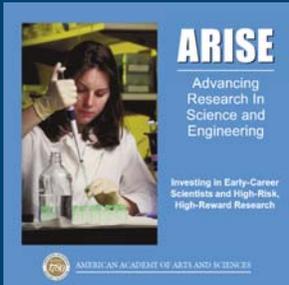




Bulletin

SPRING 2008

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Fellows and Friends Again Contribute More than \$1.5 million to the Annual Fund

In the recently completed fiscal year, the Academy's Annual Fund reached a new level. The fund surpassed the \$1.5 million mark for the second consecutive year, with gifts up 5 percent over the previous year; 1,280 donors helped to accomplish this goal.

Chair of the Academy Trust and Vice President Louis W. Cabot noted, "Every Annual Fund gift helps to achieve these results. New research projects and studies, and a growing number of programs and activities across the country, rely on resources provided by a successful Annual Fund."

The Academy is indebted to the Fellows, friends, foundations, and staff members for supporting its work. We are particularly grateful to a growing number of leadership donors, including Leonore Annenberg, Stephen D. Bechtel, Jr., John P. Birkelund, James A. Block, Louis W. Cabot, John E. Cogan, Jr., Alan M. Dachs, Lauren B. Dachs, Arthur Gelb, Michael E. Gellert, William T. Golden, F. Warren Hellman, Robert P. Henderson, Walter B. Hewlett, Seng T. Lee, Tom Leighton, Martin Lipton, Peter and Ginny Nicholas, Carl H. Pforzheimer III, John S. and Cynthia L. Reed, Elihu Rose, Gerald Rosenfeld, E. John Rosenwald, Jr. and Patricia Rosenwald, and John C. Whitehead.

A complete list of contributors to the 2007–2008 Annual Fund will appear in the Academy's *Annual Report*, to be published in the fall of 2008.

The members of the Development and Public Relations Committee are Louis W. Cabot and Robert A. Alberty, cochairs; Jesse H. Choper, Alan M. Dachs, Michael E. Gellert, Charles M. Haar, Jack W. Peltason, and Nicholas T. Zervas. ■

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Saturday, October 11, 2008

Stated Meeting and Induction Ceremony – Cambridge

Location: Sanders Theater, Harvard University

Sunday, October 12, 2008

Stated Meeting – Cambridge

Location: House of the Academy

Thursday, November 6, 2008

Stated Meeting – New York

Judicial Independence

Speakers: Sandra Day O'Connor (Supreme Court of the United States),
Judith Resnik (Yale Law School), Viet Dinh (Georgetown University Law
Center), Bert Brandenburg (Justice at Stake), and Linda Greenhouse
(*The New York Times*)

Location: New York University School of Law

Saturday, November 8, 2008

Stated Meeting – Chicago

The Rule of Law

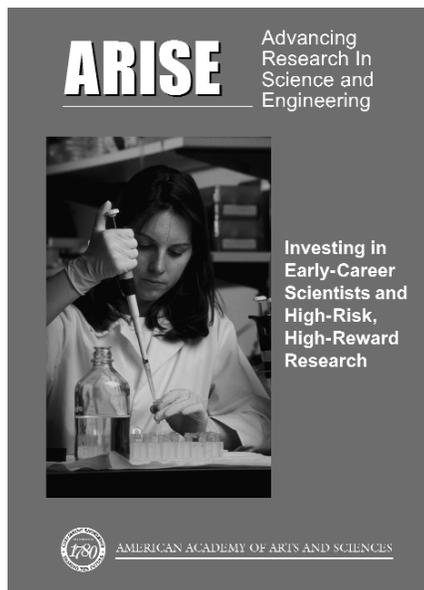
Speakers: Diane P. Wood (U.S. Court of Appeals, Seventh Circuit),
Frank H. Easterbrook (U.S. Court of Appeals, Seventh Circuit), and
Geoffrey Stone (University of Chicago Law School)

Location: Northwestern University Law School

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

Academy News and Projects

Academy Report Recommends Changes in Federal Science Funding



A new Academy white paper, titled *ARISE – Advancing Research In Science and Engineering: Investing in Early-Career Scientists and High-Risk, High-Reward Research*, argues that for America to remain competitive in the new global environment, it must develop funding policies and grant programs specifically dedicated to support early-career scientists and stimulate high-risk, high-reward research. Over the past year, a blue-ribbon panel of leaders from science, industry, and the public policy sector, chaired by Nobel laureate and Howard Hughes Medical Institute President Thomas Cech, analyzed current science-funding mechanisms and devised strategies to maximize the impact of federal science dollars.

“The Academy asked this committee to examine the impact and best uses of federal science funding for the long-term benefit of the nation,” notes Cech. “Our study calls on federal agencies, research institutions, universities, and private foundations to provide secure funding for the best and brightest young scientists and to bolster innovative, breakthrough research that could potentially transform our approaches to some of the world’s gravest problems.”

Today’s early-career faculty will be responsible for our nation’s future scientific and technological discoveries and for the education of new Ph.D.-level scientists and engineers. Yet, as this report demonstrates, they are disproportionately disadvantaged by intensified competition for research funds. Data indicate that the average age of those receiving individual (RO1) research grants from the National Institutes of Health is 51.7; and the average age for first-time awards has risen to 42.9. To address this issue, federal agencies should:

- Create or strengthen existing large, multi-year award programs for early-career faculty.
- Adopt career-stage-appropriate expectations for mainstream grant funding, with merit-review processes tailored for beginning independent researchers.
- Initiate policies responsive to the needs of primary caregivers, primarily women, such as grant extensions or other support mechanisms to enable them to advance in science and engineering.

Universities need to contribute as well by actively mentoring young faculty and reviewing tenure and promotion criteria to ensure that those who participate in collaborative, team-based research projects receive appropriate credit for their work.

To expand and encourage high-risk, high-reward investigations, the Academy report advocates the development of both specialized federal programs to foster potentially transformational research and initiatives within established award programs that boost more creative proposals. It also maintains that the overburdened peer-review system and the relatively low investment in administrative support for agency program officers are additional obstacles to the funding of risky research.

Continued on page 2

Project Committee Members

Thomas Cech, *Chair* (Howard Hughes Medical Institute)

David Baltimore (California Institute of Technology)

Steven Chu (Lawrence Berkeley National Laboratory)

France Córdova (Purdue University)

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Keith Yamamoto (University of California at San Francisco)

Huda Zoghbi (Baylor College of Medicine)

Leslie C. Berlowitz, *ex officio* (American Academy of Arts and Sciences)

Lounsbery Foundation Grant Promotes Report's Findings

The Richard Lounsbery Foundation has awarded the Academy support to promote *ARISE – Advancing Research In Science and Engineering: Investing in Early-Career Scientists and High-Risk, High-Reward Research* to a broad scientific audience, as well as to policymakers in Washington, D.C. The grant supports the design and printing of the *ARISE* report, as well as its broad dissemination among target audiences.

The Academy will widely circulate the report's findings to senior policy officials at the major federal funding agencies, industry executives, congressional leaders, university administrators, and members of national academic and scientific societies. Committee members and Academy staff presented the study's recommendations at recent meetings of the Association of American Universities, the American Association for the Advancement of Science, and the National Postdoctoral Association, among others. Several national scientific membership organizations are collaborating with the Academy to publicize the report in their publications and on their websites.

ARISE report continued from page 1

Other aspects of the current federal funding environment impede the research of early-career faculty and stifle transformative research. One of the key recommendations of the report is the systematic tracking of demographic data about grant applicants on a government-wide basis. Only a few federal funding agencies collect demographic information about applicants, and no agency follows the funding success of individuals over time. The current nonstandardized tracking among funding agencies hinders efforts to assess how well we are supporting early-career scientists.

Here again, universities need to accept their share of responsibility for advancing path-breaking research. Charging a portion of faculty salaries to grants is necessary and appropriate, but the extreme model of expecting faculty to raise all of the funds for their own salaries, their students' stipends and tuition, and their research space discourages risk-taking by younger and well-established scientists alike. As funds are raised to construct research buildings, campaign goals should include a continuing responsibility to maintain the facility and to support programmatic activities.

ARISE was released at the National Press Club in Washington, D.C., on June 3. Thomas Cech, Neal Lane, and Keith Yamamoto highlighted the committee's findings and recommendations. The audience included senior representatives from government agencies, research universities, and science organizations, as well as early-career scientists, congressional staff, and members of the press.

The report was conducted by the Academy's Initiative for Science, Engineering, and Technology, cochaired by Charles Vest (National Academy of Engineering) and Neal Lane (Rice University). Its purpose is to examine the role that science and technology play in society today, how that role has changed, and how we can better prepare for the future. The full report may be downloaded from the Academy website at <http://www.amacad.org/ARISE>.

