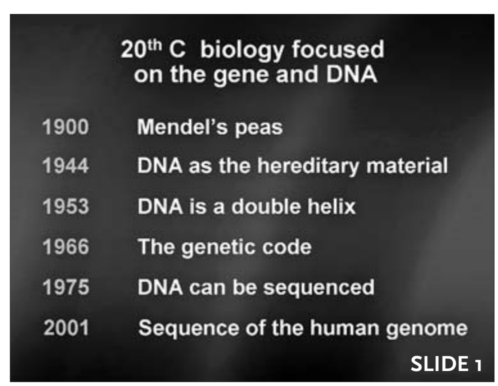
When I started my stem cell research, I never imagined that it would create so much interest in the public's mind. On the one hand, scientists do like people to know what they are doing and want others to pay attention to it, particularly young people. But I have to admit, I am surprised when the President and other public figures speak about stem cell research on the national stage and when it is presented on television news programs and even in various comedy acts. I might reflect, for just a minute, on why that is the case.

To biologists, stem cells are interesting for two reasons. One, they can teach us a lot about how animals develop; how cells work. Second, they have the potential to help alleviate diseases from which many people in our society suffer. But stem cells are probably in the public's mind for a different reason, namely, they touch on the question of what it means to be human, specifically on when life begins.

To biologists, stem cells are interesting for two reasons. One, they can teach us a lot about how animals develop; how cells work. Second, they have the potential to help alleviate diseases from which many people in our society suffer.

There are a number of different aspects to this subject, all of which we could discuss, but I will begin with the biology. Then I will talk about how stem cell research affects or is affected by public policy and politics, which is related to the philosophical or metaphysical aspects of this work. This then brings us into what laws might or might not be passed to restrict it. I will say rather little about the long-term requirement that some commercialization will have to take place if this research is ever going to benefit patients.

To put stem cells in context, I am going to show you a couple of slides about how biologists got to this point in their work. This slide (see Slide 1) oversimplifies the last century of biology by saying that it focused almost obsessively on DNA, beginning with Mendel's

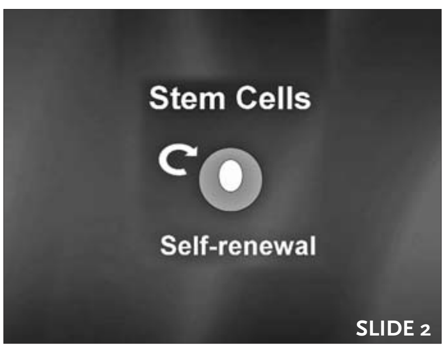


SLIDE 1

work with peas and his finding that inherited elements determine our character and extending to the discovery that DNA was the chemical basis of hereditary material. The results of the double helix experiment were published in 1953, followed by the elucidation of the genetic code, the demonstration that DNA could be sequenced, and then the sequencing of the whole genome.

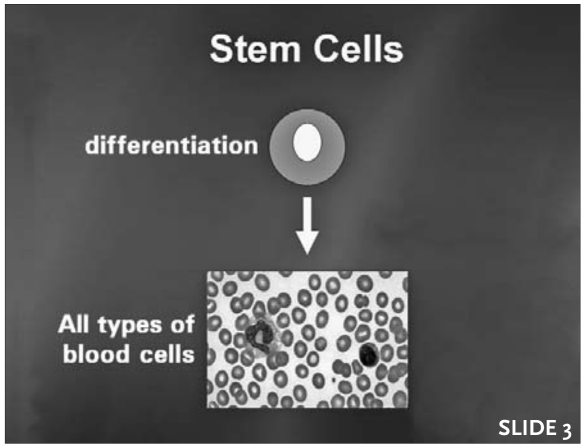
So the public might be forgiven for thinking that all of biology is really DNA: that DNA is destiny and that DNA is all that biologists "do." But I would suggest that we are now living in a century that will not be so much about DNA, but instead will center on figuring out how pieces of DNA, or genes, interact to make the real unit of life, the cell.

For fun, I will say that this century will be the century of cells and stem cells. Why stem cells? In my view, stem cells are the most interesting. Let me provide a short primer on what stem cells do and why biologists find them interesting.



SLIDE 2

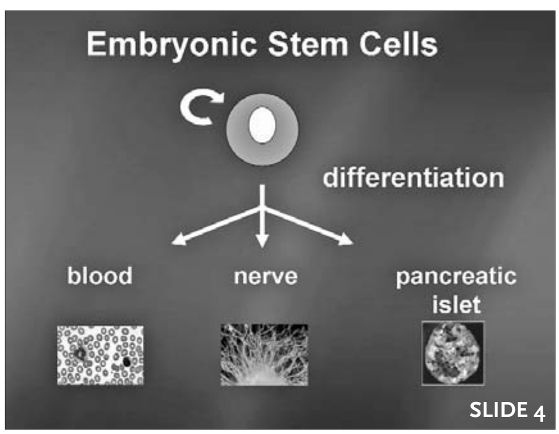
A stem cell has two main properties. First, a stem cell can self-renew (see Slide 2) – that is, it can divide and make a copy of itself. "Self-renewal" should make you think of "repair," "regeneration," "replenishment." If we could understand the genetic program, the basics of how a cell makes an exact copy of itself, that knowledge would strengthen our understanding of how we can repair or replenish our bodies. Second, stems cells have the capacity to make different kinds of daughter cells by means of a process called "differentiation," which signifies to specialize, to become different from one another (see Slide 3). This slide shows that a blood stem cell can make all the different kinds of cells found in the blood. The adult stem cell for blood is known to many of you: it is the cell found in the bone marrow that is used to treat cancer patients



SLIDE 3

after radiation. A bone-marrow transplant is actually a transplant of adult hematopoetic, or blood-forming, cells.

Now, these two properties, self-renewal and differentiation, are highlighted in a very special way in an embryonic stem cell. Embryonic stem cells can also self-renew and differentiate, but interestingly, and most importantly, they can make any cell type found in the body: blood cells, nerve cells, the cells of the pancreatic islet that make insulin, etc., etc. (see Slide 4) Adult stem cells, in contrast, are restricted. Adult blood stem cells, for example, make blood; they do not make fat, nerves, or pancreatic islets – they only make blood.



SLIDE 4

The capacity of embryonic stem cells to make any part of the body is especially significant because not all tissues in adults have a stem cell. The pancreas – particularly the pancreatic beta cell – does not have an adult stem cell, which is important as we begin to talk about disease: if a person has lost a particular cell type, like a pancreatic beta cell, it no longer has the capacity to make more. Thus if this nation were to say that we could only work on adult stem cells, that measure would more or less consign people with certain diseases to be ineligible for new therapies from stem cells.

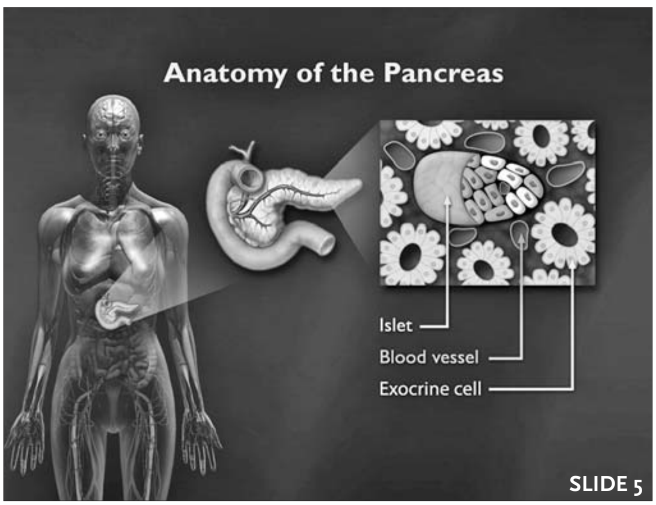
The ability of embryonic stem cells to make any part of the body is fascinating to biologists because we can, as I said, begin to study properties of self-renewal and differentiation; to determine how a cell knows which genes to turn on and off to make different cell types. But the real reason it gets so much public attention lies in its potential for treating degenerative diseases, particularly the diseases of neurodegeneration, including Alzheimer's, Parkinson's, Amyotrophic Lateral Sclerosis (ALS, sometimes called Lou Gehrig's Disease), spinal muscular atrophy, cardiovascular disease, and diabetes.

The biomedical community has largely failed to make significant advances in understanding these afflictions, but they will become ever more important as our society ages. Just to put a number on this, I will cite data taken from the year 2000: the number of patients who could benefit from some new treatments for these diseases is 128 million in the United States alone, not to mention all over the world.

Tying together stem cells and these diseases is relatively simple to do. While these diseases are multigenic, and interact with the environment or require an environmental stimulus, they are, in general, the result of a deficiency in a particular cell type. Here are two examples. The first is cardiovascular disease. Since we can make cardiomyocytes (heart muscle cells) from embryonic stem cells, imagine how useful that will be to learning about how to repair the heart. Could one transplant those cells? Could one learn how they develop normally, how to keep them in better shape, and what causes them to become dysfunctional or die?

I want to say a bit more about the area in which I work – diabetes – to give a slightly different example. In the case of diabetes, as Harvey mentioned, the principal problem in Type 1 or juvenile diabetes is that the cells that make insulin are absent. They are called pancreatic beta cells and they produce insulin in response to glucose in the blood. Without those cells, a patient will not survive. The cells are destroyed by an autoimmune attack. It is obvious, then, that if you have a cell that can make pancreatic beta cells, why not try to figure out how to make it at a scale so that you might transplant it into patients?

Here is a picture of the pancreas, which is next to the duodenum at the bottom of the stomach tube (see Slide 5). Inside the pancreas are islets, little islands of cells. The pancreas has about a million pancreatic islets in it: the pancreas is about the size of a banana, and the islets are like a million little raisins peppered through it. The key cell here is the pancreatic beta cell, the one that makes insulin.

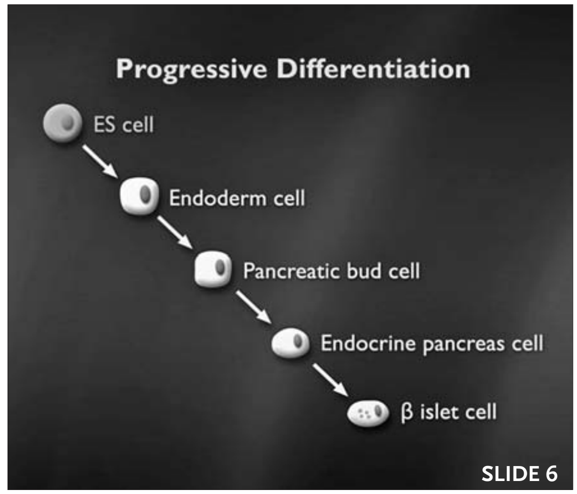


The blood vessels are next to the islet, so that when you have a drink with sugar in it or eat a meal – and your stomach turns the food or sugar into glucose – your body is able to make use of that energy source because these cells secrete insulin. In the case of Type 1 diabetes, however, the cells that make insulin are destroyed, so the patient cannot make insulin and requires daily blood-glucose tests and insulin injections for survival.

The evidence in mice for the conclusion that no adult stem cells exist for these beta cells is now quite convincing. Once all of the beta cells expire – either killed by an autoimmune attack or otherwise removed – the mouse does not have the capacity to make more beta cells. To make more of these cells, we must turn to embryonic stem cells. How do we try to create beta cells using embryonic stem cells?

We believe we can do that through the process of progressive differentiation (see Slide 6). A cell does not decide to become a muscle cell, or a nerve cell, or a pancreatic beta cell in just one step. As in the education of a child, many steps are required. We have focused on each of these steps for the last few years, studying in normal animals how signals are sent to cells to tell them what to do. We have adapted methods for putting human embryonic stem cells into dishes that have lots of little wells in them – kind of like bingo cards with three hundred or four hundred little wells in each of them. Next, we treat each well with a different chemical, and we look for which chemicals tell the cell to move one step further. In this systematic way, we are able to move forward step by step in directing the differentiation of cells into the type of cell we would like. This process takes several years. In some cases – and I will discuss motor neurons in a few minutes – scientists are much further along than in others. Thinking ahead to the future, we have every reason to believe that we will be able to make your favorite cell type. Let us say, for example, that you are concerned about getting a little bit too plump. If we make fat cells in a dish, we could begin to study much more easily what makes them divide and what makes them grow – and how we could control their division, or the amount of adipose tissue in a person. And I could make the same argument for any type of cell in the body.

But let us return to cases like heart disease or diabetes. I want to emphasize that for these degenerative diseases, there is a single cell type that is missing or defective. In Alzheimer's, the defective cell is a basal forebrain neuron; in Parkinson's, it is the dopamine-producing midbrain neuron; in ALS, it is the motor neuron. In each of these cases, scientists are studying how to take this very potent embryonic stem cell and tell it what it should



become. Having embryonic stem cells that can make any part of the body is an extremely powerful capability. However, several factors make these degenerative diseases difficult to study. First, all of them are complex genetic disorders. In other words, they are

If we could understand the genetic program, the basics of how a cell makes an exact copy of itself, that knowledge would strengthen our understanding of how we can repair or replenish our bodies.

not the result of a single genetic defect. An example of a simpler disease is cystic fibrosis. If a patient has a mutation in a gene called the cystic fibrosis transmembrane regulator (CFTR), it does not matter what other genes the patient has, or in what form, or in what environment he or she grows up: that patient will have cystic fibrosis. That is a very simple – monogenic – type of disease; in contrast, all of the degenerative diseases I have mentioned are multigenic. Worse yet, in every case, we do not know all the genes involved, so for almost every disease, we have very poor or inadequate animal models.

Also, in each of these cases, there is an environmental trigger that has yet to be identified. One way to think about this situation is to envision identical twins – with the same genes, of course – only one of whom has the disease. In such a case, there had to be an environmental trigger, whether it was the amount of exercise they did, or the food they ate, or the length of time they spent sitting in the sun. In most cases, we are not sure what the signal is, but we know that it has to exist.

Finally, these diseases are difficult to study because of the long gap between the primary cause and the effect. When a patient appears with one of these diseases, the primary cause could have been something that happened many years earlier.

The ability of embryonic stem cells to make any part of the body is fascinating to biologists because we can begin to study properties of self-renewal and differentiation; to determine how a cell knows which genes to turn on and off to make different cell types.

With these challenges in mind, I want to outline why we want to do somatic-cell nuclear transfer, or, as it's more popularly known, human cloning. Let's take the case of ALS, which involves a degeneration of the motor neurons. This disease occurs at an unfortunately high frequency in our population; most people with ALS do not survive for more than three years, although some people survive for as many as five years. There is no treatment and no cure, and we do not really know the primary cause.

At the Harvard Stem Cell Institute, we are trying to remove the study of this disease from patients and reduce it to examining cells in a petri dish. In this way, we can combine the potential of stem cell biology with somatic-cell nuclear transfer.

For a patient suffering from ALS, we would normally do a skin biopsy, with the intention of isolating the nucleus from one of the skin cells. Remember, while we do not know all of the genetic variants that cause the person to get the disease, we do know that all of the genes are inside the nucleus of every cell in the patient's body. Because of the work of John Gurdon and others, we know it is possible to remove this nucleus and inject it into an egg recipient – an unfertilized human oocyte – to create what are called patient-specific stem cells.

For those of you who have read anything about this work in the newspapers, you probably know that scientists want to make patient-specific stem cells in order to transplant them back into people. I am not talking about that tonight because I think such a procedure is years away. I believe what is more important is to be able to make disease-specific – patient-specific – stem cells – not ones that we would put back in a patient, but ones that we would use to understand the root causes or mechanisms of these diseases. Let's see how that is actually done.

There are two people involved in making disease-specific (ALS) embryonic stem cells. First, beginning with an ALS patient, a skin biopsy is performed to get skin cells that will serve as the nuclear donor. Separately, a female oocyte donor is required – here using the same procedures that in-vitro fertilization (IVF) clinics use to obtain an unfertilized egg or oocyte. The nucleus is removed from that oocyte and replaced with the skin cell nucleus from the ALS patient. This transplanted cell will divide several times to form a blastocyst, a very early stage of embryonic development, from which an embryonic stem cell can be derived.

Why would one want to create a diseased stem cell? One reason is to study its development alongside that of normal cells, to ask the simple question of what goes wrong? Why do motor neurons in patients who have Lou Gehrig's disease screw up? Why do these cells die? As we can all appreciate, it is impossible to study these questions in people very effectively, but if we watch the developmental process unfold in a petri dish, we can begin to understand what is going on. Significant progress has been made using this approach through the work of my colleagues Kevin Eggan and Lee Rubin, who made genetically altered stem cells, using the genetic alteration in cells found in ALS patients, and watched them develop into motor neurons that are distinctly different from the normal type of motor neuron. They observed a defective cell phenotype – the pathology of the human disease – in a petri dish.

Exchanging genetic material – by somatic-cell nuclear transfer – enables us to reduce the study of degenerative human diseases to a petri dish, and thus to find drugs that may slow or even stop the progression of those diseases.

Again, I want to be clear about why we want to do this, because if we make defective motor neurons, they are of no use for transplantation back into a patient. We make defective neurons because we want to do what is called "pharmaceutical" or "chemical" screening, where we look for chemicals that prevent the cells from dying, from having these so-called amyloid inclusion bodies. This screening, if it works well, could lead us to find chemicals, and eventually drugs, that do not necessarily cure or reverse the disease, but at least slow down the degeneration. In the ideal case, they might even stop the disease from progressing further.

Exchanging genetic material – by somatic-cell nuclear transfer – enables us to reduce the study of degenerative human diseases to a petri dish, and thus to find drugs that may slow or even stop the progression of those diseases. This outcome is quite different from the cellular transplantation you read about in the media, which, in my opinion, is still years away.