The Academy is grateful to the S. D. Bechtel, Jr. Foundation; Stephen D. Bechtel, Jr.; the Howard Hughes Medical Institute; the Richard Lounsbery Foundation; and the Merck Company Foundation for supporting this work. ■

* * * * *

Statements of Support

"Among the greatest risks America can take in its science and engineering research enterprise is to become risk averse or to overlook the immense contributions that have historically been made in these fields by younger researchers. The American Academy's *ARISE* report points the way to address the opportunities implicit in these considerations."

– Norman R. Augustine, Retired Chairman and Chief Executive Officer, Lockheed Martin Corporation

"Faculty in science and engineering are the idea engines that drive technological progress in America. The American Academy's *ARISE* report provides a frank assessment of the danger we face if, due to increasingly constrained funding, we lose our most promising scientists from the basic science arena."

– Bonnie L. Bassler, Squibb Professor and Director of Graduate Studies in the Department of Molecular Biology, Princeton University; Howard Hughes Medical Institute Investigator

"Focused, sensible, realistic, well-researched, and well-documented, this report addresses two primary weaknesses in federal research strategy. Our national ability to innovate and compete ultimately depends on attracting the best and brightest young men and women to research careers and enabling them to pursue bold new ideas. Hence, the guidance in this report is critically important."

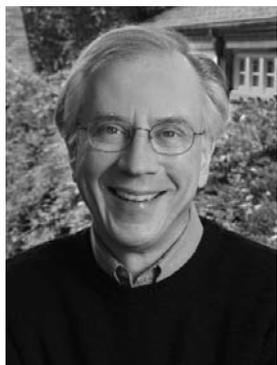
– Charles M. Vest, President, National Academy of Engineering

"Tom Cech and his colleagues address two of the most significant problems in today's research environment: the delays in establishing the independence of new investigators and the reluctance to support research that can fundamentally change the way we think. The recommendations will be of interest to those in government, other funding agencies, and universities who have the potential to change current practices."

– Harold Varmus, President, Memorial Sloan-Kettering Cancer Center

Academy News and Projects

Strategies for Nurturing Science's Next Generation



Thomas R. Cech

Nobel laureate Thomas R. Cech is chair of the *ARISE* report panel and president of the Howard Hughes Medical Institute. He has been a Fellow of the American Academy since 1988.

“Woe be on woe . . . , frenzy of the mind distraught.” Like the wailing chorus in a Sophoclean tragedy, today’s academic research scientists are constantly bemoaning their funding fate.

No wonder – the NIH budget has declined in real dollars for five consecutive years, and the NSF’s substantial budget increase committed by the America COMPETES Act has gone unfunded. But in addition to concerns about budget levels, we need to be concerned about how federal research funds are distributed. These latter issues provide the topic of a new study by a committee of the American Academy of Arts and Sciences. Our report is entitled *ARISE: Advancing Research in Science and Engineering*.

While numerous matters concerning mechanisms of federal funding of research are worthy of analysis, our committee chose to focus on two areas that are broadly acknowledged as being particularly endangered.

First is the difficulty assistant professors face in obtaining stable funding for their research. The nation invests 25 to 30 years in the education of these faculty, who then compete with perhaps a hundred other applicants to land a position; finally, when they should be in their laboratories making discoveries and in classrooms training the next generation,

they are driven to their offices to become serial grant-writers. And their students and postdoctoral fellows, listening a bit too seriously to their mentors’ travails, start pondering alternative careers.

The second issue: As research funds get tighter, review panels shy away from high-risk, high-reward research, and investigators adapt by proposing work that’s safely in the “can-do” category. The clear danger is that potentially transformative research – that which has a chance to disrupt current complacency, connect disciplines in new ways or change the entire direction of a field, but at the same time incurs the very real possibility of failure – finds scant support.

As research funds get tighter, review panels shy away from high-risk, high-reward research.

Our scientific leaders in Washington are well aware of these pressing issues, and they have taken action within their considerable constraints. At the NIH, first-time grant applications with scores just outside the funding line are frequently rescued. Potentially transformative research is supported through the Pioneer Awards at NIH, although to a very small extent, and NSF has developed plans to encourage such research.

Thus, some *ARISE* recommendations reinforce what agencies are already predisposed to do, and hopefully will give them additional fortitude for doing so. For example, the NIH is already considering shorter grant applications emphasizing potential impact and restricting the amount of methodological detail. And its Pioneer Awards program puts greater emphasis on previous inventiveness of the researcher who proposes bold new directions.

Other recommendations provide fresh ideas. Our meetings with early-career faculty revealed that obtaining a second major federal research grant, or a competitive renewal of

the first grant, is often as much of a career bottleneck as the first grant. So we recommend that review panels be instructed to evaluate applications by career-stage-appropriate criteria, taking into account the time it takes to build a research team.

Implementing such recommendations takes money. From where will it come? The committee decided not to distract from its message about modes of funding by tackling budgetary issues; in short, we strongly believe that early-career faculty and potentially transformative research deserve priority independent of whether budgets are flat or increasing. Each agency should examine its entire portfolio (not just individual research grants, but also large projects and intramural programs) and redirect funds from areas that are underperforming.

The report’s most radical recommendations are to universities, which are urged to take more responsibility for faculty salaries. This is not to say that recharging salaries to research grants is bad. To the contrary, American research universities and medical school faculties have been built on such federal support, to everyone’s benefit. But medical schools have found that they can establish new programs with little institutional commitment: Soft-money faculty are hired and then write grants to obtain even 100 percent of their salaries, the stipends and tuition payments for graduate students, and indirect costs to help repay the debt on the research building, all without much institutional backup should they suffer a lapse in funding. That system weighs heavily on early-career faculty. When the risk of a grant not being funded means no salary and no job, it inhibits high-risk, high-reward grant applications. Rebalancing of responsibilities is needed, in small steps and with advance warning to avoid disrupting the system.

Indeed, in times of constricted budgets it is particularly important for academic scientists to *ARISE* and advocate some changes in the priorities of federal research funding. ■

Reprinted from *Science News*.

ARISE

Check List for Action

Recommendations to:

Federal Agencies

- Create Targeted Grant Programs for Early-Career Faculty
- Create Seed Funding Programs for Early-Career Faculty
- Pay Special Attention to Early-Career Faculty in Regular Grant Programs
- Develop Supportive Policies for Primary Caregivers
- Explore Targeted Grant Mechanisms and Policies to Foster Potentially Transformative Research
- Adopt Funding Mechanisms and Policies That Nurture Transformative Research in All Award Programs
- Strengthen Grant Review Processes
- Invest in Program Officers
- Establish New Programs Only if They Have Critical Mass
- Track Demographics on a Government-Wide Basis

Universities

- Actively Mentor Early-Career Scientists
- Create Seed Funding Programs for Early-Career Faculty
- Reconsider Promotion and Tenure Policies
- Address the Needs of Primary Caregivers and Childbearing Needs
- Accept Institutional Responsibility for a Greater Portion of Faculty Salaries
- In Building New Facilities, Shoulder a Larger Share of the Financial Cost

Private Foundations

- Spread the Wealth: Ensure a Greater Number of New Investigators by Capping the Number of Start-up and First Awards to a Single Individual

The *ARISE* report also received statements of support from:

Martin L. Leibowitz, Managing Director, Morgan Stanley; Chairman of the Board, Institute for Advanced Study

Richard H. Scheller, Executive Vice President, Research, Genentech

Debra W. Stewart, President, Council of Graduate Schools

Mark Fishman, President, Novartis Institutes for BioMedical Research

Mary Woolley, President and Chief Executive Officer, Research!America

Bruce E. Bursten, President, American Chemical Society

Arthur Bienenstock, President, American Physical Society

Howard J. Silver, Executive Director, Consortium of Social Science Associations

Doug Comer, Director, Legal and Technology Policy, Intel Corporation; Chair, Task Force on the Future of American Innovation

Peter S. Kim, President, Merck Research Laboratories

Joan R. Goldberg, Executive Director, American Society for Cell Biology

Joann Boughman, Executive Vice President, American Society of Human Genetics

Richard T. O'Grady, Executive Director, American Institute of Biological Sciences

P. Patrick Leahy, Executive Director, American Geological Institute

Stuart I. Feldman, President, Association for Computing Machinery

Russell J. Lefevre, President, Institute of Electrical and Electronics Engineers (IEEE)-USA

Alan Bernstein, Executive Director, Global HIV Vaccine Enterprise

Academy News and Projects

A Decade of Study on the Humanities

At a meeting of the President's Committee on the Arts and the Humanities, held at the Academy in 1998, leaders of national humanities organizations expressed concern about a growing lack of public understanding and support for the humanities. The gathering served as the impetus for establishing the Academy's Initiative for Humanities and Culture to analyze and address the challenges facing the humanities and to articulate their importance in American civic and cultural life.