So you might reasonably ask, "How could anyone object to this?" I have made primarily a scientific argument about what we want to do, what the cells can do, and why we want to do it. The tricky part is the intersection of this subject with religion and politics. I would like to take this opportunity at the end of my talk to outline my views on this matter.

The problem centers on the source of the cells. As you know, there are two kinds of stem cells: adult and embryonic stem cells. The controversy surrounds embryonic stem cells that come from an early stage of development called the blastocyst. In early development, after the egg is fertilized, cell division proceeds to form eight, then sixteen, then thirty-two cells in a ball. At this early stage, the solid mass of dividing cells is sometimes called a morula, after the Latin word for mulberry or raspberry, because that is pretty much what this state of embryo development looks like on the outside: they have little bumps like a raspberry, though of course, it is much smaller than a raspberry, more like the period at the end of a typed sentence. The cells continue to divide to form a ball with more cells called the blastocyst. At this stage of embryonic development the cells are unspecialized, or undifferentiated; there are no tissues or organs nor even any specialized nerve or muscle cells. The question is, what is the moral status of this ball of cells that has the potential to become a human being?

We derive embryonic stem cells by taking the cells out of the middle of the blastocyst and growing them in a culture dish – this is the creation of a stem cell line. For those who are not biologists, I want to make clear that this is not something that has a brain or arms or a heart – it is not at all what you might normally think of as an embryo or a fetus that has form and patterned tissues.

How do we obtain these blastocysts for research? Currently, we get leftover or excess blastocysts from IVF clinics, and we have been doing so for some years now. In collaboration with Dr. Douglas Powers at Boston IVF, we have isolated about thirty-two human embryonic stem cell lines, and we continue to derive cell lines, using this excess or leftover material. When a couple goes in for infertility treatment, more human eggs are fertilized than are implanted in nearly every case. The leftover fertilized eggs are usually frozen or discarded. There are estimated to be four hundred thousand frozen embryos in the United States today; we have used about three hundred to derive our human embryonic stem cell lines.

As I have indicated, this research has become controversial because of questions arising about the moral status of the frozen embryos.

Our nation does not seem to be very good at having inclusive, well-informed discussions about matters such as this, even though nearly a decade has passed since the issue was first discussed in the halls of Congress and elsewhere. While we wait, other nations are moving ahead.

In my view, the problem is twofold, and it is related to the question of when life begins. To a biologist, that is not really the right question, because life began eons ago. It is better to ask, "When does a person begin?" When does a cell or a fertilized egg become a person?

First, let me be clear that I consider this to be a metaphysical, not a scientific, question and in my view all citizens have a right to reach an answer about this question. Society should not look to science for an answer, because the question is unanswerable in terms of the experiments that we might do. I think it is possible to have respect for a fertilized egg,

This research has become controversial because of questions arising about the moral status of the frozen embryos.

or a four-cell embryo, and not consider it to be the same thing as a baby. I could give you a number of ways of thinking about this, but one sort of operational definition is that *a fertilized egg* can be kept in the freezer for ten years and retain the potential or capacity to make a person, and *a baby* cannot.

Of course, the real question is whether they are morally equivalent, and what rights or laws should be applicable to the treatment of eggs. I mentioned that during the treatment of infertility, in IVF clinics, human eggs and embryos are present, and that there is always egg and embryo loss. So when a couple attempts to have a baby by IVF treatment, the process always involves the loss or destruction of embryos. They are either frozen or thrown away, or they die during the procedure. Our society has concluded that to treat infertility, it is acceptable to suffer the loss of those eggs and cells. But somehow we have gotten into this paradox: when you ask the question, "Could you use that same material to treat these diseases?" the answer seems to be no. To me, this is very puzzling. Why is it permissible to use procedures that result in the loss of human eggs and embryos to treat infertility, but not for the treatment of degenerative diseases?

Furthermore, if this type of research is wrong – if it is unethical and morally wrong to do this work – we should not be discussing whether to use federal dollars or private dollars; we should just not be doing it. But if it is right, why do it with so many restrictions? Why make it so difficult for scientists to do things that have the potential to help people?

One of my favorite quotes, related to the second main point I want to make, comes from my – as Harvey nicely said – ineffective trips to Washington. What I have discovered is that no matter how and when I try to discuss this issue, it is inextricably bound to the tortuous politics of abortion. So this inclined me to read the *Roe v. Wade* decision, which has a wonderful line from Supreme Court Justice Harry Blackmun: "We need not resolve the difficult question of when life begins. When those trained in the respective disciplines of medicine, philosophy, and theology are unable to arrive at any consensus, the Judiciary, at this point in the development of man's knowledge, is not in a position to speculate as to the answer." I do not need to remind you of how many years our nation has been "arguing" or "debating" the *Roe v. Wade* decision. I fear that we will find ourselves in a similar position over stem cell research.

What is the way forward? If I could be so bold as to make some suggestions, the first would be to try to have an informed public discussion and establish a federal – not a state – policy. I think our nation has taken the wrong path in creating state funding and regulations. This approach ties the hands of scientists in terms of the free dissemination of reagents and ideas, which is not good for the science nor, ultimately, for patients. Moving away from establishing state policies, of course, would mean we would have to explore stem cell potential with federal funding and federal regulatory oversight.

While numerous states, including Massachusetts, California, and others, are passing legislation that governs these "experiments," other states, like Texas, have no regulations, which means that scientists there are doing whatever they like. In the absence of federal policy, we will end up with an unsatisfactory situation, with people arguing over who owns the rights to what research. If someone does an experiment in Texas and creates a stem cell line, can it be transferred across state borders? To a scientist, this seems like an odd question to be asking if what you are trying to do is to understand the basic properties of these cells.

My last suggestion is one that could help clarify issues: a clear and complete federal ban on so-called human reproductive cloning. You notice that I used the word "cloning" when I talked about somatic-cell nuclear transfer, and it is the right term. But in general, people tend to think of cloning as making genetic copies, replicas, of babies. No scientist I know thinks that is a good idea. It would help us reach a federal policy if everyone just agreed that it was a bad idea and passed a law that banned it. My own opinion is that the law has not been passed because some groups want to use that confusion to try to stop all research in this area.

Now, this might make you think that I am a pessimistic person, which is not true. I want to finish by telling you about a good thing that is going on in Boston. With the help of a large number of hospitals and all of the different schools within Harvard University, we created the Harvard Stem Cell Institute. People from many disciplines, who agree that this problem is both important and difficult, have come together to establish common rules, common institutional review boards, and common funding for work not supported by federal funding. We are also collaborating with colleagues at neighboring institutions, particularly MIT, to try to move the science forward. At the moment, there are about 40 principal investigators, which means almost 600 people are involved in this venture. Every six weeks we have interlab meetings that bring together hundreds of students and postdocs. Federal restrictions do not mean that scientists are sitting on their hands. Of course, we would make faster and better progress if our government clarified the rules and provided federal funding, but work is proceeding at the Harvard Stem Cell Institute nevertheless. ■

Alan Lightman (MIT), Jamshed Bharucha (Tufts University), and Lawrence Bacow (Tufts University)

Herman Chernoff (Harvard University), Bertram Malenka (Northeastern University), and Benoit Mandelbrot (Yale University)

Gerald Holton (Harvard University), Howard Hiatt (Brigham and Women's Hospital), and Irving London (MIT)

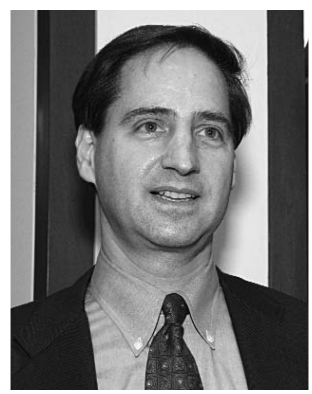
Academy Meetings

Photo by Sonali Reddy Bloom

Education in the Developing World

David E. Bloom, Michael R. Kremer, and Gene B. Sperling

This panel discussion was given at the 1912th Stated Meeting, held at the House of the Academy in Cambridge on March 14, 2007. It is part of the Academy's major project on Universal Basic and Secondary Education (UBASE), cochaired by David E. Bloom and Joel E. Cohen. This project has collected new data and new thinking on the long-term value of education in the developing world. The meeting provided an opportunity for Fellows, other experts, and the media to learn about a major Academy program. The UBASE project is supported by grants from the William and Flora Hewlett Foundation, the Golden Family Foundation, and the Sergei S. Zlinkoff Fund for Medical Education and gifts from John and Cynthia Reed and Paul Zuckerman.



David E. Bloom

David E. Bloom is Clarence James Gamble Professor of Economics and Demography and Chair of the Department of Population and International Health at the Harvard School of Public Health. He was elected to the American Academy in 2005.

I am pleased to have this opportunity to share with you some of the work that I've been doing on education for the last few years. I've done a great deal of this work with Joel Cohen of Rockefeller and Columbia Universities. Joel and I direct the Academy's project on Universal Basic and Secondary Education (UBASE), an initiative that focuses on the rationale, means, and consequences of providing a quality education to all of the children in the world. The project is obviously quite ambitious, and perhaps that's why it took us five years to produce our latest publication, *Educating All Children: A Global Agenda*.

I have also conducted studies on higher education, primarily with Henry Rosovsky of Harvard University and Matthew Hartley of the University of Pennsylvania.

To begin, I'd like to comment on the different ways in which the world is falling short in providing educational opportunities in developing countries. Then, I'd like to spell out the various justifications for addressing these deficiencies and to argue that we're not dealing with an insurmountable problem.

H. G. Wells once described human history as a race between education and catastrophe. Looking at the state of global education over the last few decades, I find the image of a race quite apt.

Many of the world's aspirations for education are reflected clearly in a series of United Nations declarations, programs of action, and conventions and covenants. I'd like to draw your attention to four documents in particular. The first is the Convention on the Rights of the Child, which was drafted between 1975 and 1990. Signed by 195 countries and ratified by 193, it is the world's most nearly universally accepted human-rights treaty. The only two countries that haven't ratified this convention are Somalia and the United States; this may be the only thing these two countries have in common. Article 28 of the Convention states that primary education should be compulsory and available free to all.

The second statement emerged in 1990 at the World Conference on Education for All, held in Jomtien, Thailand. The 155 delegates in attendance declared their interest in universalizing primary education and dramatically reducing illiteracy by the year 2000. The delegates left that meeting greatly energized. Their countries made quite respectable educational advances in the 1990s, but by 2000 it was clear that the goal of universal primary education was nowhere close to being achieved.

In 2000, one-sixth of the world's children of primary-school age, 97 million in all, were not enrolled in school; and more than half of those 97 million were girls.

The global community granted itself an extension when it adopted a new framework for action in 2000 at the Dakar World Education Forum. The 164 representatives present at the meeting again declared their commitment to universal primary education, but this time by 2015. In 2000, the international community was also reinvigorating its collective educational goal by including the universal completion of primary education by 2015 among the United Nations Millennium Development Goals. I would note here that, in addition, the Millennium Development Goals call for the elimination of gender disparity in primary and secondary education, preferably by 2005, which has come and passed, and in all levels by 2015. All 191 member nations of the United Nations pledged to meet those goals.

It is important to note that all four of these statements pertain to education at the primary level. None mention secondary or tertiary education, and none refer to the quality of education, but these are also areas in which the world is experiencing severe deficits.

In 2000, one-sixth of the world's children of primary-school age, 97 million in all, were not enrolled in school; and more than half of those 97 million were girls. It's also quite apparent now that the 2015 deadline for universal primary education will not be met. Even if countries continue to enjoy the same rate of increase in educational access that they have experienced since 1990 – the year of the Jomtien conference – we estimate that 114 million primary-age kids will still be out of school in 2015. Educational access is not expanding fast enough to keep pace with the increase in school-aged population, and the shortfall in primary education is only the tip of the iceberg.

The story of our global educational deficits becomes even more bleak when you shift the focus to secondary education. As part of the UBASE project, we've estimated that 226 million children of secondary-school age are not attending school – or 30 percent of 12- to 17-year-olds worldwide, and a slightly higher percentage of 12- to 17-year-olds in developing countries. The global shortfalls I'm speaking about are equally striking if one looks at the tertiary level. People living in developing countries account for 85 percent of the world's population but little more than 50 percent of the world's university students.

These enrollment deficits at all levels are quite consequential. On the basis of historical and comparative analysis, countries that exhibit sluggishness in the expansion of schooling find it difficult to advance both economically and socially. Part of the problem is that these countries have a thin and fragile skill base. For example, women who don't make it to secondary school tend to have more children than those who do, and they tend to give their children childhoods that are materially sparser, thereby building a much weaker foundation for future economic progress.

Low enrollment rates at the tertiary level also suggest that developing countries are forgoing the massive economic and social benefits of higher education. Some of the forgone benefits are the unrealized productivity and earnings of those who don't make it to college. A study by labor economist Enrico Moretti, and another study that I conducted with Henry Rosovsky and Matt Hartley, found that workers who are surrounded by college graduates earn more, whether or not they actually attended college. In other words, even the earnings of high-school dropouts or just high-school graduates are higher if they're working in a labor market with a higher proportion of college graduates, after taking into consideration numerous other factors that are commonly believed to affect earnings.

In another study, we analyzed the G.I. Bill in the United States and found that enrollment rates are very responsive to public subsidies. Taken together, these two findings indicate that by boosting enrollment rates public subsidies for higher education benefit society at large because they promote earnings growth for both graduates and the rest of the workforce.

Another piece of the puzzle relates to the quality of education. Enrollment statistics aren't everything. Enrollment doesn't necessarily mean attendance. Attendance doesn't necessarily mean receiving an education. Receiving an education doesn't necessarily mean receiving a good education. In many developing countries, educational experiences at all levels – primary, secondary, and tertiary – are characterized by outdated curricula and learning materials and by uninspiring, underqualified teachers.

Let me focus for a moment on India. Most of us think of India as a real powerhouse in the realms of math and science, but the foundation for that perception, at least at the primary and secondary level, seems to be rather shaky, on the basis of a recent study of students in 142 of the top private schools in the five metro areas in India. According to that study, a shocking proportion of Indian students couldn't demonstrate anything beyond the capacity for memorization. For example,

Educational access is not expanding fast enough to keep pace with the increase in school-aged population, and the shortfall in primary education is only the tip of the iceberg.

three-quarters of the students in the fourth grade were unable to use a ruler to determine the length of a pencil, if the starting point for the pencil was not zero but rather one centimeter. They weren't able to figure out that you had to take the total amount and subtract one to get the answer. Among sixth-grade students, only one in six recognized that steam is nothing more than gaseous water, and half of the students in grades four and six showed very little understanding of even the simplest use of decimal points. Now from this study, recently published in India's version of *Time* magazine, it would be fair to conclude that India has become a math, science, and engineering powerhouse in spite of, and not because of, the quality of its education system.

The various educational deficits to which I've drawn attention, both those relating to access and those relating to quality, are consequential problems from a multitude of perspectives. But they are also rather pathetic because in a sense they're absolutely surmountable. So what's to be done? One major action involves, not surprisingly, devoting greater resources to education. The World Bank, UNESCO, and UNICEF have estimated that it would cost between $6.5 and $35 billion annually to get 97 million children who are currently not in school into primary school. In one chapter of our book, Melissa Binder, an economist in New Mexico, estimates that an additional $27 to $34 billion would make it possible to achieve universal secondary education. The numbers are higher here because secondary education is more expensive per pupil than primary education and because there are more kids who would need to be taken into school. At any rate, the totals here at the primary and the secondary level basically amount to somewhere between $34 and $69 billion annually.

I will be the first to acknowledge that this is a great deal of money, but I also believe that it's within our capacity to generate that funding. Even the upper end of that range, $69 billion, is just two-thirds of annual U.S. outlays in Afghanistan and Iraq. If the poor countries of the world, the developing countries, were to cover that $69 billion, it would take between 0.5 and 1 percent of their national incomes. But if the rich countries paid for it, it would take about 0.25 percent of their incomes. That amount would effectively double the amount of overseas development assistance coming from the wealthy industrial cities, but it would still leave them well below the 0.7 percent standard that all these countries agreed to in writing just a couple of years ago. Britain has actually taken a major step in that direction. It's committed to spending $15 billion on education between 2005 and 2015.

These needs are by no means trivial, but there are a number of creative mechanisms for development financing. In particular, Gordon Brown, Britain's Chancellor of the Exchequer, (now Prime Minister), has proposed something known as the International Finance Facility. This plan is a very simple and straightforward, but quite imaginative, merger of classic development finance, which is done on a year-by-year basis by bilateral and multilateral organizations, with principles of commercial finance. It has the potential to help finance the investments that are needed, but ultimately – and I think this is important –

The totals for primary and secondary education amount to somewhere between $34 and $69 billion annually . . . Even the upper end of that range, $69 billion, is just two-thirds of annual U.S. outlays in Afghanistan and Iraq.

the kinds of investments we're speaking about will pay for themselves through the returns they yield. Therefore, it's really just a question of finding a way to finance the necessary investments. If we do that, we will realize the benefits in the future.

In thinking about these investments, we also have to keep in mind the various arguments that we have for undertaking them. Let me sketch them briefly. The first set of arguments is moral, ethical, and humanitarian. Devoting resources to education is the right thing to do; it's a good thing to do; it's a fair thing to do; it's the just thing to do. The second argument is that education is a fundamental human right. The opportunity to be educated is a legally just claim to which all human beings are entitled by virtue of the fact that they are human beings. I've mentioned the Convention on the Rights of the Child, which embodies this principle; the Universal Declaration of Human Rights, which was signed and issued in December 1948, also very much espouses this principle.

Argument number three is economic. Education improves the productivity and the economic well-being of individuals and also advances the technological and institutional innovation and the economic performance of societies, capturing not just the earnings gains of the people who are educated but also the spillovers that I mentioned before. Some of the spillovers take the form of higher earnings for people who don't get educated, higher rates of entrepreneurial activity, better governments, and the like.

A fourth argument involves the social benefits of education. The idea here is that education promotes the building of cohesive, equitable, and strong societies. Finally, we have the political benefits of education. Educational progress mitigates inequality both within and between nations, and in that way supports political stability and global security. There's also the idea that democracies function better when people have more access to information and the ability to process it as well as to communicate more readily.

I've painted a picture that's a bit of doom and gloom, but we have some promising news. Many global leaders with both political and economic muscle, ranging from Gordon Brown to Bill Gates, recognize that global education isn't what it could be or what it should be. They understand that we're not doing that well in the race against catastrophe, and they're starting to view the issue not as whether to act but rather as what to do. The focus is starting to shift to identifying and comparing the options we have for educational development. In other words, should we focus our attention on better curricula, teacher training, or incentivizing teachers? Should we be building more schools or equipping the schools that we have with computers and libraries? Latrines are another aspect of the educational infrastructure that is especially important for girls at the secondary-school level. Julia Chandler, a Harvard undergraduate, is completing her senior thesis on the extent to which the inadequacy of latrines at schools is responsible for the much sharper fall-off in enrollment rates of girls at the secondary level than those of boys.

We must also ask whether we should be looking outside the bounds of education in order to improve education. Maybe we should be building roads so that kids can get to school more easily, or maybe we should be working in the area of health, in particular children's health, so kids will miss less time in school and get more out of each day that they spend in school. Then, of course, we must also look at what combinations of interventions are particularly effective. In any case, we've reached the stage where we're being asked to address the questions that relate to just how wide and deep the information base is for taking action in this area. I'm very heartened by this shift in the focus of our inquiries. I think it holds the best hope for human history to keep up in the race against catastrophe.

Michael R. Kremer

Michael R. Kremer is Gates Professor of Developing Societies and Professor of Economics at Harvard University and Senior Fellow at The Brookings Institution. He has been a Fellow of the American Academy since 2003.

David considered the challenge of increasing the quantity of education. I'd like to focus on the quality of education. Before I do that, though, let me say a few words on the topic of quantity. As David pointed out, almost 100 million children of primary age are not in school.[1] But we have some grounds for hope on the quantity front. In fact, if you look at the number of years of education that people in the developing world have attained, it has consistently risen at approximately the same rate as in the developed world.[2] This is not primarily because of what rich countries are doing, but because of factors internal to developing countries themselves. India and other countries are growing rapidly and have made tremendous progress. Africa is lagging behind, but even there we have seen some improvement, in part because many countries have abolished school fees. The proliferation of conditional cash-transfer programs like PROGRESSA in Mexico, in which parents earn rewards for keeping their children in school, have also positively contributed to school enrollment.

Raising the quality of education is increasingly going to be the challenge.

What more can be done in this area? Let me just mention one very cost-effective measure. The Jameel Poverty Action Lab at MIT has compiled a short document that compares the cost-effectiveness of various approaches to ensuring children are in school.[3] One highly cost-effective measure is school health programs to treat students for worms. This program costs pennies per dose, and for every $3.50 such a program spends, it keeps an additional child in school for a year.

Raising the quality of education is increasingly going to be the challenge. Children in many developing countries are more and more frequently in school, but their performance on standardized tests and other measures of learning remains abysmal.

Some insights on educational quality can be gleaned from international tests such as TIMSS (Third International Mathematics and Science Study), PIRLS (Progress in International Reading Literacy Study), and PISA (Programme for International Student Assessment). Unfortunately, most poor developing countries do not participate in international testing, although a few, mostly middle-income countries, have begun to do so. On the 2003 PISA, 26.0 percent of children in Indonesia scored below level 1 (the lowest level) on the reading test, 26.9 percent in Brazil, 24.9 percent in Mexico, 6.5 percent in the United States, 6.3 percent in France, and 1.1 percent in Finland.

On a survey of rural children aged 11 and over in Bangladesh, 58 percent of children failed to identify at least seven of eight letters that were presented to them.[4] In Brazil, 78 percent of children cannot answer simple math prob-

[1] UNESCO, *EFA Global Monitoring Report 2006: Education for All: Literacy for Life* (Paris: UNESCO Publishing, 2006).

[2] Robert Barro and Jong Wha Lee, "International Measures of Schooling Years and Schooling Quality," *The American Economic Review* 86 (2) (1996): 218 – 223.

[3] Abdul Latif Jameel Poverty Action Lab, "Fighting Poverty: What Works?" (Cambridge: MIT, 2005).

[4] Vincent Greaney, Shahidur R. Khandker, and Mahmudul Alam, *Bangladesh: Assessing Basic Learning Skills* (Washington, D.C.: World Bank, 1999).

lems.[5] In India, when given the sentence, "The dog is black with a white spot on his back and one white leg," 28 percent of sixth graders could not correctly answer if the color of the dog was mostly black, brown, or gray.[6]

The reasons for these low levels of learning are numerous, but an important factor is teacher absence. A recent survey by Nazmul Chaudhury et al. investigated teacher attendance at schools in a variety of developing countries. In Bangladesh, 16 percent of teachers were absent; in Ecuador, 14 percent; in Peru, 11 percent; in Indonesia, 19 percent; in India, 25 percent; and in Uganda, 27 percent.[7] This means that on any given day a child might go to school, a quarter of the teachers might not be present.

Teacher attendance does not necessarily entail teaching, however. In India, for example, only about half of the teachers in the classroom were actually teaching.[8] The other half were on tea break, sitting in the classroom reading a newspaper, or otherwise occupied. Advancing past rote learning is certainly an important issue, but in some ways even getting to rote learning in some schools would be progress.

Many people believe that teachers will not improve their attendance records until they are paid well. Certainly some countries underpay their teachers, or officially give them reasonable salaries but pay them late or neglect to pay them entirely. But many other countries pay teachers much more than the typical worker receives or much more than is necessary to attract people to the position. In OECD countries, the typical teacher makes about 1.3 times the per-capita GDP; in sub-Saharan Africa the ratio is 6.7.[9] There are some very legitimate reasons for that level of salary. Teachers with a secondary or postsecondary education have much more education than the average person in a developing country does; thus they should be paid more relative to the average worker.

However, this is not the full story. In India, for example, a recent study found that salaries of teachers in rural private schools are about one-fifth the salaries of teachers in public schools.[10] And while these rural private schools are not paragons of virtue, absence rates in these schools are actually somewhat lower than in public schools, despite the much lower salaries. This suggests that there is more to the teacher-absence problem than just low salaries.

The reasons for these low levels of learning are numerous, but an important factor is teacher absence . . . on any given day a child might go to school, a quarter of the teachers might not be present.

By focusing on studies with randomized evaluations, one can see the effectiveness of different approaches to addressing this problem of teacher absences. In these types of studies, a government or an NGO introduces a program in such a way that it randomly assigns some schools or regions to be a treatment group and others to be a comparison group; alternatively, it phases in the program over time and the order of the phase-in is random. Randomizing makes it possible to isolate the impact of the program in a rigorous way.

One approach to the problem of teacher absences is to enact some sort of formal incentive system for teachers. A second approach involves local control or local teachers. And a third approach involves school choice or competition among schools.

Given the way incentive systems typically work, it seems the simplest step would be to reward teachers only if they show up at school. However, a Kenyan program that attempted to do this was a failure. A study of this program found that the headmasters who were charged with monitoring teacher attendance were reluctant to penalize teachers for not showing up, even if the school was able to keep the money that was not paid as bonuses to the teachers.[11]

Esther Duflo and Rema Hanna have evaluated a different kind of incentive program in India in which teachers in informal schools run by an NGO were asked to take pictures of themselves with their students in school. Each picture has a time and date stamp. Unlike the program in Kenya, this measure actually had a major effect on teacher absence. Teachers started showing up so that they would receive bonuses. Moreover, it led to a significant increase in test scores as well as a 43 percent increase in the number of children who went on to regular primary schools.[12]

In this program, the incentives were linked to showing up. But economists often argue that incentives should not be graded by their inputs but by their output – what one really cares about. What is the impact of these incentives linked to student test scores? An obvious danger is teaching to the test. On the other hand, it could be argued that one should not worry about teaching to the test when one cannot even get teachers to show up to school. In effect, teaching to the test is a second-order problem. On theoretical grounds, it is possible to argue either way.

Analysis of a program in Kenya, which rewarded teachers based on student test scores,

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[5] Deon Filmer, Amer Hasan, and Lant Pritchett, "A Millennium Learning Goal: Measuring Real Progress in Education," Center for Global Development Working Paper No. 97, August 2006.

[6] Marlaine E. Lockheed and Adriaan M. Verspoor, *Improving Primary Education in Developing Countries* (Washington, D.C.: Oxford University Press, 1991).

[7] Nazmul Chaudhury, Jeffrey Hammer, Michael Kremer, Karthik Muralidharan, and F. Halsey Rogers, "Missing in Action: Teacher and Health Worker Absence in Developing Countries," *Journal of Economic Perspectives* 20 (1) (2006): 91 – 116.

[8] Ibid.

[9] J. Eicher, "Educational Costing and Financing in Developing Countries: With Special Reference to Sub Saharan Africa," World Bank Staff Working Paper No. 665, 1984.

[10] Karthik Marlidharan and Michael Kremer, "Public and Private Schools in Rural India," forthcoming in Paul Peterson and Rajashri Chakrabarti, eds., *School Choice International*, MIT Press.

[11] Michael Kremer and Daniel Chen, "An Interim Report on a Teacher Attendance Incentive Program in Kenya," Mimeo, Harvard University, 2001.

[12] Esther Duflo and Rema Hanna, "Monitoring Works: Getting Teachers to Come to School," NBER Working Paper No. 11880, May 2006.

suggests teacher attendance did not improve, nor did other indicators of teacher behavior, such as assigning homework or otherwise changing pedagogical techniques. What was found was an increase in test preparation sessions.[13] Kenya, like many other developing countries, has a national exam system. These exams are very important, and schools hold test preparation sessions called "preps" to get students ready. Teachers held these sessions more often. Thus, teachers were responding to the incentive, but not necessarily on the dimensions that one would have hoped, suggesting that the problem of teaching to the test is real even in developing countries.

What happened to test scores under this program? Generally, scores increased while the program was in place, but after the program was over, test scores for the same students declined. Thus it does not appear that the program was that successful.

Karthik Muralidharan and Venkatesh Sundaramanan have examined a similar program in India and interpret the results in a much more positive light.[14] Their assessment is based on the increase in test scores on conceptual questions as well as on what they call mechanical questions. But, as in Kenya, the incentive did not result in an increase in teacher attendance, and it remains to be seen whether the effect on test scores will be permanent.

Another approach involves providing information to local decision-making bodies and local teachers. Many have argued that once parents and communities are informed of what is going on in the schools, they will demand reform. One program in India took this approach. Tentatively, the outcomes indicate that information, by itself, does not make a big difference. Another program in Kenya showed that teachers who were trained and monitored by parent committees were more likely to be in class and teaching.[15]

Another related avenue is to hire teachers from the local community. These local teachers might not have as much formal training, but because they are from the area, they presumably feel more loyalty to, or social pressure from, the community to perform their job well. In the same Kenyan program, the parent committees were empowered and funded to hire credentialed, local teachers to accommodate increased enrollment. These teachers, whether for reasons of local familiarity or because they were hired on a renewable contract, had better attendance records than their counterpart civil service teachers and their students performed better on tests.[16]

If we can build up a base of evidence and rigorously evaluate a variety of approaches, then policymakers can help ensure not only that children are in school but that they are actually learning something.

Yet another approach worth considering is using school-choice programs as a way to improve student achievement. Colombia's secondary-school voucher program is a prime example of this. In order to receive a voucher, a student had to attend a public primary school and come from one of the poorest neighborhoods. The voucher paid for these students to go to private schools – not elite private schools but private schools for relatively poor people. Because the program was oversubscribed, Colombia's leaders decided to lottery the vouchers. This, in turn, set the scene for a randomized evaluation.

A study of this program followed both the winners and losers of the lottery and found that the winners scored higher on exams and were less likely to repeat grades. In fact, a few years into the program, they were scoring about 20 percent of a standard deviation higher than those who lost the lottery.[17] This is equivalent to the difference between the fiftieth percentile and the fifty-eighth percentile in a distribution. The effect seems to have been somewhat greater for girls. Joshua Angrist et al. then looked at the long-run effects of this program – for example, on high-school completion. About 32 percent of the losers of the lottery finished secondary school. The completion rate for the winners of the lottery was about five to seven percentage points higher.

Some very important questions arise from these results. One involves generalizability. The school-choice program appears to have worked well in Colombia. The results on vouchers in the United States are not quite so promising. Perhaps this is because in U.S. public schools, despite all the complaints about them, teachers are generally not absent a quarter of the time. It remains to be seen if the results can be generalized from Colombia to other developing countries.

Another issue relevant to school choice is its impact on the system as a whole. The Colombia study suggests that the students who were able to participate in the voucher program benefited. But, of course, an important question is the effect of the program on both students who stayed in the public-school system and on students who started out in the private-school system.

Given the terrible quality of education in many developing countries, it is worth experimenting with a range of different initiatives, from hiring local teachers to involving the private sector to a greater degree. If we can build up

[13] Paul Glewwe, Nauman Ilias, and Michael Kremer, "Teacher Incentives," Mimeo, Harvard University, 2004.

[14] Karthik Muralidharan and Venkatesh Sundararaman, "Teacher Incentives in Developing Countries: Experimental Evidence from India," Harvard University Department of Economics, Unpublished Paper, November 2006.

[15] Esther Duflo, Pascaline Dupas, and Michael Kremer, "Peer Effects, Class Size and Teacher Incentives: Evidence from a Randomized Experiment in Kenya," Unpublished Paper, May 2007.

[16] Ibid.

[17] Joshua Angrist, Eric Bettinger, Erik Bloom, Beth King, and Michael Kremer, "Vouchers for Private Schooling in Colombia: Evidence from a Randomized Natural Experiment," *American Economic Review* 92 (5) (2002): 1535 – 1558.

a base of evidence and rigorously evaluate a variety of approaches, then policymakers can help ensure not only that children are in school but that they are actually learning something.

Gene B. Sperling

Gene B. Sperling is Director of the Center for Universal Education at the Council on Foreign Relations and serves as U.S. Chair of the Global Campaign for Education.

Universal primary education is simultaneously the world's most important, ambitious, and pathetic goal. An overwhelming weight of evidence suggests that education, particularly girls' education, has an impact across the board. For example, education has a fundamental influence on the size and health of families. David mentioned a study in Brazil that examined girls who went to secondary school versus girls who never went to school: the difference was 2.5 versus 6 offspring. Whether or not a girl is in school when she's 16 or 17 years old can also have dramatic effects on the likelihood of her contracting HIV/AIDS. Thus education is vital to women's empowerment in developing countries and within their family structures.

People may not grasp the crises of poor education in developing nations because they may never turn on CNN and see someone dying from a lack of education. But make no mistake about it: when you look at the effect of education on family structure, health, infant mortality, and maternal mortality, there is no question that every day thousands of children die from a lack of education.

The goal of achieving universal primary education is ambitious. As David and Joel demonstrate in *Educating All Children*, 250 to 400 million kids do not attend secondary school, and 80 to 100 million are out of primary school. Michael provided a slightly dark view, but many positive projects are out there, too, as well as examples of people who are doing great things to get kids learning in school.

Finally, universal primary education is the world's most pathetic goal. Every once in a while I speak to sixth graders. The first questions they ask every single time are: why are you only trying to get kids to elementary school, and why are you waiting until 2015? Those seem like very good questions to me. The Millennium Development Goal of having every child go to school through fifth or sixth grade is in some ways pathetic. One of the great things about this new book from the UBASE project is that it is willing to take a leap and say, even when we have so far to go to achieve universal primary education, that shouldn't be our aspiration. At minimum, our aspiration should be universal basic education, which most people think of as at least eight years, at least part of a secondary education, and at least on its way to the more ambitious vision of universal secondary education.

I have written a lot on the notion of a global compact. All major national education plans, of course, have to be consistent with the notion that the most sustainable initiatives have to come from the ground up. But those of us who live here have to ask ourselves, "What's our responsibility? What's our role?" When people like me talk about development assistance, it's not to ignore in any way the importance of what happens on the ground, or the incentives or social pressures that make teachers or students show up for school. It's simply to say that this is where we are, and to ask what our role is in fulfilling some of the human rights charters that we've signed. When I think of a global compact, I don't mean a compact in a simplistic sense. I mean it in a dynamic sense. What incentives can we provide to empower education reformers and champions in developing nations, and what must they establish to win the confidence of donor partners to step up to the plate?

Let me discuss five points we need to understand to reach universal primary education, or the even more ambitious goal of universal

What incentives can we provide to empower education reformers and champions in developing nations, and what must they establish to win the confidence of donor partners to step up to the plate?

basic or secondary education. The first point, which both speakers touched upon, is school choice. In the United States, the school-choice debate is about private schools and vouchers. In the developing world, school choice means whether or not parents can send their child to school at all, particularly their daughters.

It is clear that education is good for children and for countries. What is at times less clear is whether sending a child to school is perceived as good for the parents – the ones who are the ultimate decision makers in most cases. For parents who live in extreme poverty and believe they need the help of their children to manage day-to-day chores or to help support their family, they may believe that school is not always the best choice. So a lot of what sound policy tries to do is align what's best for the parents with what's best for the child and what's best for the country.

These incentives address three broad categories of costs. The first is direct fees. When parents have to pay fees, which make up a high percentage of their income, they usually end up sending only their oldest son to school. If you want to discourage poor people from sending their kids – especially their two youngest daughters – to school, then charge a fee per child. Eliminating fees has indisputably had a dramatic impact. When Kenya eliminated fees, it went in one year from having 5.9 million to 7.2 million children in school. In Uganda, the number went from 3.4 million to 6.5 million, and in Tanzania, from 1.5 to 3 million.