As Leslie Berlowitz, Academy CEO, has observed, "The humanities are crucial to understanding and interpreting what it means to be human, but by the late 1990s, many humanists feared that their work was becoming marginalized in academia and in society. The Academy decided to mobilize its resources to examine the state of the humanities and to develop resources and policies that would ensure their strength and significance in the twenty-first century."

"Humanists, who in the 1970s and 1980s, went through advanced exercises in public handwringing, are now ready to make a conscious effort to understand not only the changing nature of their particular fields but also the state of the humanities in terms of research, education, and the larger society. To demonstrate the value of the humanities in our culture, we need reliable data and informed analyses; we can no longer allow prescription to preempt description."

– Francis Oakley

Ten years later, projects under the Initiative for Humanities and Culture have involved hundreds of participants, led to unprecedented collaboration with national humanities organizations, sponsored original research, and resulted in groundbreaking efforts to compile reliable statistical information about the humanities. The Initiative has produced three white papers and two published volumes of essays exploring the evolution of humanities disciplines and institutions.

The Academy's decade-long commitment to the Initiative reflects a tradition of leadership in advancing the humanities. Over the years, it has played a pivotal role in establishing such important humanities institutions as the American Council of Learned Societies, the Independent Research Libraries Association, the National Endowment for the Humanities, and the Council on American Overseas Research Centers. In the mid-1970s, the Academy was the principal catalyst in the development of the National Humanities Center in North Carolina, now regarded as one of the world's leading institutes for advanced study in humanistic scholarship.

The Initiative for Humanities and Culture continues to develop the intellectual and material resources that will enable the humanities to thrive. Under the guidance of cochairs Denis Donoghue (New York University), Steven Marcus (Columbia University), Francis Oakley (Williams College), Patricia Meyer Spacks (University of Virginia), and Leslie Berlowitz



(American Academy), it is focusing on two issues vital to the health of the humanities: data collection that will serve as the basis for effective policy-making in the humanities and scholarship on the recent history and current state of the humanities.

Data Collection

When the Initiative was created, Steven Marcus argued that the humanities are the only disciplines that lack statistical data. In comparison with the prodigious amount of information available in science and technology, there are no comprehensive, longitudinal data on the humanities. Without knowledge of basic trends in these disciplines, it is difficult to develop sound policies for the humanities and to make a cogent case for funding them.

With its interdisciplinary membership and strong convening power, the Academy took the lead in organizing a consortium of

humanities organizations to create a database for the humanities. The rationale for a set of "Humanities Indicators," modeled after the National Science Foundation's *Science and Engineering Indicators*, was outlined in the Initiative's first white paper, *Making the Humanities Count: The Importance of Data* (2002). Two other data-related reports followed: *Foundation Funding for the Humanities: An Overview of Current and Historical Trends*, published in collaboration with the Foundation Center (2004); and *Tracking Changes in the Humanities: Essays on Finance and Education* (2005).

In 2006, the Academy secured major funding to develop the Humanities Indicators, including datasets, tables, charts, and interpretive essays; a draft will be completed later this year. Norman Bradburn (National Opinion Research Council) joined the Initiative to lead this part of the project. Drawing on existing data, the Indicators will provide statistical measurements on the health of the humanities in five areas: 1) Primary and Secondary Education in the Humanities, 2) Undergraduate and Graduate Education in the Humanities, 3) Humanities Workforce, 4) Humanities Funding and Research, and 5) Humanities in American Life.

In addition to collecting existing data on the humanities, the Initiative has taken steps to collect new data in areas where statistical information does not exist. The Modern Language Association, American Historical Association, College Art Association, Linguistic Society of America, American Academy of Religion, American Political Science As-

sociation, the Association of American Universities, and the American Council of Learned Societies have been working with the Academy to organize a *Humanities Departmental Survey*. Under the direction of Arnita Jones (American Historical Association) and John Hammer (American Academy), it is gathering information on faculty teaching and research, the tenure process, distribution of teaching loads, the number of majors and minors, and the type of jobs secured by graduates in departments of history, modern languages and literature, art history, linguistics, and religion.

The pilot survey was administered during the 2007–2008 academic year to over 1,400 humanities departments at institutions across the country. The Statistical Research Center of the American Institute of Physics is overseeing data management and collection, with the analysis and evaluation to be completed later this year. To date, over 60 percent of the work has been completed. The long-term goal is to develop a system of regular surveys that produces comparable data across academic disciplines.

Scholarship on the Humanities

In addition to data collection, the Humanities Initiative has also developed new scholarship on the history, content, and direction of the humanities in America. In 2006, the Academy released two volumes exploring the evolution of humanities disciplines in the twentieth century. A *Dædalus* issue, *On the Humanities*, edited by Patricia Meyer Spacks, analyzes the changes

that shaped the disciplines of law, literary studies, African American studies, history, and philosophy. The second volume, *The Humanities and the Dynamics of Inclusion since World War II*, edited by David A. Hollinger (University of California, Berkeley) and published by Johns Hopkins University Press, features essays on post–World War II social forces that transformed the humanities.

“The Humanities Now,” a *Dædalus* issue coedited by Patricia Meyer Spacks and Leslie Berlowitz, will be published later this year; it will focus on the importance of the humanities in American life and the challenges faced by humanities disciplines within and beyond academia. A number of essays will utilize data being compiled by the *Humanities Indicators* and *Departmental Survey* projects.

Humanities Resource Center Online

The Academy has created the *Humanities Resource Center Online* to house and disseminate data, commentary, and publications produced by the Initiative. The site will also include a list of selected publications and links to humanities-related organizations, associations, higher education groups, and government agencies.

Funding and Foundation Support

Throughout its ten-year history, the Initiative for Humanities and Culture has received generous support from numerous donors



and foundations. The Academy is grateful to the following individuals and organizations for supporting its efforts to strengthen the humanities in academia and in American life: William and Flora Hewlett Foundation, Andrew W. Mellon Foundation, Teagle Foundation, Sara Lee Foundation, Rockefeller Foundation, Walter B. Hewlett, the William R. Hewlett Revocable Trust, John P. Birkelund, Elihu Rose and the Madison Charitable Fund, and the National Endowment for the Humanities.

The Academy is indebted to the Fellows and Foreign Honorary Members who over the past decade have contributed their time, energy, and expertise to the important work of this Initiative. The knowledge and experience of the professional societies and humanities organizations that are working with us on this project has been an invaluable resource, and the Academy looks forward to continuing this collaboration.

Looking Ahead

While the Initiative for Humanities and Culture has contributed a great deal to advancing the role and impact of the humanities in the United States, more work is still needed. Following the release of the *Humanities Indicators*, the *Humanities Resource Center Online*, and the second *Dædalus* issue dedicated to the humanities, the existing 77 indicators will be updated as new data become available.

In March 2009, the Academy will sponsor a national conference in Washington, D.C., in conjunction with the publication of the second *Dædalus* issue. The meeting will bring together leaders in the humanities, representatives of the learned societies and national associations, as well as policymakers to reflect on and reaffirm the importance of the humanities to our society.

Efforts are also underway to develop a national system of ongoing humanities data collection based on the *Humanities Indicators*. A second *Departmental Survey* is planned for fall 2009, and the content of the *Humanities Resource Center Online* will continue to add links and enable users to go behind the charts to access data directly. ■

Academy News and Projects

Recent Publications from Reconsidering the Rules of Space Project

The Academy is pleased to announce the publication of two new occasional papers from its project on Reconsidering the Rules of Space. *Russian and Chinese Responses to U.S. Military Plans in Space*, written by Pavel Podvig (Center for International Security and Cooperation, Stanford

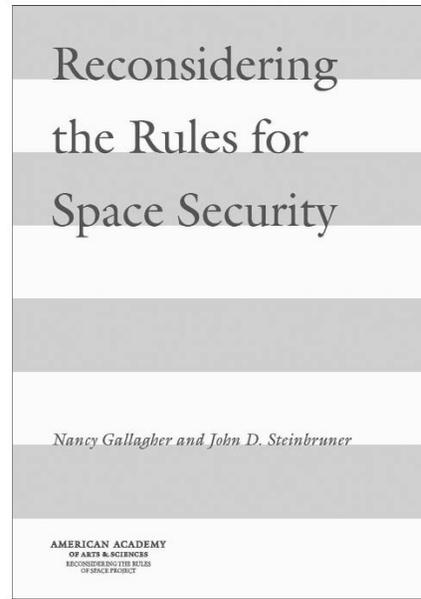
and that both nations are likely to respond to U.S. threats with “asymmetric” countermeasures, including reconsidering commitments to arms control agreements, developing anti-satellite weapons, extending the service life of ballistic missiles, and shifting political alignment. The authors conclude that none of these actions will benefit any nation’s security interests.