We also have to consider the indirect costs of education. Michael did a study on school uniforms, transportation fees, and commuting hours. These are all examples of indirect costs, which also discourage parents from sending their children to school.

Finally, we have to take into account opportunity costs. Parents who must weigh the opportunity costs of educating their children are not simply those who rely on the income their children receive from working for somebody else. In situations of extreme poverty, children often help their families directly by gathering water or wood and taking care of young children.

In Brazil, Bolsa Escola, now called Bolsa Familia, conditions their version of the earned income tax credit on sending one's kids to school and the kids having 90 percent attendance. Policies and programs like Bolsa Familia's, which align incentives for the parent with what is best for the child, have proven successful – even in the face of cultural or religious barriers. Let me be anecdotal here. I have spoken to many people in the field who say, "The religious leaders in this community were against sending the girls to school, but when we built the school there, when we built a well nearby, when it was easier to educate their children, when the costs of doing it decreased, the resistance tended to fade." When you reduce the cost in the cost-benefit analysis, parents will often choose what's best for their child's future.

Second, how do we avoid trade-offs between access and quality? Uganda is everybody's favorite success and failure story. It attained tremendous success in getting kids into school, but it failed a bit on the quality side. What you see in many places is that as kids come to school, class sizes explode and teacher-student ratios go up dramatically. I visited a school in Tanzania with 140 kids for one teacher. I've been in a school in Ethiopia with 170 kids for one teacher. In the Tanzanian class that I saw, all but 10 or 15 students were sitting on the floor.

Now, many people would propose solving this problem by not scaling up as fast. In other words, don't try to accomplish these ambitious goals. I always feel that people would only recommend that solution for children they don't love or see every day. If I told the superintendent of the Washington, D.C., schools that I have an excellent idea for how to improve the quality of education for 60 percent of the children in the schools as long as we deny the other 40 percent the ability to attend school, I don't think my idea would go very far. So for moral as well as other reasons, the idea of improving quality by slowing the matriculation of children into school should not even be on the table.

On the topic of development assistance, over the last four or five years, I have seen education ministers lay out their "education for all" plans. Yet, since finance ministers have not seen proof that donor nations will provide significant long-term and predictable funding, they are usually unwilling to approve plans to do what they often most need: hire new teachers. Why? They use the money for building schools or other one-time costs, but what they do not do – take Kenya, for example – is hire the teachers they need to keep class sizes from exploding because they do not trust that the money will last long enough to bear the recurrent costs of their salaries. This is a huge issue in the financing of quality basic education. As one who had to work on eight U.S. budgets, I understand their concern: you are not supposed to try to pay for a recurrent cost like salaries with a one-time sale. I can't tell you how many times somebody in one of our departments, a cabinet member, has called me and said, "I have a great idea. We can do the spectrum sale and use the money to fund Head Start." I always reply: "You know that money for Head Start has to go on forever, whereas you can only sell that park or asset once." That's the situation a lot of developing countries confront. If you were to ask the minister of education from Kenya why they don't even try to penetrate their most nomadic region, where only 17 to 18 percent of the kids are in school, he would tell you that by the time he figured out a way to give teachers an incentive to move there and then trained them, the three-year World Bank funding cycle would be up.

It is clear that education is good for children and for countries. What is at times less clear is whether sending a child to school is perceived as good for the parents.

In contrast, the Gordon Brown approach is not just to give $1.5 billion to a developing country next year, which is a huge jump in funding for a G8 country. His message has been that if a developing nation provides a ten-year plan, we should try to assure that country that the money will be there over the long haul, so that it can plan a scaling-up of teachers, textbooks, and other factors that affect quality without fearing that the support will suddenly come up dry. There are many problems in implementation, but the basic understanding is that with teachers comprising 75 percent of the cost of education virtually everywhere, and with that being an ongoing cost, you cannot expect to get this other half of kids into school unless you have a plan that gives finance ministers the confidence that they can have the funding going forward. Rwanda's minister of education once told me, "We have an expression for it. We call it 'aid shock.' I will never use development assistance money for teachers because if it runs out they'll be outside my window throwing rocks. They won't be outside the World Bank's or USAID's windows."

A third issue is how to build mutual trust if you have this compact. I already described the trust we need to build from the developing country's perspective – the trust that the resources will be there in a significant and long enough way to expand educational access. But there's something else. Everybody in this room will tell you that really high-quality universal preschool in the United States has high rewards. There's very little dispute that if we spent enough money and did it right, it would work. Yet we don't even come close to doing it. Meanwhile, every year, mysteriously, there's enough money for the transportation budget. There's enough money for that extra project for a member of Congress to name. The point is, in the United States, a rich country, people focus much more on things they can do immediately and get immediate credit for, such as creating jobs or naming that bridge.

When you go to a developing country and say the goals for your presidency, for your moment in history, should be to try to get all your 5-year-olds in school, you are asking that leader to do something that is going to help the economy of his successor, and his successor's successor, and so on. When heads of state decide that they want to make their legacy universal primary education, the one thing the rest of the world should not do is make them look like they stepped up to the plate and no one supported them. If that happens, then other nations' presidential advisors are going to tell the next president not to try to accomplish universal education: "Don't do it. Look what happened. Everybody was excited for two years. The development assistance flowed; it raised expectations; and now people aren't happy."

From a donor nation's perspective, the most important issue for establishing mutual trust is the assurance that the dollars are going to the right place, that the money won't go to teachers who don't show up or to cronies. From the donor country's perspective, a developing country has to understand that accountability and transparency matter. Kenya worked out an agreement with DFID, in which the money went directly to local banks. Headmasters picked up the money by bringing a voucher. That kind of creative measure gives people the confidence that the dollars are, at least, going to where they are critically needed and designed to go.

In development assistance, we look at two models. One is the global compact: there are some governments that are making sure that their kids are in school, that there is a nationally owned plan, and that donor countries are supporting them. This is the model behind the Monterey Consensus, the Millennium Challenge account, and the Education Fast Track Initiative.

The other model, which David talked about, focuses on the rights of a child. We have to acknowledge a basic tension here. Under the Millennium Challenge idea, you don't give money to a country if you don't trust its government. You don't give money if you don't believe there is a trustworthy compact. But if you believe that every child has a right to go to school, then why would you do less for a child who has the double or triple misfortune to be in a poor developing country *and* to be a refugee or to be internally displaced and living in a fragile state? If we're really serious about the rights of children, we have to figure out how to get money to children in situations where either we do not trust the government, as in Zimbabwe, or we think the leader is wonderful but we question his capacity, as in Liberia.

The best way for the United States to win hearts and minds anywhere is to be the world leader that seeks to get all children into school everywhere.

In nations affected by conflict, we need to build trust that funds will not be wasted or diverted to war or used to promote ethnic tension. We must reduce the trust gap. We have to try to distribute aid in a way that empowers the state the most, but if you have a Taliban situation and you have to go through NGOs, then you do the best you can and figure out a plan to reinstate the state's authority over time as the political situation improves. Of 80 to 90 million kids not in school, 20 to 25 million are in places of conflict and in refugee camps. These children have been through the greatest hardship in the world, and education could make a dramatic difference in turning their lives around.

I'll just mention the fourth point very briefly. When you're calculating the cost of universal primary education, one view holds that figuring out the cost of just five or six years is enough. Even if you thought that was the right goal, which I don't, it is absolutely insane to price out 100 percent completion of sixth graders and not factor in the additional cost that a lot of those sixth graders will now want to go to seventh, eighth, and ninth grades. That may seem obvious, but I have been to a place in Egypt where our government helped get 95 percent of rural girls through sixth grade only to neglect to provide a dollar for them to go to seventh grade.

Finally, I want to explain why this issue is now receiving a little bit more attention in D.C.: people are starting to see a connection between education and the fight against global terror. There are certainly some fundamentalists – not a huge number but some – that teach hate and terrorism and violence. Some of the children that attend those schools would not go if they had a better alternative.

But the notion that the right way to do this is to have a targeted Muslim education initiative from the United States is counterproductive. I say this based on conversations I have had repeatedly. In Bahrain, three women who sought to improve science education there said they were reluctant to take any kind of assistance from the United States because people have now started to ask whether they are tools of the U.S. government. When I was asked to speak at the U.S. Muslim Conference on Universal Education, the number one comment I heard was, "You never cared about our kids before 9/11, why do you care about them now?"

Here is my bottom line: If you want to win hearts and minds, you don't do that by showing people that you care about their children only to the extent that they don't grow up to blow up your children. If you want to show people that you care about their children, the simple answer is that you should care about their children regardless of where they live. The best way for the United States to win hearts and minds anywhere is to be the world leader that seeks to get all children into school everywhere. In other words, we need to show the world not a calculated foreign policy mind but a big U.S. heart. I believe that if people in a Muslim country saw that we were expending the same effort in Rwanda or places that were not important to us strategically, they would interpret the actions we take in their country as more genuine.

The last sentence in my contribution to *Educating All Children* is something President Clinton said when he was trying, in the final months of his administration, to achieve peace in the Middle East. His team told him that the chances of peace looked pretty low, to which he responded, "Well, this is so important that there are really only two options. One, we have to succeed, or two, we have to be caught trying." So I honor this Academy project because I think that you've certainly been caught trying. I believe it will make a real difference in the lives of a lot of poor children who have many of the same aspirations and dreams that our children do. ■

Visiting Scholars Taylor Fravel, Anthony Mora, and Anne Stiles

Francis Bator (Harvard University) and Louis W. Cabot (Cabot-Wellington, LLC)

Henry Rosovsky (Harvard University) and Rose Frisch (Harvard University)

Bruno Coppi (MIT), Laszlo Tisza (MIT), and Academy President Emilio Bizzi (MIT)

Robert A. LeVine (Harvard University) and Howard Gardner (Harvard University)

A Poetry Reading by Galway Kinnell

Introduction by Rosanna Warren

This presentation was given at the 1913th Stated Meeting of the Academy and Joint Meeting with the Boston Athenaeum, held at the House of the Academy in Cambridge on March 27, 2007. Two of the poems that Galway Kinnell read that evening are reprinted below.

Photo by Mike Minehan

Rosanna Warren

Rosanna Warren is Emma MacLachlan Metcalf Professor in the Humanities at Boston University. She has been a Fellow of the American Academy since 1997.

Introduction

You can see a portrait of Galway Kinnell in his poem "The Past":

"A chair under one arm,
a desktop under the other,
the same Smith-Corona
on my back I even now batter
words into visibility with . . ."

Battering words into visibility: that is what he has been doing now through eleven books of poems. Did you think you knew the English language? Think again. Some of the words Kinnell batters into sight are not even in the OED – or if they are, only under "obsolete," or "origin unknown." Like shinicle, clart, hirple, drouk, scummage, and dunch, all from just two poems in the blazing new book, *Strong Is Your Hold*.

Kinnell has never shied away from the sublime, or the elemental. In his earlier days his ambition took an almost psalmodic form:

"... the oath broken,
the oath sworn between earth and water,
  flesh and spirit, broken,
to be sworn again,
over and over, in the clouds, and to be
  broken again,
over and over, on earth."
("Under the Maud Moon," *The Book of Nightmares*, 1971).

He inhabited animals as a shaman – the bear, famously; the sow; the gray heron; he pried into birth, into dying, grandly, kabbalistically: "I thought suddenly / I could read the cosmos spelling itself."
("The Hen Flower," *The Book of Nightmares*).

And as a side effect of this visionary exuberance, Kinnell's *Selected Poems* won both the Pulitzer Prize and the National Book Award in 1982, compounded by a MacArthur Fellowship and his Erich Maria Remarque Professorship at NYU. But prizes are by the by. He has always been out for the big prize, the prize of vision, which humbles us over and over.

What began happening in his next book, *The Past*, in 1985, is a tougher story, the story where art compresses itself, endangers itself in new ways, exposes itself to greater psychic risk, and finds new form and tone in that risk. Here is another self-portrait from that period:

"What about the man splitting wood in the
  daybreak,
who looked strong? That was years ago. That
  was me."
("The Man Splitting Wood in the Daybreak," *The Past*).

For subtlety, for economy of means, for a sublimity by implication, listen to this three-line poem from *The Past*, all torqued on its syntax, which is a form of knowledge in action, a kind of Lord's Prayer:

"Prayer"

"Whatever happens. Whatever
what is is is what
I want. Only that. But that."

Kinnell is now an artist so fully a master of his means, he can reinvent the sublime, in large or small format, in basso profondo or in a whisper. Watch him do it here, in "Oatmeal," from the book *When One Has Lived a Long Time Alone* (1990):

"Maybe there is no sublime; only the shining
  of the amnion's tatters."

His new book, *Strong Is Your Hold*, is a triumph of unflinching matter of fact, the erotic, the mortal, the generous, in which spit and spirit mingle as they did in the book of Genesis and as they do again in Kinnell the snake shaman who inadvertently burns a snake in a brushfire and pulls it out, ". . . a small blackened snake, the rear half / burnt away, the forepart alive . . . ." This unbearable, important poem brings life out of death, brings live words out of a language sleeping if not dead, and provides us with an *ars poetica* for this poet seer of the real.

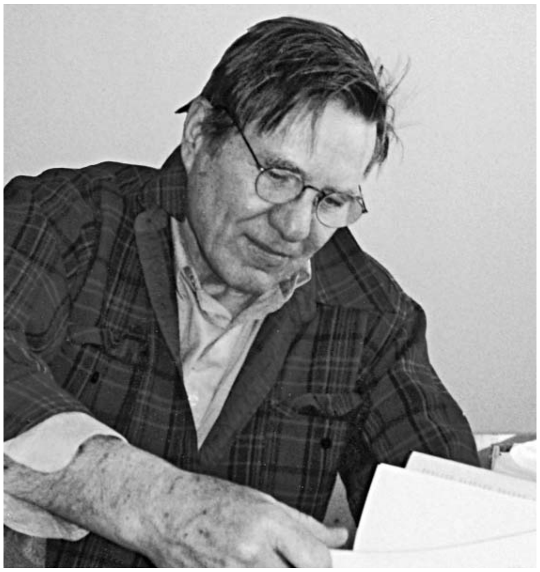


Photo by Bobbie Kinnell

Galway Kinnell

Galway Kinnell, a Fellow of the American Academy since 1997, has been a MacArthur Fellow and the state poet of Vermont. For many years he was the Erich Maria Remarque Professor of Creative Writing at New York University. He is currently a chancellor of the Academy of American Poets.

Reading

"Everyone Was in Love"

One day, when they were little, Maud and Fergus
appeared in the doorway naked and mirthful,
with a dozen long garter snakes draped over
each of them like brand-new clothes.
Snake tails dangled down their backs,
and snake foreparts in various lengths
fell over their fronts. With heads raised and swaying,
alert as cobras, the snakes writhed their dry skins
upon each other, as snakes like doing
in lovemaking, with the added novelty this time
of caressing soft, smooth, moist human skin.
Maud and Fergus were deliciously pleased with themselves.
The snakes seemed to be tickled, too.
We were enchanted. Everyone was in love.
Then Maud drew down off Fergus's shoulder,
as off a tie rack, a peculiarly
lumpy snake and told me to look inside.
Inside the double-hinged jaw, a frog's green
webbed hind feet were being drawn,
like a diver's, very slowly as if into deepest waters.
Perhaps thinking I might be considering rescue,
Maud said, "Don't. Frog is already elsewhere."

"The Room"

The door closes on pain and confusion.
The candle flame wavers from side to side
as though trying to break itself in half
to color the shadows too with living light.
The andante movement plays over and over
its many triplets, like farm dogs yapping
at a melody made of the stylized
gratification-cries of cocks. I will not stay long.
Nothing in experience led me to imagine
having. Having is destroying, said
my version of the vow of impoverishment.
But here, in this brief, waxen light,
I have, and nothing is destroyed. The flute
that guttered those owl's notes into the waste hours
of childhood joins with the piano
and they play, *Being is having*. Having
may be nothing but the grace of the shell
moving without hesitation, with lively pride,
down the stubborn river of woe. At the far end,
a door no one dares open begins opening.
To go through it will awaken such regret
as only closing it behind can obliterate.
The candle flame's staggering makes the room
wobble and shift – matter itself, laughing.
I can't come back. I won't change.
I have the usual capacity for wanting
what may not exist. Don't worry.
That is the dew wetting my face.
You see? Nothing that enters the room
can have only its own meaning ever again.

An Evening of Chamber Music

Members and guests were treated to an Evening of Chamber Music at the Academy's 226th Annual Meeting and 1914th Stated Meeting, held on May 9, 2007, at the House in Cambridge. The Arron Chamber Ensemble performed works by Fellows John Corigliano and William Bolcom as well as pieces by Pleyel and Brahms.

Musical Program

Pleyel: Trio for Violin, Viola, and Cello Opus 10 No 2
- I. Allegro
- II. Rondo, Allegretto

John Corigliano: Fancy on a Bach Air for Solo Cello (1996)

William Bolcom: Graceful Ghost Rag for Solo Piano (1970)

Brahms: Quartet for Piano, Violin, Viola, Cello in g minor Opus 25
- I. Allegro
- II. Intermezzo, Allegro ma non troppo
- III. Andante con moto
- IV. Rondo alla Zingarese, Presto.

Sharl Heller and Eric Heller (Harvard University)

Members of the Arron Chamber Ensemble: Abraham Appleman, *violin;* Jeewon Park, *piano;* Edward Arron, *cello;* and Ronald Arron, *viola*

Photo courtesy of Northwestern University

Students outside University Hall on the Northwestern Evanston campus

Presentations by Academy Fellows at Northwestern University

Darlene Clark Hine and Barbara Newman

This presentation was given at an Academy meeting held on the Northwestern University campus on May 7, 2007. Northwestern University President Henry Bienen and Academy CEO Leslie Berlowitz welcomed Fellows and guests to the meeting. At this meeting, J. Larry Jameson, Irving S. Cutter Professor of Medicine, Vice President for Medical Affairs, and Dean of the Feinberg School of Medicine, also spoke. His remarks will appear in a forthcoming issue of the *Bulletin*.

Darlene Clark Hine

Darlene Clark Hine is Board of Trustees Professor of African American Studies and Professor of History at Northwestern University. She was elected to the American Academy in 2006.

The Black Professional Class

"The Black Professional Class" is the working title of a project that I have been engaged in for about twenty-five years. Given that length of time, you would think that I would have completed it by now. Well, I am nearing the end, but at the moment I am in a conundrum. I invite you to share your thoughts as to possible resolutions.

I begin with a quote from Booker T. Washington, the head of Tuskegee Institute, known primarily for his staunch advocacy of industrial and agricultural education for black people. In 1905, Washington, in an apparent departure from his insistence on the primacy of agricultural and industrial education, declared, "No one understanding the real need of the race would advocate that industrial education should be given to every Negro to the exclusion of the professions and other branches of learning. It is evident that a race as largely segregated as the Negro is must have an increasing number of its own professional men and women." On this point black conservatives and radicals shared common ground at the dawn of the twentieth century. Writing in 1908, T. Thomas Fortune, editor of *The New York Age*, echoed Washington's call for more professional men and women, deeming them to be "vital forces in the work of racial redemption."

In this study of the Black Professional Class during the Jim Crow era, I examine the consequences of white separatism and the legal denial to African Americans of equal access to employment and educational opportunities. In order to survive and progress, African Americans had to create a class of professional men and women, specifically nurses, physicians, and lawyers. This first, or emergent, generation of professionals acted individually and collectively to found the essential institutions – medical schools, hospitals and clinics, nursing schools, and law schools – required to facilitate professional reproduction. In order to advance itself and to better serve impoverished and exploited black communities while developing and honing their skills, the emergent generation founded an array of black professional organizations that were analogous to white-only organizations: physicians founded the National Medical Association (1895), nurses launched the National Association for Colored Graduate Nurses (1909), and lawyers established the National Bar Association (1925).

In order to survive and progress, African Americans had to create a class of professional men and women, specifically nurses, physicians, and lawyers.

One of the preeminent physicians of the emergent generation was Dr. Daniel Hale Williams, Northwestern University's first black medical graduate. In 1891, Dr. Williams founded Provident Hospital and Nursing Training School in Chicago – the first black hospital operated solely by African Americans. In 1894, he went to Washington, D.C., to help establish a Hospital and Nursing Training School, later affiliated with Howard University. By 1900, Dr. Williams – already renowned for his surgical skills – acquired a national reputation as a forceful proponent of autonomous black health-care and training facilities. He was a revered member of the National Medical Association. Its charter pledged that the NMA would "effect a strong organization among Negro physicians, dentists and pharmacists . . . in order that they may have a voice in matters of public health and medical legislation in general, and in such matters as may affect the Negro race in particular. . . ." It is this final charge that upon first reading gave me pause: ". . . and to develop a profound race consciousness." What is a "profound race consciousness?"

A tireless lecturer, Williams enjoined black communities to create their own hospitals and nursing training schools. He explained why black institutions were necessary, declaring, "In view of the cruel ostracism, affecting so vitally the race, our duty seems plain. Institute Hospitals and Training Schools. Let us no longer sit idly and inanely deploring existing conditions. Let us not waste time trying to effect changes or modifications in the institutions unfriendly to us, but rather let us seek to promote the doctrine of helping and stimulating our race." By 1912, there were 63 black hospitals. By 1920, the number had doubled to 118. By 1929, there were 300 black hospitals and nursing training schools.

Many of the proprietary hospitals and schools did not survive the economic devastation of the Great Depression. While hospital beds for African Americans remained in short supply, the opportunities for medical education were limited to the two black medical schools: Howard University School of Medicine (founded in 1868) in Washington, D.C., and Meharry Medical School (founded in 1876) in Nashville, Tennessee. None of the white medical schools in the south accepted black students and most of the northern institutions restricted their admission.

Several black medical schools, such as the Leonard Medical School at Shaw University in Raleigh, North Carolina, had become casualties of the 1910 *Flexner Report*. Its author, Abraham Flexner, had concluded that of the ten or so black medical schools founded in the closing decades of the nineteenth century, only "Meharry at Nashville and Howard at Washington are worth developing and until considerably increased benefactors are available, efforts will wisely concentrate upon them." He elaborated further: "The Negro needs good schools rather than many schools. Schools in which the more promising of the race can be sent to receive a substantial education in which hygiene rather than surgery for example is strongly accentuated." White philanthropic foundations, including the General Education Board and the Rosenwald Fund, heeded Flexner's recommendations. Foundation support was essential to the survival of Meharry and Howard. From 1919 to the advent of the modern civil rights movement, Howard and Meharry produced approximately 90 percent of all black physicians in the country.

The second generation of black professionals concentrated efforts on alleviating or ameliorating the devastating social costs of educational segregation, economic discrimination, and political disfranchisement that African American communities collectively paid. Individual professionals provided leadership in the community-building process that included their service as officers of improvement associations and mutual aid societies. They also helped by raising funds and investing their own resources in community centers and schools. Black professionals helped to spur the establishment of real estate businesses, newspapers, drug stores, funeral homes, and transportation services. They frequently mediated between the white and black communities. This work within their respective communities enhanced their social status, and their economic autonomy freed them from dependence on white people. The black professional class laid the ideological foundation for racial solidarity and self-sufficiency.

Black professionals balanced precariously on the thin line separating oppositional activism that challenged the separate but unequal system of racial apartheid and the militant embrace of Black Nationalist thought – that is, advocacy of the creation and maintenance of a "nation within a nation." While physicians and nurses focused attention on the medical and health-care needs of black communities during the Great Depression decade and the resultant migrations of hundreds of thousands of dispossessed farm workers to urban areas, African American lawyers began a concerted, decades-long assault against the legal foundations of Jim Crow segregation and discrimination. Their efforts helped to shape the modern civil rights movement. Indeed, in 1993, U.S. Supreme Court Justice Thurgood Marshall insisted that "long before the Civil Rights Movement ever crystallized the plight of African-Americans, Negro lawyers had identified the inequities in the legal order and begun to lay the foundation for social change."

Black professionals helped to spur the establishment of real estate businesses, newspapers, drug stores, funeral homes, and transportation services.

Black lawyers inhabited a different professional universe. Those able to become apprentices by either reading or working in the law offices of a practicing attorney or securing admission into law schools were allowed to practice in the court system. Actually, most black lawyers had to augment their work with other jobs if they were to secure enough money to make a living by practicing law. By 1910, there were approximately 700 black lawyers – only a dozen of whom were women. By the 1940s, the number of black lawyers had more than doubled to approximately 1,700. There were approximately 3,500 black physicians and 7,000 black nurses attending to a black population of over 11 million.

Clearly, I am talking about a very small number of professionals. Many of the prominent black lawyers who would become engaged in social justice and civil rights struggles, in association with the National Association for the Advancement of Colored People, were, ironically, educated at elite white institutions in the north. Charles Hamilton Houston and William H. Hastie were both graduates of Harvard Law School; James A. Nabrit, a future president of Howard University, was a graduate of Northwestern University Law School. These men spearheaded the revitalization and transformation of Howard University Law School during the 1930s, and they were responsible for training a special cadre of civil rights lawyers, of which Thurgood Marshall would become the most renowned and representative.

The black professional class laid the ideological foundation for racial solidarity and self-sufficiency.

Beginning in 1938, black physicians, nurses, and lawyers entered the last premodern civil rights movement phase, one of class consolidation. NAACP lawyers Charles H. Houston, William H. Hastie, and Thurgood Marshall, along with members of the National Bar Association and faculty at Howard Law School, masterminded the legal assault against Jim Crow segregation and discrimination. Black lawyers won four important United States Supreme Court cases. One was the 1938 *Gaines* decision, which essentially set in motion the process of desegregating professional schools. A second was the 1944 *Smith v. Allwright* Supreme Court decision, which declared the Democratic white primary unconstitutional and opened up the arena for African Americans to retrieve the right to vote. The third was the 1948 Supreme Court ruling that housing discrimination or restrictive covenants were unconstitutional. The fourth was the 1954 *Brown v. Board of Education* decision. The civil rights lawyers worked together on these cases. Indeed, Brown was a composite of regional cases. That was the legal triumph.

Professional black men and women, working through medicine, law, and nursing, essentially, helped to lay a foundation for the modern civil rights movement.

As far as physicians were concerned, their major triumph occurred during World War II, when, collectively, the nurses and the doctors mobilized to force the desegregation of the Medical Corps and laid the foundation for Harry S. Truman's Executive Order that would desegregate the United States military. These professional black men and women, working through medicine, law, and nursing, essentially, helped to lay a foundation for the modern civil rights movement.

Let me conclude by saying something about the conundrum that I find myself in. A member of the first President Bush cabinet, Louis W. Sullivan served as Secretary of Health and Human Services. From 1970 – 1975 he was Dean of the Morehouse School of Medicine. In 1985, the school became a four-year, fully accredited medical school. Dr. Sullivan confided that he worked to establish this school because "The idea of starting a medical school to increase the number of black physicians not only in Georgia but elsewhere in America" was something that intrigued him. The establishment of the school makes me wonder how far have we progressed in terms of making opportunities available to all Americans on a fair and judicious basis if in 1985 Dr. Sullivan – one of the preeminent black physicians of our generation – successfully creates a new black medical school.

To be sure, Morehouse School of Medicine is not a Jim Crow school. But it makes me ask whether the predominantly white medical schools have failed to recruit and train black physicians in the past half century. There are now four black medical schools, and they have the great responsibility for training black physicians in this country. Is this the model we should revisit and embrace – that is, the establishment of an array of black professional schools as the answer to the dire need for significantly more black nurses, physicians, and lawyers? What are the lessons to be derived from this study of the history of the black professional class? Did integration as social policy fail? Is a variant of nationalism, in the sense of Black Nationalism creating autonomous separate institutions, still a viable ideology and strategy for acquiring parity and facilitating greater entry into mainstream American society? It is hard to know where to come down on these questions. I anticipate that readers of my book, whenever it is published, will think about new ways to improve training and expand professional educational opportunities for African Americans by evaluating the methods that worked most effectively during the era of Jim Crow when black survival and progress depended on Howard and Meharry and other black institutions that produced the black professional class. We need to reason together.

Barbara Newman

Barbara Newman is Professor of English, Religion and Classics and John Evans Professor of Latin Language and Literature at Northwestern University. She was elected to the American Academy in 2005.

Frauenlob's Song of Songs: Translating a Medieval Performance

For a period of three or four years beginning around 2001, I found myself spending my leisure time in a rather unexpected way. To divert myself from stacks of ungraded papers and to pass the long hours of insomniac nights and transatlantic flights, I took to singing duets with a poet who had been dead for seven hundred years. This is the way I see the art of verse translation, for unlike prose, a poetic translation can never attain transparency. In other words, the translator's voice cannot modestly lose itself within the author's, to be cited only by unusually scrupulous bibliographers. No, the art of verse is at once so playful, so demanding, and so irreducibly personal that the best one can hope for is a duet of compatible voices. In the brief time that we have today, I'd like to tell you why I decided to translate the German minstrel Frauenlob, and let you hear a little of both the translation and the original. Frauenlob's long poem, known as the "Song of Songs," is not just a text but a complex musical piece, its melody composed by the minstrel himself.

I took to singing duets with a poet who had been dead for seven hundred years.

A contemporary of Meister Eckhart and Dante, Frauenlob enjoyed a public career spanning four decades. Admired equally for his gifts as musician and poet, he became the acknowledged master of the so-called *geblümter Stil* or "flowery style." Like other performers of his age or, for that matter, like rappers today, he adopted a stage name. Born Heinrich von Meissen, our minstrel chose a sobriquet that can mean either "praise of ladies" (as in courtly love) or "praise of Our Lady" (meaning the Virgin Mary). The ambiguity is intended. From the mid-1270s until his death in 1318, Frauenlob traveled through the courts of northern and central Europe, composing and performing topical poems, religious verse, and the occasional love song for patrons ranging from the kings of Bohemia and Denmark to the archbishops of Bremen and Mainz. By the time of his death, he was a highly acclaimed and much imitated though controversial figure, whose talents and connections merited the privilege of burial in Mainz Cathedral. According to the chronicler Albrecht von Strassburg, "on the vigil of St. Andrew in the year 1318, Heinrich, called Frauenlob, was buried in Mainz, in the cathedral cloister near the school, with exceptional honors. Women carried him from his lodgings to the sepulchre with loud lamentation and great mourning, on account of the infinite praises that he heaped on the whole feminine sex in his poems. Moreover, such copious libations of wine were poured on his tomb that it overflowed through the whole cloister of the church. He composed the *Cantica canticorum* [or *Song of Songs*] in German, known in the vernacular as *Unser Frowen laich*, and many other good things."

Frauenlob is the most famous of a neglected group of poets who fill a key place in medieval German literature. Traditionally called *Spruchdichter* – an umbrella term for "lyric poets who were not minnesingers" – these itinerant artists composed and performed songs on a wide variety of subjects: religious, political, and moral. Unlike minnesingers or love poets, who were for the most part noble amateurs, the *Spruchdichter* were professional traveling minstrels, usually of bourgeois origin, who embraced the arts of poetry and song as a vocation rather than as a polite accomplishment. Since they made their living by their art, contemporaries called them singers who "took *guot* for *êre*," that is, received payment in money and in kind for the praise of their patrons. The willingness of nobles to support such traveling artists shows how highly they valued them for both the prestige and the entertainment they could offer.

Unlike such court poets as Geoffrey Chaucer, Frauenlob and his German contemporaries could not expect stable long-term patronage, but moved frequently, settling for a time at any court where they found a warm welcome and a solvent prince. This itinerant lifestyle was a mixed blessing. On the one hand, it rendered poet-singers marginal and highly suspect to the arbiters of morality. Like goliards or wandering students, they traveled too much to be trusted, for they seldom stayed in one place long enough to become permanent members of parishes, households, or other stabilizing institutions. If accused of any crime, they lacked family connections and long-term acquaintances to vouch for them. On the other hand, the minstrel's wandering ways enhanced his value to his patrons. Court records and account books show that, when they were not performing, poet-minstrels filled a variety of useful and remunerative roles as messengers, heralds, watchmen, interpreters, and spies. Well-traveled, versed in a range of dialects, and

Frauenlob traveled through the courts of northern and central Europe, composing and performing topical poems, religious verse, and the occasional love song.

welcomed by all social strata, such performers could be skilled information gatherers. Finally, at important festivals such as knightings, weddings, and coronations, a seasoned entertainer would be given the role of "minstrel king," responsible for devising ensemble performances and serving as master of ceremonies.

It may be in such a role that Frauenlob appears in the illuminated Manesse codex from around 1340. Or perhaps his author portrait shows him at the "singing school" he is said to have founded in the town of Mainz. In either case, the artist depicts Frauenlob presiding from a lofty chair at an outdoor music lesson or performance. Over his striped tunic he wears a cloak of ermine and a coronet trimmed with the same fur, usually reserved for high nobility but here representing the gift of a particularly lavish patron. With his right hand raised in a stylized teaching gesture, the singer-poet holds in his left hand what looks – anachronistically – like a conductor's baton. On a carpet below, stretched out by a piper on the right and a drummer on the left, a fiddler performs while other musicians listen, holding a variety of instruments including flute, psaltery, and shawm. The *meister*'s identity is confirmed by a symbolic coat of arms representing his Lady, the crowned Virgin, who extends her mantle over his shield in a gesture of protection and favor. The poem I have translated was probably meant for the kind of lavish musical performance illustrated in the Manesse miniature.

Celebrated during his lifetime and for centuries afterward, Frauenlob's fame suffered a rapid eclipse around 1700. Although a few of the Romantics appreciated him, most modern critics had little use for his hermetic and immensely learned poems, which in their view savored too much of the intellect and too little of the heart. Protestants tended to find his fervent Marian piety blasphemous, and rationalist scholars even questioned his sanity. In 1913, the first editor of his *Song of Songs*, Ludwig Pfannmüller, lavished tremendous erudition on Frauenlob's text, but he was hardly an admirer of the poet. In fact, he devoted much of his introduction to diagnosing "inadequacies of the style and the man," whom he branded a *Strudelkopf* ("noodle-head"). Thus ill-served by his editor, Frauenlob continued to languish in obscurity until 1972, when Karl Stackmann paved the way for a new critical edition with an essay arguing the radical thesis that Frauenlob's poems were, and were meant to be, comprehensible: neither the ravings of a madman, nor empty rhetoric composed merely "to please the ear and intoxicate the senses," nor oracles whose interpretive key is lost beyond recovery.

Having begun my career by studying Hildegard of Bingen – another quirky, brilliant, esoteric poet-composer in the same religious tradition, but a century and a half earlier – I recognized a kindred spirit in Frauenlob.

The Lady is not only the mother of Jesus but also a celestial goddess, the eternal partner of the Trinity.

Drawn to the intricate beauty of his verse as well as the challenge of his thought, I juggled rhyme schemes and prowled through Middle High German dictionaries in my off-hours until I had a passable translation of twenty double strophes in just over five hundred lines. But whatever was I going to *do* with them? Much to my consternation, I realized that I would have to write a whole book about Frauenlob to accompany the translation, since the sum total of Anglophone scholarship on my author amounted to less than fifteen pages. Happily, though, my book provided an occasion for the North American release of a CD by the premier early music ensemble, Sequentia, which had recorded Frauenlob's masterpiece some years earlier. I hope that the *Gesamtwerk* will now make this hitherto obscure but magnificent poet not only available to scholars, but teachable in the classroom, whether of medieval literature, religion, or early music.