Reconsidering the Rules for Space Security, by Nancy Gallagher and John D. Steinbruner (both, Center for International and Security Studies at Maryland and University of Maryland), provides a comprehensive review of U.S. military plans for space, assesses the viability of U.S. policy to achieve “dominance” in space, and explores constructive alternatives. The authors assert the United States

should abandon current policies and instead support international negotiations that build upon the 1967 Outer Space Treaty, which was designed to address the central problems of space security in the twenty-first century. Gallagher presented the paper in April in Geneva at the United Nations Institute for Disarmament Research, an autonomous institute within the United Nations that conducts research on disarmament and security issues.



University) and Hui Zhang (Belfer Center for Science and International Affairs, Harvard University), discusses the implications for Russia and China of current U.S. military plans to develop missile-defense systems and to seek military control of outer space. They argue that Russia and China have much to lose if the United States pursues the space weapons programs laid out in its military documents,



The Academy’s Reconsidering the Rules of Space project examines the implications of U.S. policy in space from a variety of perspectives and considers the international rules and principles needed to ensure a long-term balance of commercial, military, and scientific activities in space. It is developing a series of papers intended to inform public discussion of the legitimate uses of space and to stimulate further examination of U.S. official plans and policies in space. Other papers consider the physical laws governing the pursuit of security in space and challenges posed to the U.S. space program by current policies. ■

Academy News and Projects

Select Academy Publications in JSTOR

Fellows, researchers, and other interested individuals can access past issues of the *Bulletin* and the Academy's annual report through JSTOR, an online archival database of scholarly publications.

Last year, the Academy entered into an agreement with JSTOR (an acronym for Journal Storage) to digitize the Academy's five serial publications. Issues of the *Bulletin*, which began publication in 1948, and the *Records*, which were published from 1958 to 2003 as the Academy's annual report, are now available in JSTOR. *Dædalus* issues, which date to 1955, are currently being processed into electronic format. JSTOR will also digitize and archive the Academy's historic publications: the *Memoirs*, which were printed from 1785 to 1957, and the *Proceedings*, which include 85 volumes published from 1846 to 1958.

"The Academy's serial publications not only chart the history of the Academy, but the history of intellectual development and debate in America," said Managing Editor of Publications and Managing Director of Archives Phyllis Bendell. "By making our journals and reports available through JSTOR, we are offering that history to the larger scholarly community and making the important work of the Academy more widely known."

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The Academy's agreement with JSTOR includes a five-year moving wall, which means there is a gap of five years between the most recently published issue and back issues available in JSTOR.

"Having the Academy's publications available in JSTOR is an invaluable resource to scholars around the world," said Academy Archivist Beth Carroll-Horrocks. "Researchers can search for and access journal articles in seconds. For example, historians interested in the Academy's work on nuclear non-proliferation during the cold war can browse our publications from the 1940s through 2003. And they can do it from their desktop computers in Cambridge or in Moscow."

Approximately 800 different journals, including four million articles, currently are available through JSTOR, which was conceived 14 years ago by Academy Fellow William G. Bowen, who was then president of the Andrew W. Mellon Foundation. About 4,000 institutions worldwide subscribe to the service. For more information on JSTOR, go to <http://www.jstor.org>.

Available in JSTOR from the *Bulletin*:

Alfred D. Chandler, Jr., "Industrial Revolutions and Institutional Arrangements" (1980)

Charles Eames, "Language of Vision: The Nuts and Bolts" (1974)

M. Judah Folkman, "The Best-Laid Plans of Mice for Men and Women: New Directions for Angiogenesis Research" (1999)

John Hope Franklin, "Afro-American History and the Politics of Higher Education" (1986)

Hannah Holborn Gray, "The Leaning Tower of Academe" (1993)

Daniel Patrick Moynihan, "The Rule of Law in World Affairs" (1983)

Gunther Schuller, "Jazz and Composition: The Many Sides of Duke Ellington" (1992)

John Paul Stevens, "The Concept of Liberty" (1987)

Steven Weinberg, "Night Thoughts of a Quantum Physicist" (1995)

Rosalyn Yalow, "Radioactivity in the Service of Man" (1981) ■

Academy Meetings



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The Research Library in the Digital Age

Robert Darnton

This presentation, the fourth S. T. Lee Lecture in the Humanities, was given at the 1925th Stated Meeting, held at the House of the Academy on March 13, 2008. Bernard Bailyn, Adams University Professor Emeritus at Harvard University and a Fellow of the Academy, introduced Robert Darnton.



Robert Darnton

Robert Darnton is Carl H. Pforzheimer University Professor at Harvard University and Director of the Harvard University Library. He has been a Fellow of the American Academy of Arts and Sciences since 1980.

Information is exploding so furiously around us and information technology is changing at such bewildering speed that we face a fundamental problem: How do we orient ourselves in the new landscape? What, for example, will become of research libraries in the face of technological marvels such as Google? How do we make sense of it all?

I have no answer to that problem, but I can suggest an approach to it: look at the history of the ways information has been communicated. Simplifying things radically, you could say that there have been four fundamental changes in information technology since humans learned to speak.

Somewhere around 4000 BC humans learned to write. Egyptian hieroglyphs go back to about 3200 BC, alphabetical writing to 1000 BC. According to scholars like Jack Goody, the invention of writing was the most important technological breakthrough in the history of humanity. It transformed mankind's relation to the past and opened a way for the emergence of the book as a force in history.

The history of books led to a second technological shift when the codex replaced the scroll sometime soon after the beginning of the Christian era. By the third century AD, the codex – that is, books with pages that

you turn as opposed to scrolls that you roll – became crucial to the spread of Christianity. It transformed the experience of reading: the page emerged as a unit of perception, and readers were able to leaf through a clearly articulated text, one that eventually included differentiated words (that is, words separated by spaces), paragraphs, and chapters, along with tables of contents, indexes, and other reader’s aids.

The codex, in turn, was transformed by the invention of printing with movable type in the 1450s. To be sure, the Chinese developed movable type around 1045, and the Koreans used metal characters rather than wooden blocks around 1230. But Gutenberg’s invention, unlike those of the Far East, spread like wildfire, bringing the book within the reach of ever-widening circles of readers. The technology of printing did not change for nearly four centuries, but the reading public grew larger and larger, thanks to improvements in

What will become of research libraries in the face of technological marvels such as Google?

literacy, education, and access to the printed word. Pamphlets and newspapers, printed by steam-driven presses on paper made from wood pulp rather than rags, extended the process of democratization so that a mass public came into existence during the second half of the nineteenth century.

The fourth great change, electronic communication, took place yesterday, or the day before, depending on how you measure it. The Internet dates from 1974, at least as a term. It developed from ARPANET, which went back to 1969, and from earlier experiments in communication among networks of computers. The Web began as a means of communication among physicists in 1991. Websites and search engines became common in the mid-1990s. And from that point everyone knows the succession of brand names that have made electronic communication an everyday experience: Gopher, Mosaic, Netscape, Internet Explorer, and Google, which was founded in 1998.

When strung out in this manner, the pace of change seems breathtaking: from writing to the codex, 4,300 years; from the codex to movable type, 1,150 years; from movable type to the Internet, 524 years; from the Internet to search engines, 17 years; from search engines to Google’s algorithmic relevance ranking, 7 years; and who knows what is just around the corner or coming out the pipeline?

Each change in the technology has transformed the information landscape, and the speedup has continued at such a rate as to seem both unstoppable and incomprehensible. In the long view – what French historians call *la longue durée* – the general picture looks quite clear – or, rather, dizzying. But by aligning the facts in this manner, I have made them lead to an excessively dramatic conclusion. Historians, American as well as French, often play such tricks. By rearranging the evidence, it is possible to arrive at a different picture, one that emphasizes continuity instead of change. The continuity I have in mind has to do with the nature of information itself, or, to put it differently, the inherent instability of texts. In place of the long-term view of technological transformations, which underlies the common notion that we have just entered a new era, the information age, I want to argue that every age was an age of information, each in its own way, and that information has always been unstable.

Let’s begin with the Internet and work backward in time. More than a million blogs have emerged during the last few years. They have given rise to a rich lore of anecdotes about the spread of misinformation, some of which sound like urban myths. But I believe the following story is true, though I can’t vouch for its accuracy, having picked it up from the Internet myself. As a spoof, a satirical newspaper, *The Onion*, printed a story about an architect who had created a new kind of building in Washington, D.C., one with a convertible dome. On sunny days, you could push a button, the dome would roll back, and the building would look like a football stadium. On rainy days it looks like Congress. The story traveled from website to website until it arrived in China, where it was printed in the *Beijing Evening News*. Then it was taken up by *The Los Angeles Times*, *The San Francisco*

There have been four fundamental changes in information technology since humans learned to speak: the invention of writing, the codex, movable type, and the Internet.

Chronicle, Reuters, CNN, Wired.com, and countless blogs as a story about the Chinese view of the United States: they think we live in convertible buildings, just as we drive around in convertible cars.

Other stories about blogging point to the same conclusion: blogs create news, and news can take the form of a textual reality that trumps the reality under our noses. Today many reporters spend more time tracking blogs than they do checking out traditional sources, such as the spokespersons of public authorities. News in the information age has broken loose from its conventional moorings, creating possibilities of misinformation on a global scale. We live in a time of unprecedented accessibility to information that is increasingly unreliable. Or do we?

I would argue that news has always been an artifact and that it never corresponded exactly to what actually happened. We take today’s front page as a mirror of yesterday’s events, but it was made up yesterday evening – literally, by “make-up” editors, who designed page one according to arbitrary conventions: lead story on the far-right column, off-lead on the left, soft news inside or below the fold, features set off by special kinds of headlines. Typographical design orients the reader and shapes the meaning of the news. News itself takes the form of narratives composed by professionals according to conventions that they picked up in the course of their training – the “inverted pyramid” mode of exposition, the “color” lead, the code for “high” and “the highest” sources, and so on. News is not what happened but a story about what happened.

Of course, many reporters do their best to be accurate, but they must conform to the

conventions of their craft, and there is always slippage between their choice of words and the nature of an event as experienced or perceived by others. Ask anyone involved in a reported happening. They will tell you that they did not recognize themselves or the event in the story that appeared in the paper. Sophisticated readers in the Soviet Union learned to distrust everything that appeared in *Pravda* and even to take nonappearances as a sign of something going on. On August 31, 1980, when Lech Walesa signed the agreement with the Polish government that created Solidarity as an independent trade union, the Polish people refused at first to believe it, not because the news failed to reach them but because it was reported on the state-controlled television.

We live in a time of unprecedented accessibility to information that is increasingly unreliable.

I used to be a newspaper reporter myself. I got my basic training as a college kid covering police headquarters in Newark in 1959. Although I had worked on school newspapers, I did not know what news was – that is, what events would make a story and what combination of words would make it into print after passing muster with the night city editor. When events reached headquarters, they normally took the form of “squeal sheets” or typed reports of calls received at the central switchboard. Squeal sheets concerned everything from stray dogs to murders, and they accumulated at a rate of a dozen every half hour. My job was to collect them from a lieutenant on the second floor, go through them for anything that might be news, and announce the potential news to the veteran reporters from a dozen papers playing poker in the press room on the ground floor. The poker game acted as a filter for the news. One of the reporters would say if something I selected would be worth checking out. I did the checking, usually by phone calls to key offices like the homicide squad. If the information was good enough, I would tell the poker game, whose members would phone it in to their city desks. But it had to be really good – that is, what ordinary people would

consider bad – to warrant interrupting the never-ending game. Poker was everyone’s main interest – everyone but me: I could not afford to play (cards cost a dollar ante, a lot of money in those days), and I needed to develop a nose for news.

I soon learned to disregard DOAs (dead on arrival, meaning ordinary deaths) and robberies of gas stations, but it took time for me to spot something really “good,” like a hold-up in a respectable store or a water main break at a central location. One day I found a squeal sheet that was so good – it combined rape and murder – that I went straight to the homicide squad instead of reporting first to the poker game. When I showed it to the lieutenant on duty, he looked at me in disgust: “Don’t you see this, kid?” he said, pointing to a *B* in parentheses after the names of the victim and the suspect. Only then did I notice that every name was followed by a *B* or a *W*. I did not know that crimes involving black people did not qualify as news.

Having learned to write news, I now distrust newspapers as a source of information, and I am often surprised by historians who take them as primary sources for knowing what really happened. I think newspapers should be read for information about how contemporaries construed events, rather than for reliable knowledge of the events themselves. A study of news during the American Revolution by a graduate student of mine, Will Slauter, provides an example. Will followed accounts of Washington’s defeat at the Battle of Brandywine as it was refracted in the American and European press. In the eighteenth century, news normally took the form of isolated paragraphs rather than “stories” as we know them now, and newspapers lifted most of their paragraphs from each other, adding new material picked up from gossips in coffeehouses or ship captains returning from voyages. A loyalist New York newspaper printed the first news of Brandywine with a letter from Washington informing Congress that he had been forced to retreat before the British forces under General William Howe. A copy of the paper traveled by ship, passing from New York to Halifax, Glasgow, and Edinburgh, where the paragraph and the letter were reprinted in a local newspaper.

The Edinburgh reprints were then reprinted in several London papers, each time under-

New information technology should force us to rethink the notion of information itself Instead of firmly fixed documents, we must deal with multiple, mutable texts.

going subtle changes. The changes were important because speculators were betting huge sums on the course of the American war, while bears were battling bulls on the Stock Exchange, and the government was about to present a budget to Parliament, where the pro-American opposition was threatening to overthrow the ministry of Lord North. At a distance of 3,000 miles and four to six weeks of travel by ship, events in America were crucial for the resolution of this financial and political crisis.

What had actually happened? Londoners had learned to mistrust their newspapers, which frequently distorted the news as they lifted paragraphs from each other. That the original paragraph came from a loyalist American paper made it suspect to the reading public. Its roundabout route made it look even more doubtful, for why would Washington announce his own defeat, while Howe had not yet claimed victory in a dispatch sent directly from Philadelphia, near the scene of the action? Moreover, some reports noted that Lafayette had been wounded in the battle, an impossibility to British readers, who believed (wrongly from earlier, inaccurate reports) that Lafayette was far away from Brandywine, fighting against General John Burgoyne near Canada.

Finally, close readings of Washington’s letter revealed stylistic touches that could not have come from the pen of a general. One – the use of “arraying” instead of “arranging” troops – later turned out to be a typographical error. Many Londoners therefore concluded the report was a fraud, designed to promote the interests of the bull speculators and the Tory politicians – all the more so as the press coverage became increasingly inflated through the process of plagiarism. Some London papers claimed that the minor defeat had been a major catastrophe for the

Americans, one that had ended with the annihilation of the rebel army and the death of Washington himself. (In fact, he was reported dead four times during the coverage of the war, and the London press declared Benedict Arnold dead 26 times.)

Le Courrier de l'Europe, a French newspaper produced in London, printed a translated digest of the English reports with a note warning that they probably were false. This version of the event passed through a dozen French papers produced in the Low Countries, the Rhineland, Switzerland, and France itself. By the time it arrived in Versailles, the news of Washington's defeat had been completely discounted. The Comte de Vergennes, France's foreign minister, therefore continued to favor military intervention on the side of the Americans. And in London, when Howe's report of his victory finally arrived after a long delay (he had unaccountably neglected to write for two weeks), it was eclipsed by the more spectacular news of Burgoyne's defeat at Saratoga. So the defeat at Brandywine turned into a case of miswritten and misread news – a media *non-event* whose meaning was determined by the process of its transmission, like the blogging about the convertible dome and the filtering of crime reports in Newark's police headquarters.

Information has never been stable. That may be a truism, but it bears pondering. It could serve as a corrective to the belief that the speedup in technological change has catapulted us into a new age, in which information has spun completely out of control. I would argue that the new information technology should force us to rethink the notion of information itself. It should not be understood as if it took the form of hard facts or nuggets of reality ready to be quarried out of newspapers, archives, and libraries, but rather as messages that are constantly being reshaped in the process of transmission. Instead of firmly fixed documents, we must deal with multiple, mutable texts. By studying them skeptically on our computer screens, we can learn how to read our daily newspaper more effectively – and even how to appreciate old books.

Bibliographers came around to this view long before the Internet. Sir Walter Greg developed it at the end of the nineteenth century, and

Donald McKenzie perfected it at the end of the twentieth century. Their work provides an answer to the questions raised by bloggers, Googlers, and other enthusiasts of the World Wide Web: Why save more than one copy of a book? Why spend large sums to purchase first editions? Aren't rare book collections doomed to obsolescence now that everything will be available on the Internet? Unbelievers used to dismiss Henry Clay Folger's determination to accumulate copies of the First Folio edition of Shakespeare as the mania of a crank. The First Folio, published in 1623, seven years after Shakespeare's death, contained the earliest collection of his plays, but most collectors assumed that one copy would be enough for any research library. When Folger's collection grew beyond three dozen copies, his friends scoffed at him as Forty Folio Folger. Since then, however, bibliographers have mined that collection for crucial information, not only for editing the plays but also for performing them.