Frauenlob's hallmark is the unique blend of learning, Biblical allusion, dense word-play, and lush sensuality. . . .

The *Song of Songs* takes the form of a visionary dialogue between the poet-speaker and a Lady who is conventionally identified as the Virgin Mary. But she is also much more – not only the mother of Jesus but also a celestial goddess, the eternal partner of the Trinity, identical with divine Wisdom as well as the goddess of Love, Frau Minne – a kind of Christianized Venus. In celebrating this composite figure, "Frauenlob" fully earns his sobriquet. His hallmark is the unique blend of learning, Biblical allusion, dense wordplay, and lush sensuality he offers as homage to his Lady and places in her mouth. I will end by citing three strophes of the poem, the first two in the seer's voice, the third in the Lady's.

Strophe 3

Fertile maid and favored lady,
your meadow wet with heaven's dew
flowers in resplendent show.
Hear the turtledoves singing their song,
loud-ringing,
a song of longing
for sweet May's treasure.
Winter's ordeal is over:
your vineyards blossom
with fruit so wholesome.

Your beloved calls from the vineyard, from
the garden
where hallowed grapes ripen:
"Come, love, come!" He is waiting
on the mountain of myrrh where lions stalk.
Your way cannot err
should he wish to talk
among roses. Listen with love
most tender, daughter,
mother, maid, you must go!

Strophe 4

Tell no lie, never try to deny:
you alone were meeting
with the king
in his cellar—
you knew his greeting,
you felt his touch. How much,
fair maid, did you dally?
We do not envy the wine of bliss
you drank there with sweet, sweet milk.

I know well his own tongue should tell you
the toll—
why the watchmen took
your cloak,
asking what do you seek,
fair maid, so late
in these alleys? "Never cease,
we must seize
the beloved!" Deep in your wounds
he's branded his threefold mark.

Strophe 9

I am the great and chosen Lady,
my will is ripe, my desire is mighty.
For fervent love I must unbar
the lattice of my cloister door—
my love all passionate drew near.
His hand caressed me, wet with dew—
O taste of honey through and through!
I ate the comb
and drank the foam
then came back home.
My God, such bliss!
What's the harm in this?

I the weasel bore the ermine
that bit the snake. With morning dew
I split the hard rock of the curse.
My divining rod, unforked,
crushed the heads of hell's black vermin.
When the palm tree of the Cross
saw me, it reddened without dye.
Speak, wise Adam, noble friend,
and tell how I
have come to end
your ancient blight—
I the Maid, by a mother's right.

Translations from Barbara Newman, *Frauenlob's Song of Songs: A Medieval Poet and His Masterpiece* (Penn State University Press, 2007). ■

J. Larry Jameson, David Austen-Smith, Lauren Pachman, Robert Porter, and Mark A. Satterthwaite (all, Northwestern University)

Xenia Semenova and Yuri I. Manin (Northwestern University)

Former Visiting Scholar Jay Grossman (Northwestern University)

Northwestern University President Henry Bienen and Robert A. Lamb (Northwestern University)

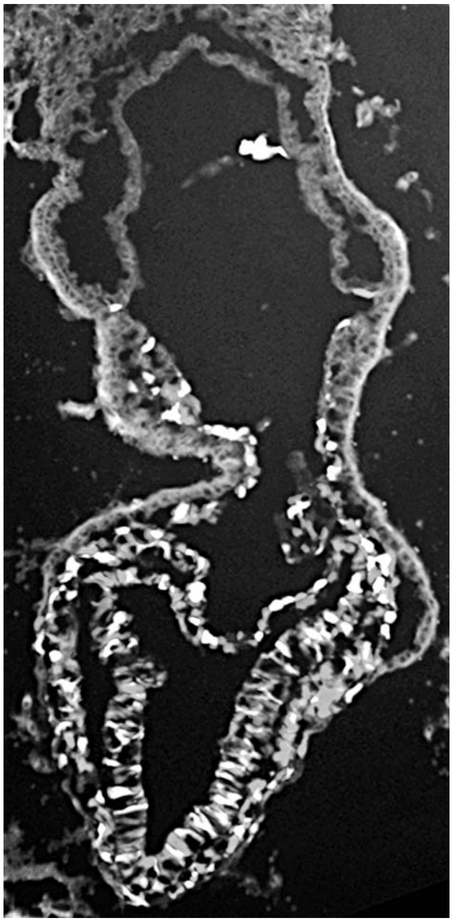
Academy Meetings

Gathering at the University of Michigan

Academy Fellow Bernard Agranoff organized a meeting and reception on the University of Michigan campus on May 14, 2007. Recently elected Fellows of the Academy were recognized, and Teresa A. Sullivan, Provost and Executive Vice President for Academic Affairs and Professor of Sociology at the University of Michigan, led a discussion about "Debt as Metaphor." An authority on consumer debt, she explored the history of personal bankruptcy, noting the important role it played in the lives of immigrants in nineteenth-century America. She also considered the effect of debt, or potential debt, on the educational plans of many segments of the U.S. population today.

Fellows Arlene Saxonhouse and Joseph Vining (both, University of Michigan)

University of Michigan President Mary Sue Coleman (far left) with recently elected Academy Fellows from the University: Robert L. Greiss, Jr., Judith Temkin Irvine, Richard Charles Murray Janko, Robert K. Lazarsfeld, Rosina Bierbaum, Rowena Green Matthews, Arthur Lupia, and David Ginsburg, with speaker Teresa Sullivan and Academy host Bernard W. Agranoff



Stem Cells: Politics and Promise

Irving L. Weissman

Introduction by John L. Hennessy

This presentation was given at the 1911th Stated Meeting, held at Stanford University on February 26, 2007. Stanford University President John Hennessy and Academy CEO Leslie Berlowitz welcomed over one hundred Fellows and guests to the meeting.

Microphotograph of an early mouse embryo derived from 4 different colored embryonic stem cells (green, blue, red, and uncolored). The colored cells came from injected mouse embryonic stem cells, while the uncolored cells came from the mouse blastocyst (pre-embryo) into which the colored cells were injected. One can see the earliest stages of formation of the primitive cell layers that will later form tissues and organs. Above the embryo proper (bottom portion of the image) are a few colored cells migrating into an uncolored tissue. The migrating cells include the first blood-forming stem cells and also blood vessel–forming stem cells; they will make blood islands in the yolk sac. Photo and experiments by Hiroo Ueno and Irv Weissman.

John L. Hennessy

John L. Hennessy is President of Stanford University. He was elected to the American Academy in 1995.

Introduction

One of the remarkable characteristics of the American Academy is its ability to reach across disciplinary boundaries, and there is perhaps no topic more appropriate for a cross-disciplinary discussion than stem cell research – a subject that involves issues not only in science but also in ethics and politics. Stanford University is committed to being a leader in stem cell research. Our speaker today, Irv Weissman, and his colleague Paul Berg have convinced me of the importance of this research, and I firmly believe that universities should take a stand and support work in this area.

Irv, of course, has been a pioneer in the study of stem cell biology and cancer research. He came to us from the remote and underrepresented state of Montana. As a boy, Irv became interested in science by reading about the work of Ehrlich and Pasteur in Paul De Kruif's *Microbe Hunters*. From an early age, he knew that science was something he wanted to do. In high school he began working in a lab, and as an undergraduate at Montana State University he began publishing. Irv has been at Stanford since 1960, first as a medical student and then as a member of the faculty. In 1987, he succeeded in isolating the first blood-forming stem cells; the following year, he reported the results in *Science*, informing researchers of this highly significant breakthrough.

In 2002, he was named California Scientist of the Year. He has received numerous honors: our own Linus Pauling Medal for Outstanding Contributions to Science, the Alan Cranston Award from the Alliance for Aging Research, the Medal for Distinguished Contributions to Biomedical Research from the New York Academy of Science, and the Bass Award from the Society of Neurological Surgeons. He also holds numerous memberships in key academies.

Irv has several appointments at Stanford. He is professor of pathology and of developmental biology, but by courtesy he is also in the neurosurgery and biological sciences departments. The Weissman laboratory has a group of researchers at Stanford's Hopkins Marine Station in Pacific Grove, and Irv has also managed to find time to be an entrepreneur in two different companies.

Since 2003, Irv has also been serving in leadership roles in the university. One of the remarkable things about him is his capacity to take on these administrative positions while continuing to spend considerable time in the lab pursuing basic science. Irv directs the Institute for Stem Cell Biology and Regenerative Medicine here at Stanford. He is also the Director of the Comprehensive Cancer Center and the Director of the Ludwig Center for Cancer Stem Cell Research and Medicine, a wonderful new institute that probes the fascinating interaction between cancer and stem cells. Irv has helped pilot this research here and, equally importantly, has built an incredible faculty.

Stem cell research is a critical topic not only because it holds great potential for medicine but also because it has become so politicized. Of course, we live in a state that is far more progressive in its support than are many other parts of the country. In 2004, California voters approved Proposition 71, authorizing $3 billion in bonds for stem cell research. But as you may know, repeated attempts to repeal it or delay it have largely stymied its implementation. The first grants were just made, and Stanford led California's universities in receiving awards.

Irv's work – from the identification of blood-forming stem cells in mice to debating the federal government's position on embryonic stem cell research and championing the California State Ballot Initiative – demonstrates his vision and boldness. To quote one of his former students: "One thing you can say about Irv is that he's fearless. If it's important, he wants to work on it." Please join me in welcoming our colleague Irv Weissman.

Irving L. Weissman

Irving L. Weissman is Virginia and D. K. Ludwig Professor for Clinical Investigation in Cancer Research; Director of the Comprehensive Cancer Center; Director of the Institute for Stem Cell Biology and Regenerative Medicine; and Director of the Ludwig Center for Cancer Stem Cell Research and Medicine at the Stanford University School of Medicine. He has been a Fellow of the American Academy since 1990.

Presentation

I put the beginnings of stem cell research at the bombing of civilian populations in Hiroshima and Nagasaki. The people who perished at the lowest lethal dose of radiation died about fifteen days after their exposure. When experiments were done on mice and dogs to replicate that effect, the animals died because radiation destroyed their blood-forming systems – a result that intrigued hematologists and experimental biologists. At higher doses, the victims died much faster and the radiation affected other body systems. So a community of scientists began to try to figure out why the bone marrow – the blood-forming organ – was destroyed at lower radiation levels.

One of the key experiments was done in 1961 in Toronto, where, indirectly, James Till and Ernest McCulloch showed that a certain type of cell likely existed in the bone marrow. When this cell divided into two daughter cells, it gave rise to one cell just like itself – a stem cell – and another cell that started to form blood. We now know that a single mouse blood-forming stem cell can end up making over thirty thousand stem cells in the body. It does this for the life of the animal, after which we can transfer a stem cell to another animal for its life, and so on.

If we gave blood-forming stem cells from a nondiabetic parent or sibling mouse to the mouse that was getting diabetes, we could stop that reaction forever and cure the disease.

This discovery spurred scientists to try to locate that cell rather than just be aware of its existence. That's where we came in, beginning in the early 1980s. We discovered a way to isolate these cells, a general approach that allows one to isolate stem cells in the brain, in other tissues, and from cancers. These blood-forming stem cells are rare cells, about one in twenty thousand, in the bone marrow.

In mice we found that we could isolate these cells as a pure population of cells, free of all other marrow cells, and that by transplanting these cells we could save mice, even genetically unrelated mice, from radiation damage. Those stem cells regenerated the bone marrow, the blood-forming organ, and replaced themselves, all in a different host. So, for example, if both John and I were mice, and if my stem cells were growing in his body, they would produce my blood-forming system and my immune system in him. We eventually figured out that the donor stem cells, growing up in the host's body, would tolerate the host. The cells of the immune system would not react against him because, as they grew up from the primitive cell, they would accept him as self. But because they came from me genetically, they would express all of my genes and tolerate me as self, too.

So, in 1986, I did this experiment in which I irradiated a mouse and transplanted our candidate blood stem cells from another mouse. I actually did this experiment for the first time in 1957 when I was in high school in Great Falls, Montana. I found that I could transplant skin from the donor into the bone marrow–transplanted host without any further treatment, indicating that skin transplants could be accepted. I went home and told my mom at lunch that in a matter of just three or four years, people would be transplanting bone marrow and hearts and skin and lungs.

As we know, that kind of transplant is just barely getting started now. I learned a big lesson in how long it takes to translate a discovery into medicine. Now, hopefully, things will go a lot faster, but then again, I was sure of my prediction in 1957 and my mom is still waiting for it to happen. She'd actually like some bone-forming stem cells right now.

At the time we were able to isolate those cells, I was working with a Stanford medical student, Judy Shizuru, who was interested in diabetes. In the 1970s, Stanford's Hugh McDevitt had shown that diabetes was neither a disease of the pancreas nor a disease of insulin-producing cells. It was a disease of the immune system. The genetic predilection of the diabetic mouse or diabetic human meant that instead of censoring the kinds of immune cells that would react against self, the system allowed them to escape, proliferate, and mature. So juvenile diabetes, or Type One diabetes, turned out to be an autoimmune disease – a disease where the body destroys its own insulin-producing cells. Using the mouse model of the disease, Judy and I went on to show that if we gave blood-forming stem cells from a nondiabetic parent or sibling mouse to the mouse that was getting diabetes, we could stop that reaction forever and cure the disease. However, if we waited until the diabetes had killed off all of the insulin-producing cells, then we needed to give *both* blood-forming and insulin-producing stem cells from the donor.

That's where we ran into difficulty. We did not have a lot of extra insulin-producing cells. When it finally became known that there was a class of cells – embryonic stem cells – that could make any tissue in the body, we thought we could find such things as pancreatic precursors, or pancreatic stem cells, which could be grown from these very primitive embryonic stem cells. These ideas led us to the kind of investigations that began to get us into trouble with the public, because we were working with cells in a way that some people considered immoral.

The blood-forming stem cell experiment was a way forward for us: we knew that at least pancreatic tissues could be regenerated from stem cells. Later, we went on to find brain-forming stem cells and to show that those cells, unlike blood-forming cells, could actually be propagated outside of the body.

That concept, tested at a company I cofounded in 1998 (StemCells, Inc.), involved transplanting human brain stem cells into children with Batten disease, a genetic disease that is always fatal. The brains of children with this disease build up a toxic substance that they can't degrade because they lack one enzyme and the one part of a gene that would make that enzyme. Kids with Batten disease are normal until ages one to five, when cells in the eye and the optic cortex build up a fatty protein deposit that pops the cells and causes them to die. This process continues in the cerebellum, which governs balance and coordination. So the kids have what's called *cerebellar ataxia*. They start losing IQ because the process begins working on the part of the brain that involves learning, namely, the hippocampus. Finally, they go into a coma and die.

The blood-forming stem cell experiment was a way forward for us: we knew that at least pancreatic tissues could be regenerated from stem cells.

Brain stem cells isolated by Nobuko Uchida that had been taken from a human and put into the brain of an immunodeficient mouse with this genetic mutation stopped the disease in its tracks – by making the missing enzyme. The stem cells transport the enzyme out into the fluid that bathes the brain, where the cells that are missing the enzyme take it up and break down this potentially toxic product.

I'm detailing this process because we were transplanting human brain cells into the brains of mice. This excited a lot of people but not all in a good way. All sorts of images from the book *Metamorphosis* come to mind, including the idea of a human brain stuck in the body of a mouse. We accomplished the engraftment of maybe 1 percent of the neurons and the supporting cells, with the other greater than 99 percent of brain cells coming from the mouse. Senator Sam Brownback in Kansas introduced legislation to criminalize this research. If it had passed, a scientist would be fined $1 million and sentenced to ten years in jail for conducting this type of experiment.

We have used these brain stem cells to study not only neurodegenerative diseases but also some cases of spinal-cord injury, like Christopher Reeve's. In these cases, the cells that are located in the part of the body that's crushed die from lack of blood supply. The cells in the brain, however, do not die nor do the cells below the crushed part, which send pain signals to the brain. But because the cells die in the crushed area, people with these injuries don't have the cellular insulator (myelin) that allows the quick electrical transmission of pain or motor-control impulses. When Nobuko Uchida and Aileen Anderson put human brain stem cells just above and below that lesion in mice, they remyelinated the nerve cells in that area, which enabled the animals to walk.

During a Senate committee meeting, Senator Brownback questioned the morality of using such cells, and I asked him which of these diseases should not be worked on as hard as we can. His question demonstrated the disconnect between M.D.s who pledge to give our utmost to cure these diseases and people who have different points of view. Of course, everyone is allowed a point of view. A year ago, President Bush, in the State of the Union address, called this kind of transplantation of human brain cells into a mouse's brain the most egregious kind of experiment a scientist could do.

Now, the research we were doing on normal blood-, brain-, lung-, and breast-cell development – all of these tissues that have stem cells to regenerate them – led us to think about what goes wrong when someone gets a cancer or a leukemia or a lymphoma. About seven years ago, my colleague Mike Clarke, formerly of Michigan and now at Stanford (with Sean Morrison and Tannishta Reya), and I hypothesized that, in the development of a cancer, a couple of genetic changes take place in a normal stem cell. Because the only cell in a tissue that makes more of itself and stays at that stage of differentiation is the stem cell, it's the only cell that can accumulate the genetic and other changes that lead to cancer. So we proposed that cancers would be like normal tissues generated by their own cancer stem cells, each one specific to the cancer.

We have used these brain stem cells to study not only neurodegenerative diseases but also some cases of spinal-cord injury.

And that has turned out to be the case. We've demonstrated it in human leukemias, in breast, brain, and head and neck cancers. Now we're moving as fast as we can because once we discovered that each of those cancers self-renews – like a normal cell does, but out of control – it meant we could go after those tiny, rare cells within a cancer and ask what went wrong. It doesn't do any good to look at the daughter cells they make because the genes that the daughter cells express have nothing to do with the rare cancer stem cells.