To students in the 1950s, libraries looked like citadels of learning. Knowledge came packaged between hard covers, and a great library seemed to contain all of it.

They have demonstrated that 18 of the 36 plays in the First Folio had never before been printed. Four were known earlier only from faulty copies known as "bad" quartos – booklets of individual plays printed during Shakespeare's lifetime, often by unscrupulous publishers using corrupted versions of the texts. Twelve were reprinted in modified form from relatively good quartos; and only two were reprinted without change from earlier quarto editions. Since none of Shakespeare's manuscripts has survived, differences between these texts can be crucial in determining what he wrote. But the First Folio cannot simply be compared with the quartos, because every copy of the Folio is different from every other copy. While being printed in Isaac Jaggard's shop in 1622 and 1623, the book went through three very different issues. Some copies lacked *Troilus and Cres-*

sida, some included a complete *Troilus*, and some had the main text of *Troilus* but without its prologue and with a crossed-out ending to *Romeo and Juliet* on the reverse side of the leaf containing *Troilus*'s first scene.

The differences were compounded by at least 100 stop-press corrections and by the peculiar practices of at least nine compositors who set the copy while also working on other jobs – and occasionally abandoning Shakespeare to an incompetent teenage apprentice. By arguing from the variations in the texts, bibliographers like Charlton Hinman and Peter Blayney have reconstructed the production process and thus arrived at convincing conclusions about the most important works in the English language. This painstaking scholarship could not have been done without Mr. Folger's Folios.

Of course, Shakespeare is a special case. But textual stability never existed in the pre-Internet eras. The most widely diffused edition of Diderot's *Encyclopédie* in eighteenth-century France contained hundreds of pages that did not exist in the original edition. Its editor was a clergyman who padded the text with excerpts from a sermon by his bishop in order to win the bishop's patronage. Voltaire considered the *Encyclopédie* so imperfect that he designed his last great work, *Questions sur l'Encyclopédie*, as a nine-volume sequel to it. In order to spice up his text and to increase its diffusion, he collaborated with pirates behind the back of his own publisher, adding passages to the pirated editions.

In fact, Voltaire toyed with his texts so much that booksellers complained. As soon as they sold one edition of a work, another would appear, featuring additions and corrections by the author. Their customers protested. Some even said that they would not buy an edition of Voltaire's complete works – and there were many, each different from the others – until he died, an event eagerly anticipated by retailers throughout the book trade.

Piracy was so pervasive in early-modern Europe that best sellers could not be blockbusters as they are today. Instead of being produced in huge numbers by one publisher, they were printed simultaneously in many small editions by many publishers, each racing to make the most of a market unconstrained by copyright. Few pirates attempted to produce accurate counterfeits of the orig-

Students today still respect their libraries, but reading rooms are nearly empty on some campuses.

inal editions. They abridged, expanded, and reworked texts as they pleased, without worrying about the authors' intentions. They behaved as deconstructionists *avant la lettre*.

The issue of textual stability leads to the general question about the role of research libraries in the age of the Internet. I cannot pretend to offer easy answers, but I would like to put the question in perspective by discussing two views of the library, which I would describe as grand illusions – grand and partly true.

To students in the 1950s, libraries looked like citadels of learning. Knowledge came packaged between hard covers, and a great library seemed to contain all of it. To climb the steps of the New York Public Library, past the stone lions guarding its entrance and into the monumental reading room on the third floor, was to enter a world that included everything known. The knowledge came ordered into standard categories that could be pursued through a card catalogue and into the pages of the books. In colleges everywhere the library stood at the center of the campus. It was the most important building, a temple set off by classical columns where one read in silence: no noise, no food, no disturbances beyond a furtive glance at a potential date bent over a book in quiet contemplation.

Students today still respect their libraries, but reading rooms are nearly empty on some campuses. In order to entice the students back, some librarians offer them armchairs for lounging and chatting, even drinks and snacks, never mind about the crumbs. Modern or postmodern students do most of their research at computers in their rooms. To them, knowledge comes online, not in libraries. They know that libraries could never contain it all within their walls, because information is endless, extending everywhere on the Internet, and to find it one needs a search engine, not a card catalogue. But this, too, may be a grand illusion – or, to put it positively, there is something to be said for both visions, the library as a citadel and the Internet as

open space. We have come to the problems posed by Google Book Search.

In 2006 Google signed agreements with five great research libraries – the New York Public, Harvard, Michigan, Stanford, and Oxford's Bodleian – to digitize their books.

Books in copyright posed a problem, which soon was compounded by lawsuits from publishers and authors. But putting that aside, the Google proposal seemed to offer a way to make all book learning available to all people, or at least those privileged enough to have access to the World Wide Web. It promised to be the ultimate stage in the democratization of knowledge set in motion by the invention of writing, the codex, movable type, and the Internet.

Now, I speak as a Google enthusiast. I believe Google Book Search really will make book learning accessible on a new, worldwide scale, despite the great digital divide that separates the poor from the computerized. It also will open up possibilities for research involving vast quantities of data, which could never be mastered without digitization. As an example of what the future holds, I would cite the Electronic Enlightenment, a project sponsored by the Voltaire Foundation of Oxford. By digitizing the correspondence of Voltaire, Rousseau, Franklin, and Jefferson – about 200 volumes in superb, scholarly editions – it will, in effect, re-create the trans-Atlantic republic of letters from the eighteenth century. The letters of many other philosophers, from Locke and Bayle to Bentham and Bernardin de Saint-Pierre, will be integrated into this database, so that scholars will be able to trace references to individuals, books, and ideas throughout the entire network of correspondence that undergirded the Enlightenment.

Many such projects – notably American Memory sponsored by the Library of Congress¹ and The Valley of the Shadow created at the University of Virginia² – have demonstrated the feasibility and usefulness of databases on this scale. But their success does not

¹ It is, according to the site, "a digital record of American history and creativity," including sound recordings, prints, maps, and many images.

² An archive of letters, diaries, official records, periodicals, and images documenting the life of two communities – one Northern, one Southern – 200 miles apart in the Shenandoah Valley during the years 1859 – 1870.

prove that Google Book Search, the largest undertaking of them all, will make research libraries obsolete. On the contrary, Google will make them more important than ever. To support this view, I would like to organize my argument around eight points.

First, according to the most utopian claim of the Googlers, Google can put virtually all printed books online. That claim is misleading, and it raises the danger of creating false consciousness, because it may lull us into neglecting our libraries. What percentage of the books in the United States – never mind the rest of the world – will be digitized by Google: 75 percent? 50 percent? 25 percent? Even if the figure is 90 percent, the residual, nondigitized books could be important. I recently discovered an extraordinary libertine novel, *Les Bohémiens*, by an unknown author, the Marquis de Pelleport, who wrote it in the Bastille at the same time that the Marquis de Sade was writing his novels in a nearby cell.

There is something to be said for the library as a citadel and the Internet as open space.

I think that Pelleport's book, published in 1790, is far better than anything Sade produced; and whatever its aesthetic merits, it reveals a great deal about the condition of writers in pre-Revolutionary France. Yet only six copies of it exist, as far as I can tell, none of them available on the Internet.³ (The Library of Congress, which has a copy, has not opened its holdings to Google.) If Google missed this book, and other books like it, the researcher who relied on Google would never be able to locate works of great importance.

The criteria of importance change from generation to generation, so we cannot know what will matter to our descendants. They may learn a lot from studying our harlequin novels or computer manuals or telephone books. Literary scholars and historians today depend heavily on research in almanacs, chapbooks, and other kinds of "popular" lit-

³ See my essay, "Finding a Lost Prince of Bohemia," *The New York Review of Books*, April 3, 2008, 44 – 48.

erature, yet few of those works from the seventeenth and eighteenth centuries have survived. They were printed on cheap paper, sold in flimsy covers, read to pieces, and ignored by collectors and librarians who did not consider them “literature.” A researcher at Trinity College, Dublin, recently discovered a drawer full of forgotten ballad books, each one the only copy in existence, each priceless in the eyes of the modern scholar, though it had seemed worthless two centuries ago.