In a report just published in the *New England Journal of Medicine*, Clarke shows that by looking at a patient's breast-cancer stem cells and the genes they express, one can predict the patient's outcome with high accuracy, regardless of the therapy he or she gets. This predictive capacity extends to lung and prostate cancer as well as some other cancers. We know that it happens in brain cancer, and (again countering the Brownback Bill) we found that human brain-cancer cells, glioblastomas and medulloblastomas, are the only cells that transfer the disease from the human brain to the mouse brain. They require something in that brain environment to keep them growing. Because we can get those cells out and look at the genes they express and at the abnormalities that occur, we think we can begin to attack brain cancer. As an immunologist, I believe we can find new ways to diagnose or treat it. I know this sounds like a lot of hope and hype, but that's where stem-cell thinking is taking us.

Earlier I mentioned a class of cells called embryonic stem cells. That's actually a misnomer. The embryologists of the nineteenth century and most of the twentieth century didn't label a fertilized egg in the first stages of development an "embryo." After the egg pops out of the ovary, a sperm fertilizes it. As it travels down the Fallopian tube, it divides seven, eight, nine times until it forms an entity we call a blastocyst. On the outside of the blastocyst there are about one hundred to one hundred fifty cells that help implant it in the uterus and start to form the placenta. Inside are twenty or so cells that eventually form the embryo and then the fetus, but it has not yet been determined what tissue each of those cells will make. It's only after implantation that differentiation begins.

Before this political era, most of the embryologists called the blastocyst after implantation an embryo, and the blastocyst before implantation a pre-embryo. Nevertheless, it's common parlance to call a blastocyst before implantation an embryo, and if I tried to say in Congress that it's not an embryo, they'd say you're just trying to fool us by changing the word. So we say what people commonly use.

The cells in the very middle of the blastocyst can be removed and cultured. Gail Martin at UCSF and Martin Evans in Wales did it first in mice in the 1980s. Their work proved to be extremely important for the study of mouse development and of genetic diseases – at least the ones we could study in mice. In 1998, James Thompson at the University of Wisconsin modified the technique and did it for the first time with human cells – a very important technical advance.

Now we can have these cell lines growing to very large numbers, starting with this undifferentiated cell. The important thing to remember, though, is that these cells remain at that early stage of development. If you remove the factors that make them grow so rapidly, then they start turning on their own, willy-nilly, into different cell types of the body – some blood cells, some teeth cells, some hair-follicle cells that some of us could use. It's so important to study these kinds of cells because they have the genetic instructions, somehow, to make every known cell type in the body. Studying development, therefore, with human embryonic stem cells would be straightforward.

Human embryonic stem cells come mainly from in vitro fertilization clinics. The sperm and the egg are put together in a test tube, development occurs, and then a few blastocysts – usually two or three at most – are put in the mother. About eight to ten blastocysts are made, and the remainder are frozen. Up until 2001, scientists who wanted to work on those cell lines started with the in vitro fertilization clinic. The cells from these clinics come from mainly white, mainly well-to-do, and always infertile people. So if we were going to learn something about development from those cells, we'd be learning from a limited source in our society. It is possible that those cells could encompass the genes of all the diseases – sickle cell disease or Mediterranean anemia or other kinds of genetic disorders – that we would like to understand and treat, but it is unlikely.

So it was with some excitement when several scientists, including Rudy Jaenisch at the Whitehead Institute at MIT and others in Hawaii and in Japan, found that, in mice, one could take a skin-cell nucleus – a cell that's determined to be skin – from one mouse and put it into an egg of another mouse, removing the chromosomes from that mouse egg first so that the only genetic information comes from the adult skin cell. In a low but significant fraction, the nucleus was reprogrammed back to the earlier time point, and it was the egg's RNA components and protein components that did it. This is called nucleus transfer pluripotent (several potencies) stem cells.

The research we were doing on normal blood-, brain-, lung-, and breast-cell development . . . led us to think about what goes wrong when someone gets a cancer or a leukemia or a lymphoma.

We don't know yet how that process works, but it meant that we could get an embryonic stem cell line from a predefined donor mouse through that reprogramming process. Rudy did a terrific experiment. He took skin cells from a mouse with a genetic immunodeficiency so that it had no immunity lymphocytes. He put the nucleus in and got out a cell line: it made brain cells, skin cells, hair cells, but it could not make the cells of the immune system. So the genetics of the skin-cell donor read true in the cell line: the pluripotent stem cell line had a disease that recapitulated itself. When George Daley and Rudy got the blood-forming skin cells from that line and put them back in the mouse, they retained that disease-genetic immunodeficiency. Then they did another beautiful experiment. They fixed the gene in the stem cell line; although it wasn't a perfect experiment, they fixed the disease by transplanting the "fixed" blood progenitors from the line into the immunodeficient mice.

Now, that is what you hear when people talk about therapeutic cloning: a therapeutic attempt to change a person's genetic deficiency in which somatic cells are used to make a pluripotent stem cell line in which scientists fix the gene, which is then transplanted back into their own cells. If that's all it were, it would be terrific, but, in fact, I think it's much more important. If we had the genetics of Lou Gehrig's disease, or Parkinson's disease, or Huntington's disease – or any of a large number of genetic disorders in cell lines that recapitulated the developmental defect, or the pathogenesis, of the disease – the biomedical community could begin to understand these diseases.

In biomedical research universities, we really want to begin to understand how these diseases work. The sequencing of the human genome has led us to many of the genes that we knew had to be inherited to cause these diseases. But the disconnect is between knowing what the gene is and how a combination of genes leads to a particular disease. Lou Gehrig's disease involves motor-neuron degeneration. Even today we don't know if the genetic defect is in the motor neurons, or in the cells that nourish them, or in the connections to the muscle, or in something else we haven't even thought of yet. In order to understand disease development, we need to fix one of the three or four or five genes in a cell line and say, 'OK, what does that do?' That's why understanding how genetic defects lead to disease is interesting, not only for us in the biomedical research industry but also, and that's a long time coming, for the pharmaceutical and biotech industries.

Now, you may have thought that this would be the kind of triumph that everybody would applaud. I was the head of a National Academy of Sciences/National Academy of Engineering panel, at the National Research Council and the Institute of Medicine, on human reproductive cloning and nuclear transfer to make stem cells. (Bruce Alberts, the president of the National Academy of Sciences, perhaps figuring I was the only person who hadn't made up his mind at that time, asked me to head the panel.) We examined all of the animal experiments that involved taking the nucleus, let's say, from a skin cell and putting it into the egg. When the egg got to that blastocyst stage and was actually implanted in the uterus of an animal of the same species, it was found that 99.2 percent of those fetuses died. They didn't die as they do in a regular miscarriage. They didn't die just a few days to a few weeks after they were implanted; those that didn't die right away died in mid- and late pregnancy. And in cows, mice, and other animals, they would quite often kill the mother.

Now we're moving as fast as we can because once we discovered that each of those cancers self-renews – like a normal cell does, but out of control – it meant we could go after those tiny, rare cells within a cancer and ask what went wrong.

My panel was made up of scientists, including a medical ethicist and a reproductive biologist, who had all agreed before we met that we'd find out the facts about this field before we made a judgment – and we'd keep our mouths shut until we had argued the facts. So we could say, unanimously, on the basis of these facts, that reproductive cloning was not ready for prime time. Even if you had no objection to cloning humans, nobody after the Nuremberg Trials would submit a person to that kind of medical experimentation, where the fetus could die and over half the mothers that take it beyond mid-gestation could die. We asked for a legally enforceable ban on human reproductive cloning, but said we would come back in five, six, seven years to see if things had improved in the animal experiments to the same safety level as in vitro fertilization, so that we could contemplate it – without giving our own particular judgments about whether we liked or didn't like the outcome of reproductive cloning. From the experiments of Jaenisch and others, it was clear that it was a different thing to make a cell line by nuclear transfer so that we could learn about human diseases and treat them.

Unanimously we asked for this kind of stem cell research to go forward, but because it impacted so many aspects of society, we said there should be a panel of experts in law, ethics, and medicine to help advise leaders in Congress, the medical field, and elsewhere about whether this would be a good thing to do. We didn't presume that we knew the answer to that.

But in the middle of our deliberations, and right after we had a public workshop on the issues, President Bush, on August 9, 2001, said that we should go forward with human embryonic stem cell research using cell lines made before that date but not afterward – and that we should not undertake nuclear transfer at all. Of course, as President, he could and did issue an executive order related to federal funding. This research was not criminalized. Congressman David Weldon of Florida then introduced a criminalization bill in the House (with Senator Brownback in the Senate), proposing a $1 million fine and ten years in jail if a scientist did this research. It passed after two hours of debate in the House, but it got stuck in the Senate, largely through the bipartisan efforts of Orrin Hatch, Arlen Specter, Ted Kennedy, Diane Feinstein, and Tom Harkin. They blocked this legislation after holding hearings with us, whereas the House did not have hearings.

The political debate came to California next. A group of people, mainly in Hollywood, mainly parents of diabetic children, wanted to see whether this research could help their children. I have never seen anything like parents of kids with juvenile diabetes; unlike relatives of people with other diseases, they are the most aggressive, most committed individuals. Eventually, Robert Klein, now Chair of the Independent Citizens Oversight Committee of the California Institute of Regenerative Medicine, became involved with this nascent group. He asked scientists to help write the legislation, which we did, to assure that if we received funding from the state, the reviews of the science would be expert. We also included the proviso that nobody on the review panel could be from California or have a close connection or receive funds. Then we suggested that the reviewers get at least enough money to do their work.

So the campaign began and ended with 59 percent of Californians voting in favor of setting aside $3 billion to be spent over ten to thirteen years. One of the key events took place a few weeks before the 2004 election when George Schultz met with and advised Governor Arnold Schwarzenegger, who, instead of staying out of the debate, came out in favor of Proposition 71 – further evidence that this was not a partisan issue. It was an issue about the right of people in California to enjoy the best that could come from this very long-term research in terms of the diagnosis and treatment of diseases. The proposition was immediately held up to question by lawsuits on constitutional grounds, but the major opposition was from a well-known religious organization.

The basis of the debate is whether a nuclear-transfer blastocyst is a person. Is it a person with the same rights as an individual that is born? The President is very clear: he believes it is a person and that nuclear transfer would, therefore, be a form of research intended to kill a person. He came out in favor of the Brownback Bill, which states that this research should not go forward.

When Congress started looking at these issues again, the tide had turned dramatically, perhaps as a result of the California vote. Now, the majority in the House and in the Senate are in favor of funding at least expanded embryonic stem cell research, if not nuclear-transfer research. But this support was not enough to overcome a veto: last year, the Castle-DeGette Bill was passed in Congress but vetoed by President Bush. Later that day, Governor Schwarzenegger loaned $150 million from the state budget to the California Institute of Regenerative Medicine: it is because of that loan that the funding has begun. Now, finally, we can move at least California forward in all aspects of stem cell research. Hopefully, it will eventually be permitted and funded throughout the United States. ■

John Brauman (Stanford University) and Leslie Berlowitz (American Academy)

George P. Shultz (Stanford University) and Gerhard Casper (Stanford University)

David Kennedy (Stanford University) and Gordon Moore (Intel Corporation)

Remembrances

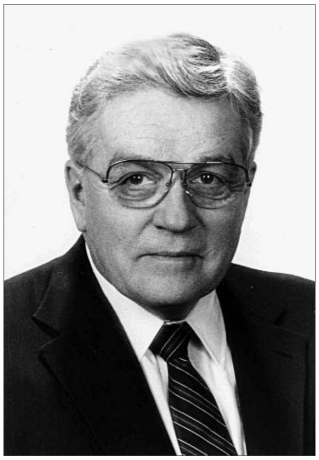


Photo courtesy of the University of Washington

John R. Hogness

John R. Hogness, who passed away in Seattle on July 2, 2007, was a statesman of thought and action in the world of medicine. As a Fellow for over thirty years, he was an admired mentor and dedicated colleague who worked to advance the Academy as a national institution committed to serving scholarship and society.

Educated at Haverford College and the University of Chicago, he began his career with a private medical practice in Seattle before joining the faculty at the newly established University of Washington School of Medicine in 1950. Throughout a long career at the University, he served as Dean of the School of Medicine from 1964 – 1969, as University of Washington Executive Vice President and Vice President of the University of Washington Health Sciences from 1969 – 1971, and as President of the University from 1974 to 1979. In the 1980s, he returned to the University of Washington as professor of health sciences. His more than seventy papers and publications reflect his wide-ranging interests, including his early work in chemistry and endocrinology, a year at Los Alamos preparing reports on tracer techniques and beta-ray burns at Eniwetok, and his involvement in medical education, administration, and health policy, particularly the relationship between government and medicine and the social and ethical aspects of medicine.

In the midst of his university service, Hogness was appointed the first President of the Institute of Medicine. The IOM was not born easily, but he recognized that if this new organization were to become a major presence in the medical world, it would have to be more than an honorary society. It would have to stake its reputation on marshalling the expertise of its members to produce impartial, authoritative studies. It would have to speak out on matters of national policy and bring emerging health issues to public attention well before they reached a crisis stage. Hogness stepped up to this daunting responsibility and, in his own words, promised "one hell of a show."

To those who worked with Hogness at the Academy, this institutional commitment has particular meaning. In the late 1980s, the Academy set out to create a new blueprint for its future; Hogness was one of the principal architects of the strategic plan that emerged from a series of discussions involving over eighty Fellows. Recognizing that it was critical for the Academy to strengthen and expand its research program, he saw its honorary membership as an invaluable intellectual resource. In his view, the Academy's convening power – its ability to draw on members representing diverse fields and perspectives – was the key to developing long-term analyses of important social and scholarly issues that would inform policymakers and the broader intellectual community.

Greater communication within the membership was also one of Hogness's goals. As chair of the Western Center and a member of the Council, he guided us in developing a model for Fellows' gatherings in other parts of the country. During the past year, we held over forty meetings and workshops, including a joint meeting of the Academy and the American Philosophical Society in Washington, D.C., focusing on several of the most pressing issues facing the nation – from the independence of the courts to energy choices and global warming.

He is survived by his wife, Margaret; nine children and stepchildren; ten grandchildren; and his brother, David S. Hogness, also a Fellow of the Academy. His contributions to the medical community and to the Academy represent a living legacy for those who will always value his innovative spirit, his extraordinary insight, and his abiding good humor.

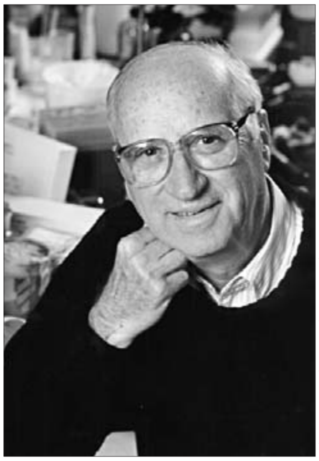


Photo credit: Robert Holmgren

Daniel E. Koshland, Jr.

As this issue of the *Bulletin* went to press, we learned of the death of Daniel Koshland, Jr. Visionary biochemist, skilled administrator, brilliant editor, and noted philanthropist, he was widely recognized as a preeminent leader of the scientific community. Koshland's research led to major advances in the understanding of enzymes and protein chemistry. Always searching for scientific insights that would benefit society, he later focused on the chemical reactions involved in Alzheimer's disease and on the emerging field of bioenergy, with its potential for using cyanobacteria to produce methane as an alternative energy source. He received many honors throughout his career: the National Medal of Science in 1990, the Albert Lasker Award for Special Achievement in Medical Science in 1998, and the Welch Award in Chemistry in 2006, among others.

A professor in the University of California, Berkeley's Department of Molecular and Cell Biology since 1965, Koshland never confined himself to bench science. In the 1980s, he reorganized the biological sciences program on campus, consolidating eleven small departments into three – plant biology, integrative biology, and molecular and cellular biology – that reflected the changing nature of research. While continuing his work at Berkeley, he accepted another responsibility that would establish him as an eloquent spokesman for science. From 1985 – 1995, he served as editor of *Science*, improving the peer-review process, upholding the highest standards for the publication of pioneering research, strengthening the editorial board to include more scientists with the background needed to evaluate content, and introducing technology-based production processes. Under his creative leadership, the journal began to exert a major influence on public policy and became the voice of science in the nation.

A Fellow of the American Academy for forty years, Koshland served as a Councilor in the 1970s when he provided advice and guidance on a number of issues that continue to concern us today – from questions of nuclear proliferation to the future of the humanities. Both Dan and his late wife, the distinguished immunologist Marion Koshland, were members of the Council and strong advocates of the interdisciplinary research that is at the center of the Academy's work. In the late 1980s, Koshland participated in a strategic planning effort that set the future direction of the Academy's work; with his insight and experience as an editor, he helped to transform *Dædalus* into a more effective publication that communicates with Academy members and the broader intellectual community.

He is survived by his wife, Yvonne; three daughters; two sons, including Douglas Koshland, a Fellow of the Academy; and an extended family. In his scientific work and his service to the Academy, he was always open to discussion and debate. His integrity, generosity, and sense of purpose inspired all those he touched.

Noteworthy

Select Prizes and Awards

National Medals of Science, 2005

Biological Sciences

Anthony S. Fauci (National Institutes of Health)

Torsten N. Wiesel (The Rockefeller University)

Chemistry

Tobin J. Marks (Northwestern University)

Engineering

Jan D. Achenbach (Northwestern University)

Physical Sciences

Ralph A. Alpher (The Dudley Observatory)

National Medals of Science, 2006

Biological Sciences

Rita R. Colwell (Canon U.S. Life Sciences, Inc.)