Second, although Google pursued an intelligent strategy by signing up five great libraries, their combined holdings will not come close to exhausting the stock of books in the United States. Contrary to what one might expect, there is little redundancy in the holdings of the five libraries: 60 percent of the books being digitized by Google exists in only one of

No computer screen gives satisfaction like the printed page. But the Internet delivers data that can be transformed into a classical codex.

them. There are about 543 million volumes in the research libraries of the United States. Google reportedly set its initial goal of digitizing at 15 million. As Google signs up more libraries – at last count, 28 are participating in Google Book Search – the representativeness of its digitized database will improve. But it has not yet ventured into special collections, where the rarest works are to be found. And of course the totality of world literature – all the books in all the languages of the world – lies far beyond Google’s capacity to digitize.

Third, although it is to be hoped that the publishers, authors, and Google will settle their dispute, it is difficult to see how copyright will cease to pose a problem. According to the copyright law of 1976 and the copyright extension law of 1998, most books published after 1923 are currently covered by copyright, and copyright now extends to the life of the author plus 70 years. For books in the public domain, Google will allow readers to view

the full text and print every page. For books under copyright, however, Google will display only a few lines at a time, which it claims is legal under fair use. Google may persuade the publishers and authors to surrender their claims to books published between 1923 and the recent past, but will it get them to modify their copyrights in the present and future? In 2006, 291,920 new titles were published in the United States, and the number of new books in print has increased nearly every year for the last decade, despite the spread of electronic publishing. How can Google keep up with current production while at the same time digitizing all the books accumulated over the centuries? Better to increase the acquisitions of our research libraries than to trust Google to preserve future books for the benefit of future generations. Google defines its mission as the communication of information – right now, today; it does not commit itself to conserving texts indefinitely.

Fourth, companies decline rapidly in the fast-changing environment of electronic technology. Google may disappear or be eclipsed by an even greater technology, which could make its database as outdated and inaccessible as many of our old floppy disks and CD-ROMs. Electronic enterprises come and go. Research libraries last for centuries. Better to fortify them than to declare them obsolete, because obsolescence is built into the electronic media.

Fifth, Google will make mistakes. Despite its concern for quality and quality control, it will miss books, skip pages, blur images, and fail in many ways to reproduce texts perfectly. Once we believed that microfilm would solve the problem of preserving texts. Now we know better.

Sixth, as in the case of microfilm, there is no guarantee that Google’s copies will last. Bits become degraded over time. Documents may get lost in cyberspace, owing to the obsolescence of the medium in which they are encoded. Hardware and software become extinct at a distressing rate. Unless the vexatious problem of digital preservation is solved, all texts “born digital” belong to an endangered species. The obsession with developing new media has inhibited efforts to preserve the old. We have lost 80 percent of all silent films and 50 percent of all films made

Don’t think of the library as a warehouse or a museum. While dispensing books, most research libraries operate as nerve centers for transmitting electronic impulses.

before World War II. Nothing preserves texts better than ink imbedded on paper, especially paper manufactured before the nineteenth century, except texts written in parchment or engraved in stone. The best preservation system ever invented was the old-fashioned, premodern book.

Seventh, Google plans to digitize many versions of each book, taking whatever it gets as the copies appear, assembly-line fashion, from the shelves; but will it make all of them available? If so, which one will it put at the top of its search list? Ordinary readers could get lost while searching among thousands of different editions of Shakespeare’s plays, so they will depend on the editions that Google makes most easily accessible. Will Google determine its relevance ranking of books in the same way that it ranks references to everything else, from toothpaste to movie stars? It now has a secret algorithm to rank Web pages according to the frequency of use among the pages linked to them, and presumably it will come up with some such algorithm in order to rank the demand for books. But nothing suggests that it will take account of the standards prescribed by bibliographers, such as the first edition to appear in print or the edition that corresponds most closely to the expressed intention of the author. Google employs hundreds, perhaps thousands, of engineers, but, as far as I know, not a single bibliographer. Its innocence of any visible concern for bibliography is particularly regrettable in that most texts, as I have just argued, were unstable throughout most of the history of printing. No single copy of an eighteenth-century best seller will do justice to the endless variety of editions. Serious scholars will have to study and compare many editions, in the original versions, not in the digitized reproductions

that Google will sort out according to criteria that probably will have nothing to do with bibliographical scholarship.

Eighth, even if the digitized image on the computer screen is accurate, it will fail to capture crucial aspects of a book. For example, size. The experience of reading a small duodecimo, designed to be held easily in one hand, differs considerably from that of reading a heavy folio propped up on a book stand. It is important to get the feel of a book – the texture of its paper, the quality of its printing, the nature of its binding. Its physical aspects provide clues about its existence as an element in a social and economic system; and if it contains margin notes, it can reveal a great deal about its place in the intellectual life of its readers.

Books also give off special smells. According to a recent survey of French students, 43 percent consider smell to be one of the most important qualities of printed books – so important that they resist buying odorless electronic books. CaféScribe, a French online publisher, is trying to counteract that reaction by giving its customers a sticker that will give off a fusty, bookish smell when it is attached to their computers.

When I read an old book, I hold its pages up to the light and often find among the fibers of the paper little circles made by drops from the hand of the vatman as he made the sheet – or bits of shirts and petticoats that failed to be ground up adequately during the preparation of the pulp. I once found a fingerprint of a pressman enclosed in the binding of an eighteenth-century *Encyclopédie* – testimony to tricks in the trade of printers, who sometimes spread too much ink on the type in order to make it easier to get an impression by pulling the bar of the press.

I realize, however, that considerations of “feel” and “smell” may seem to undercut my argument. Most readers care about the text, not the physical medium in which it is embedded; and by indulging my fascination with print and paper, I may expose myself to accusations of romanticizing or of reacting like an old-fashioned, ultra-bookish scholar who wants nothing more than to retreat into a rare book room. I plead guilty. I love rare book rooms, even the kind that make you put on gloves before handling their treasures.

Rare book rooms are a vital part of research libraries, the part that is most inaccessible to Google. But libraries also provide places for ordinary readers to immerse themselves in books, quiet places in comfortable settings, where the codex can be appreciated in all its individuality.

In fact, the strongest argument for the old-fashioned book is its effectiveness for ordinary readers. Thanks to Google, scholars are able to search, navigate, harvest, mine, deep link, and crawl (the terms vary along with the technology) through millions of websites

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and electronic texts. At the same time, anyone in search of a good read can pick up a printed volume and thumb through it at ease, enjoying the magic of words as ink on paper. No computer screen gives satisfaction like the printed page. But the Internet delivers data that can be transformed into a classical codex. It already has made print-on-demand a thriving industry, and it promises to make books available from computers that will operate like ATM machines: log in, order electronically, and out comes a printed and bound volume. Perhaps some day a text on a handheld screen will please the eye as thoroughly as a page of a codex produced two thousand years ago.

Meanwhile, I say: shore up the library. Stock it with printed matter. Reinforce its reading rooms. But don't think of it as a warehouse or a museum. While dispensing books, most research libraries operate as nerve centers for transmitting electronic impulses. They acquire data sets, maintain digital reposi-

ries, provide access to e-journals, and orchestrate information systems that reach deep into laboratories as well as studies. Many of them are sharing their intellectual wealth with the rest of the world by permitting Google to digitize their printed collections. Therefore, I also say: long live Google, but don't count on it living long enough to replace that venerable building with the Corinthian columns. As a citadel of learning and as a platform for adventure on the Internet, the research library still deserves to stand at the center of the campus, preserving the past and accumulating energy for the future. ■

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Academy Meetings



Apis mellifera, the Western honey bee. Photo courtesy of James Sternburg

The Disappearance of Species

Neil H. Shubin and May R. Berenbaum

Introduction by John Katzenellenbogen

Welcome by John W. McCarter, Jr.

This presentation was given in collaboration with The Field Museum and the Chicago Humanities Festival at the Academy's 1918th Stated Meeting, held on November 10, 2007, at The Field Museum in Chicago.



John W. McCarter, Jr.

John W. McCarter, Jr. is President and Chief Executive Officer of The Field Museum. He has been a Fellow of the American Academy of Arts and Sciences since 2005.

Welcome

Distinguished members of the Academy, members of the Chicago Humanities Festival, and any others who may have wandered in from the cold, we are delighted that you are here in The Field Museum. I thought I would tell you about two milestones that are currently taking place at The Field Museum. The first is that our team that conducts bio-

logical inventories in Peru, Colombia, Bolivia, and Ecuador returns this week from their latest month in the field. This distinguished group of ornithologists, botanists, ichthyologists, environmental biologists, and anthropologists has worked throughout the Andes and the upper reaches of the Amazon to areas of marvelous biological diversity that are critically threatened by deforestation, mining, oil and gas exploration, and agricultural expansion. To date, with the cooperation of those governments, we have set aside 40,000 square miles of threatened rain forest – that is two-thirds the size of Illinois.