Nina V. Fedoroff (Pennsylvania State University)

Lubert Stryer (Stanford University)

Chemistry

Marvin H. Caruthers (University of Colorado, Boulder)

Peter B. Dervan (California Institute of Technology)

Robert S. Langer (Massachusetts Institute of Technology)

Mathematics/Computer Science

Hyman Bass (University of Michigan)

Physical Sciences

Daniel Kleppner (Massachusetts Institute of Technology)

National Medal of Technology, 2006

Charles M. Vest (National Academy of Engineering)

Shaw Prize, 2007

Peter Goldreich (Institute for Advanced Study)

Robert P. Langlands (Institute for Advanced Study)

Robert J. Lefkowitz (Duke University)

Kiel Prize, 2007

Helmut Schmidt (Die Zeit)

Amartya Sen (Harvard University)

Other Awards

James Roger Prior Angel (University of Arizona) was awarded the 2007 Joseph Fraunhofer Award/Robert M. Burley Prize by the Optical Society of America.

Norman E. Borlaug (Dallas, TX) was awarded the Congressional Gold Medal, America's highest civilian honor.

John Groves (Princeton University) is the recipient of the MERIT award from the National Institutes of Health.

Thomas Kailath (Stanford University) is the recipient of the 2007 IEEE Medal of Honor, awarded by the Institute of Electrical and Electronics Engineers.

Toni Morrison (Princeton University) was awarded the 2007 Radcliffe Institute Medal, given by the Radcliffe Institute for Advanced Study.

Maynard Olson (University of Washington) is the winner of the 2007 Gruber Prize in Genetics.

Saul Perlmutter (University of California, Berkeley) is among the recipients of the 2007 Gruber Prize in Cosmology.

Condoleezza Rice (United States Department of State) is the recipient of the 2007 WNBA Inspiration Award.

Joseph L. Sax (University of California, Berkeley) was awarded the 2007 Blue Planet Prize.

Theda Skocpol (Harvard University) has been awarded the 2007 Johan Skytte Prize in Political Science.

Gabor Somorjai (University of California, Berkeley) was awarded the 2008 Priestley Medal.

Charles P. Thacker (Microsoft Corporation) received the John von Neumann Medal for Outstanding Achievements in Computer-related Science and Technology, given by the Institute of Electrical and Electronics Engineers.

New Appointments

Ernest Beutler (Scripps Research Institute) has been appointed to the Scientific Advisory Board of Protalix BioTherapeutics, Inc.

Mary Schmidt Campbell (New York University) has been nominated to serve as Chair and member of the Board of the New York State Council on the Arts.

Thomas Carew (University of California, Irvine) was elected President of the Society for Neuroscience.

Carol T. Christ (Smith College) has been elected to the Board of Directors of Merrill Lynch & Co., Inc.

Ching-Wu Paul Chu (University of Houston) has been named to the Advisory Board of Aurora Imaging Technology, Inc.

Nina V. Fedoroff (Pennsylvania State University) has been named Science and Technology Advisor to U.S. Secretary of State Condoleezza Rice.

Frances Daly Fergusson (Vassar College) has been elected to the Board of Trustees of the J. Paul Getty Trust.

Jeffrey S. Flier (Beth Israel Deaconess Medical Center) has been named Dean of Harvard Medical School.

M. Judah Folkman (Harvard Medical School) has been appointed to the Scientific Advisory Board of Predictive Biosciences.

Paul L. Joskow (Massachusetts Institute of Technology) has been elected President of the Alfred P. Sloan Foundation.

Paul LeClerc (New York Public Library) has been elected to the Board of Trustees of the J. Paul Getty Trust.

Mary Patterson McPherson (Andrew W. Mellon Foundation) has been named Executive Officer of the American Philosophical Society.

Richard A. Meserve (Carnegie Institution) has been elected to the Board of Overseers of Harvard University.

Robert Pozen (MFS Investment Management) will chair a new Securities and Exchange Commission advisory committee to study how to make the U.S. financial reporting system less complex and costly.

Neil L. Rudenstine (ARTstor) has been elected to the Board of Trustees of the J. Paul Getty Trust.

Virginia Sapiro (Boston University) has been named Dean of Boston University's College and Graduate School of Arts and Sciences.

S. Shankar Sastry (University of California, Berkeley) has been named Dean of the College of Engineering at the University of California, Berkeley.

Kay Kaufman Shelemay (Harvard University) has been appointed Chair of Modern Culture in the John W. Kluge Center at the Library of Congress.

Subra Suresh (Massachusetts Institute of Technology) has been appointed Dean of the School of Engineering at the Massachusetts Institute of Technology.

Lewis T. Williams (FivePrime) has been appointed to the Board of Directors of Juvaris BioTherapeutics, Inc.

Select Publications

Poetry

Geoffrey Hill (Boston University). *A Treatise of Civil Power.* Yale University Press, January 2008

Fiction

Woody Allen (New York, NY). *Mere Anarchy*. Random House, June 2007

Ha Jin (Boston University). *A Free Life*. Pantheon, November 2007

Garrison Keillor (Prairie Home Companion). *Pontoon: A Lake Wobegon Novel*. Viking, September 2007

Jim Lehrer (Public Broadcasting System). *Eureka*. Random House, October 2007

Alan Lightman (MIT). *Ghost.* Pantheon, October 2007

Ian McEwan (Oxford, United Kingdom). *On Chesil Beach.* Doubleday, June 2007

Philip Roth (New York, NY). *Exit Ghost*. Houghton Mifflin, October 2007

William Trevor (London, United Kingdom). *Cheating at Canasta*. Viking, October 2007

Nonfiction

Rolena Adorno (Yale University). *The Polemics of Possession in Spanish American Narrative.* Yale University Press, December 2007

Alan Alda (New York, NY). *Things I Overheard while Talking to Myself*. Random House, September 2007

Francisco J. Ayala (University of California, Irvine). *Darwin's Gift to Science and Religion.* Joseph Henry Press, June 2007

Thomas Bender (New York University). *The Unfinished City: New York and the Metropolitan Idea.* NYU Press, September 2007

Thomas Bender (New York University) and Wilson Smith (University of California, Davis), eds. *American Higher Education Transformed, 1940 – 2005: Documenting the National Discourse.* Johns Hopkins University Press, September 2007

Floyd E. Bloom (Scripps Research Institute), ed. *Best of the Brain from Scientific American.* Dana Press, June 2007

Leon Botstein (Bard College). *The History of Listening.* Basic Books, July 2007

Tom Brokaw (NBC News). *BOOM!* Random House, November 2007

William J. Clinton (New York, NY). *Giving: How Each of Us Can Change the World*. Knopf, September 2007

Sheldon H. Danziger (University of Michigan) and Cecilia Elena Rouse (Princeton University), eds. *The Price of Independence: The Economics of Early Adulthood.* Russell Sage Foundation, December 2007

Denis Donoghue (New York University). *On Eloquence.* Yale University Press, January 2008

Freeman J. Dyson (Institute for Advanced Study). *A Many-Colored Glass: Reflections on the Place of Life in the Universe*. University of Virginia Press, August 2007

Martin Filler (New York, NY). *Makers of Modern Architecture.* New York Review Books, July 2007

Joel L. Fleishman (Duke University). *The Foundation: A Great American Secret – How Private Wealth is Changing the World.* Public Affairs Books, January 2007

Saul Friedlander (University of California, Los Angeles). *The Years of Extermination: Nazi Germany and the Jews, 1939 – 1945*. HarperCollins, April 2007

Frank F. Furstenberg (University of Pennsylvania). *Destinies of the Disadvantaged: The Politics of Teenage Childbearing.* Russell Sage Foundation, November 2007

Al Gore (Nashville, Tennessee). *The Assault on Reason*. Penguin Press, May 2007

Michael J. Graetz (Yale Law School). *100 Million Unnecessary Returns: A Simple, Fair, and Competitive Tax Plan for the United States.* Yale University Press, January 2008

Gertrude Himmelfarb (Washington, D.C.), ed. *The Spirit of the Age: Victorian Essays.* Yale University Press, November 2007

Robert Hollander (Princeton University) and Jean Hollander, trans. *Paradiso* by Dante. Doubleday, August 2007

Jerome Kagan (Harvard University). *What is Emotion?: History, Measures, and Meanings.* Yale University Press, November 2007

Nikki Keddie (University of California, Los Angeles). *Roots and Results of Revolution.* Yale University Press, August 2006

Anthony T. Kronman (Yale Law School). *Education's End: Why Our Colleges and Universities Have Given Up on the Meaning of Life.* Yale University Press, September 2007

Paul MacAvoy (Yale University). *The Unsustainable Costs of Partial Deregulation*. Yale University Press, July 2007

Guillermo O'Donnell (University of Notre Dame). *Dissonances: Democratic Critiques of Democracy.* University of Notre Dame Press, September 2007

Stanley G. Payne (University of Wisconsin-Madison). *Franco and Hitler: Spain, Germany, and World War II.* Yale University Press, January 2008

James Peacock (University of North Carolina, Chapel Hill). *Grounded Globalism: How the U.S. South Embraces the World.* University of Georgia Press, July 2007

Norman Pearlstine (The Carlyle Group). *Off the Record: The Press, the Government, and the War over Anonymous Sources.* Farrar, Straus & Giroux, August 2007

Steven Pinker (Harvard University). *The Stuff of Thought: Language as a Window into Human Nature.* Viking, September 2007

Diane Ravitch (New York University) and Chester E. Finn, Jr. (Thomas B. Fordham Institute), eds. *Beyond the Basics: Achieving a Liberal Education for All Children.* Thomas B. Fordham Foundation, July 2007

Jeffrey D. Sachs (Columbia University). *Common Wealth: Economics for a Crowded Planet.* Penguin Press, August 2007

Jeffrey D. Sachs (Columbia University), Macartan Humphreys (Columbia University), and Joseph E. Stigliz (Columbia University), eds. *Escaping the Resource Curse.* Columbia University Press, June 2007

Oliver Sacks (New York, NY). *Musicophilia: Tales of Music and the Brain.* Knopf, October 2007

Frederick A. O. Schwarz, Jr. (Brennan Center for Justice) and Aziz Z. Huq (Brennan Center for Justice). *Unchecked and Unbalanced: Presidential Power in a Time of Terror.* New Press, March 2007

Jonathan D. Spence (Yale University). *Return to Dragon Mountain: Memories of a Late Ming Man.* Viking, September 2007

Peter Stansky (Stanford University). *The First Day of the Blitz.* Yale University Press, November 2007

Yi-Fu Tuan (University of Wisconsin-Madison). *Coming Home to China*. University of Minnesota Press, April 2007

John Updike (Boston, Massachusetts). *Due Consideration: Essays and Criticism*. Knopf, October 2007

Helen Vendler (Harvard University). *Our Secret Discipline: Yeats and Lyric Form*. Harvard University Press, October 2007

J. Craig Venter (J. Craig Venter Institute). *A Life Decoded: My Genome, My Life.* Viking, September 2007

Alice Waters (Chez Panisse Foundation). *The Art of Simple Food: Notes and Recipes from a Delicious Revolution.* Clarkson Potter, October 2007

Theodore Ziolkowski (Princeton University). *Modes of Faith: Secular Surrogates for Lost Religious Belief*. University of Chicago Press, June 2007

Exhibitions, Performances, and Commissions

John Baldessari (University of California, Los Angeles). "Ways of Seeing" at the Hirshhorn Museum and Sculpture Garden, Smithsonian Institution, July 26 – September 20, 2007.

Eric Fischl (New York, NY). Fourteen new, previously undisplayed bronze sculptures as well as large-scale drawings, at the Kestnergesellschaft, Germany, November 30, 2007 – February 3, 2008.

Frank Gehry (Frank O. Gehry & Associates) is designing a playground in New York, in Battery Park on the southern tip of Manhattan.

Jasper Johns (Sharon, CT). "Gray" at the Metropolitan Museum of Art, New York, February 5 – May 4, 2008.

Brice Marden (New York, NY). "12 Views for Caroline Tatyana" at the San Jose Museum of Art, June 9 – October 14, 2007.

Bruce Nauman (Galisteo, NM). "One Hundred Fish Fountain" at the Kestnergesellschaft, Germany, September 27 – November 4, 2007.

Billie Tsien (Tod Williams Billie Tsien Architects) and **Tod Williams** (Tod Williams Billie Tsien Architects) will design the Reva and David Logan Center for Creative and Performing Arts at the University of Chicago.

Bill Viola (Bill Viola Studio). "Ocean Without A Shore" at the San Gallo Church, San Marco, Venice, Italy, June 10 – November 24, 2007.

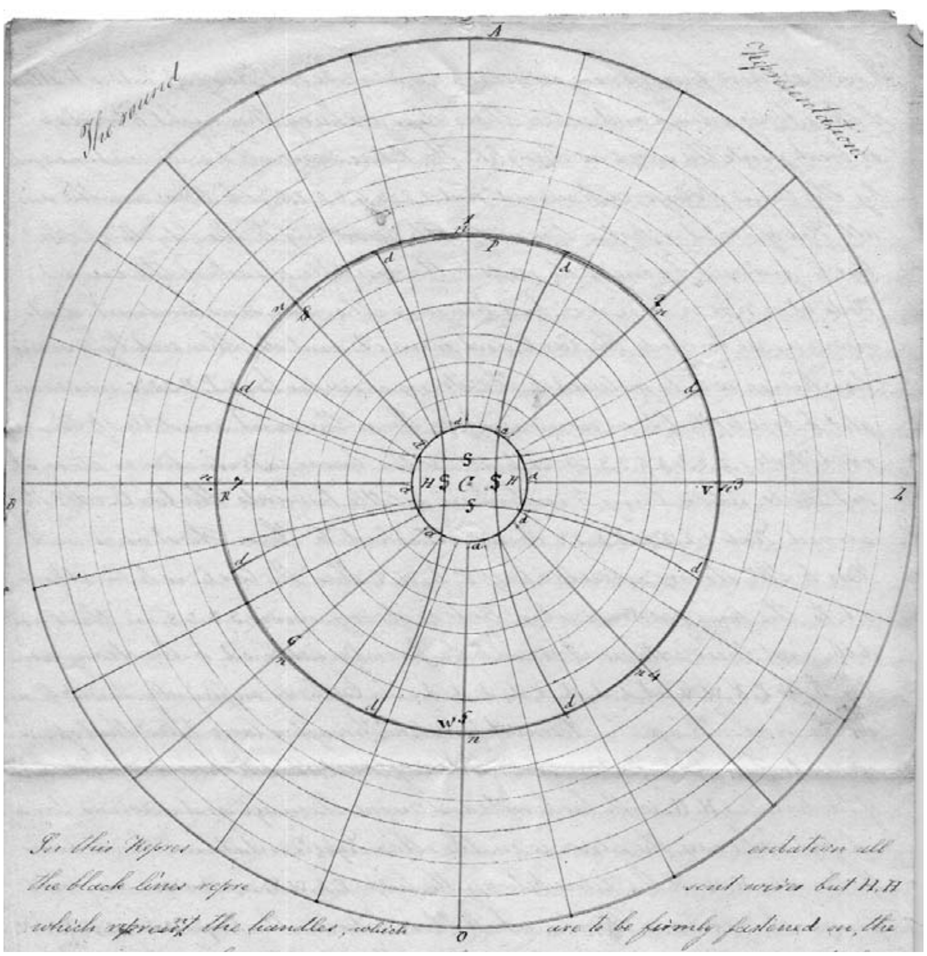
We invite all Fellows and Foreign Honorary Members to send notices about their recent and forthcoming publications, scientific findings, exhibitions and performances, and honors and prizes to bulletin@amacad.org. ■

From the Archives

Since 1780, the Academy's sponsorship of exploration and innovation has made it a natural place for both Fellows and members of the public to present, discuss, and publish new ideas in science and technology. The Academy's archives hold many communications, both practical and philosophical, some of which were published in the *Memoirs* or *Proceedings*.

H. Strait of Rensselaer County, New York, in a letter to the Academy dated December 10, 1832, submitted his plan for the construction and motion of wings for human flight. Mr. Strait was not a member of the Academy.

> Having given considerable attention to the study of Aeronauticks and discovered a principle, which I deem will be eminently useful and applicable; if put in practice, to that noble and neglected Branch of rational Science, and being myself unable from want of sufficient money and mechanical skill to give it a complete investigation by Experiment I am constrained either to solicit assistance or drop it where it is. Having therefore examined its Reasons with Care and Attention, I chose what I deemed to be the most advisable alternative and resolved immediately to send you my plan with the Reasons in its support in order to solicit your assistance. The importance of the Object, if it shall prove to be universally applicable, the eminent utility it will be to the Geographer, the Traveller, the Philosopher, and to Posterity: the Sublimity it will present to the inspired Poet and Observer of the Beauties of Nature; nay more a sincere desire to advance and promote the Happiness of the whole human Family, and to make them at once alive to the noblest feelings of the Heart and conscious of the high Powers with which they are intrusted to improve and control for the most exalted purposes. . . . Is now high time that the Reasons of Flying which have as yet stood unrefuted and uninvestigated, should receive a rational demonstration of their solidity or fallacy by the established laws of natural Philosophy.



H. Strait's eight-page letter to the American Academy describing his design for wings for human flight included two illustrations, this one for "The round Representation." The Aeronaut was to place himself in Car C, "take hold of the handles H,H," and "raise them up and down as fast as he can."

AMERICAN ACADEMY
OF ARTS & SCIENCES

Norton's Woods, 136 Irving Street, Cambridge, MA 02138
telephone 617-576-5000, *facsimile* 617-576-5050,
email aaas@amacad.org, *website* www.amacad.org

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Norton's Woods
136 Irving Street
Cambridge, MA 02138-1996 USA

telephone 617-576-5000
facsimile 617-576-5050
email aaas@amacad.org
website www.amacad.org