The second is that we are partners in a new endeavor funded by the John D. and Catherine T. MacArthur Foundation and the Alfred P. Sloan Foundation called “The Encyclopedia of Life.” This idea belongs to Edward O. Wilson, the distinguished biologist from Harvard University. His plan is to create a web page for every one of the 1,800,000 species that has been identified and named thus far. The coalition consists of Harvard University, which has focused on the curriculum for higher education; the Smithsonian, which is working on a curriculum for K-12; the Marine Biological Laboratory at Woods Hole, which is doing the bioinformatics; the Missouri Botanical Garden, which is taking care

of the botany; and The Field Museum, which is creating a biosynthesis center to handle the taxonomic, geographic, and paleontological issues related to “The Encyclopedia of Life.” Our objective, by March 1, 2008, is to have pages for 80,000 of the 1,800,000 species up and running.

The Field Museum is a Center for the Study of the Environment and of Evolution. We opened our exhibit on evolution in March 2006, and currently we have had almost 2 million people come through to see the story of evolution over the course of the last 4 billion years of life on Earth. Earlier this year, we brought over from Brno in the Czech Republic the archival papers and materials from Gregor Mendel's laboratory; and currently, in conjunction with the American Museum of Natural History, whose provost, Michael Novacek, is here, we are hosting an exhibit on Charles Darwin.

Once again, welcome to The Field Museum. We are delighted to serve as the venue for this evening's discussion.



John Katzenellenbogen

John Katzenellenbogen is Swanlund Professor of Chemistry at the University of Illinois at Urbana-Champaign. He has been a Fellow of the American Academy of Arts and Sciences since 1992 and is Vice President of the Midwest Region of the American Academy.



Neil H. Shubin

Neil H. Shubin is Provost of Academic Affairs at The Field Museum. He is also Associate Dean of Organismal and Evolutionary Biology and the Robert R. Bensley Professor at the University of Chicago.

Presentation

I will admit to feeling a certain degree of fear when I was asked to speak about the disappearance of species, because I am a paleontologist who has spent his career focusing on the origin of species in deep time. That said, paleontology gives us a wonderful perspective – a perspective of millions, if not billions,

Introduction

The theme of the Chicago Humanities Festival this year is the climate of change. Our program tonight on “The Disappearance of Species” addresses one aspect of that theme most appropriate for presentation here at The Field Museum, where one can learn about species past and present and the implication of their stories for species in the future. It is my pleasure to introduce our two distinguished speakers this evening, Neil Shubin and May Berenbaum.

Neil Shubin serves as Provost of Academic Affairs at The Field Museum. A paleontologist and a professor at the University of Chicago, Neil was in the news last spring with his discovery of *Tiktaalik*, an unusual fossilized creature – part fish, part amphibian –

* * * * *

of years. What lessons can we extract from that perspective about our world today?

Let me open with a vignette. I work in ancient rocks in the Canadian Arctic at a latitude of about 80 degrees north. I look for fossils inside rocks that are about 380 million years old. What we look for is the transition from life in water to life on land. What we find, when we are very lucky, are creatures like the *Tiktaalik*, which is a mix of amphibian and fish.

Paleontology gives us a wonderful perspective – a perspective of millions, if not billions, of years.

But what I am here to talk about tonight is the enormous disconnect between present and past. When one looks inside ancient rocks, one sees an environment that is both tropical and subtropical. It is lush, teeming with life and plants. One can also view some of the earliest forests and shallow freshwater streams, as well as very warm, adapted species. The difference between present and past could not be more stark.

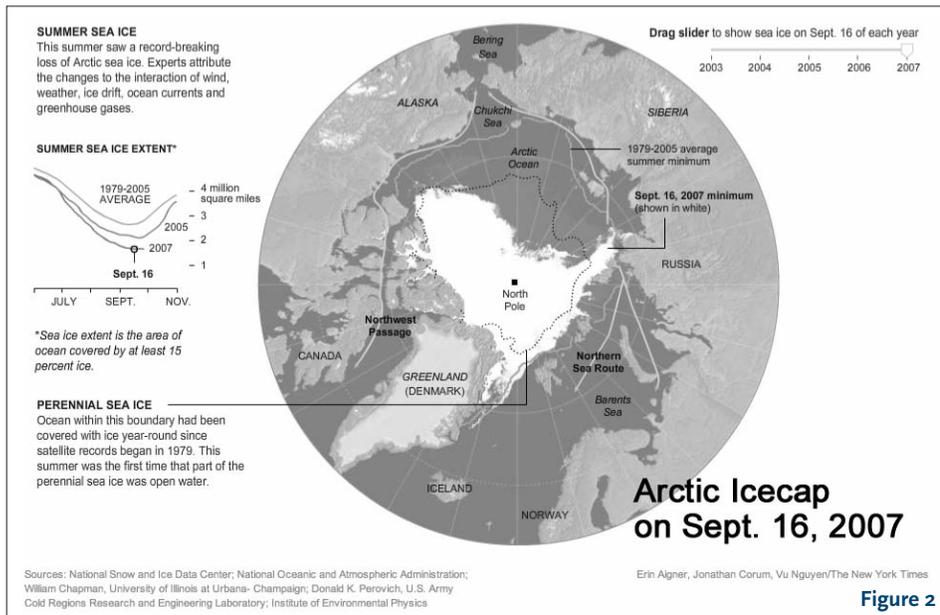
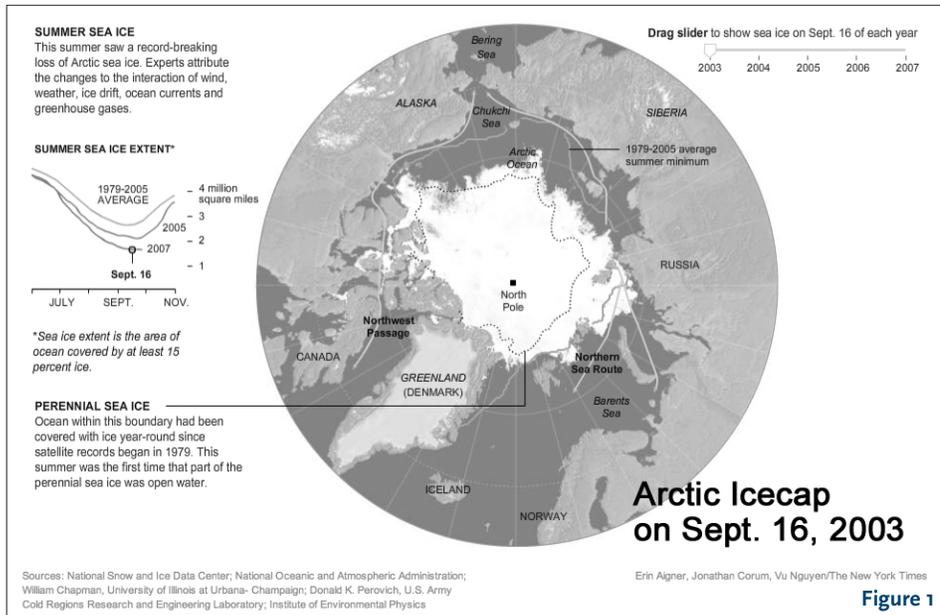
that demonstrates a key transition in evolution. Some of you may have visited the *Tiktaalik* exhibit here at the Museum. This evening, Neil will provide us with lessons from the past about the disappearance of species.

May Berenbaum, my colleague at the University of Illinois at Urbana-Champaign, is a professor of entomology. She specializes in the study of species in the here and now, particularly the relationship between insects and plants. May was most recently featured in the Public Broadcasting series *Nature*, talking about the topic that she will address this evening: another aspect of the disappearance of species – the strange phenomenon affecting bees known as “colony collapse disorder.”

As paleontologists, we are used to dealing with the dynamism of our earth. One of the reasons the Canadian Arctic was so warm 380 million years ago was because Ellesmere Island was much closer to the equator than it is today. What we now know, when we look at the 4.5-billion-year history of our planet, is that everything about our earth is dynamic. Over time, the continents have rafted around. Seas have formed. Mountains have risen and eroded away. The environment has changed dramatically, from the atmosphere to the life in it.

So what lesson can I offer as a paleontologist? When I look at the ancient earth, I see that virtually every property of our earth has changed. Yet, when I look at our social systems, I see that society and well-being are based on a snapshot of time. We humans have created a system that is changing the earth, but we – our environment, our agriculture, our economy, our social structures, even our relationships to microbes – are dependent on a particular kind of earth.

Nowhere is this more apparent to me than in my beloved Arctic. Figure 1 shows the Arctic ice cap on September 16, 2003. Figure 2 shows it just a few months ago. Note the dramatic change. Nonetheless, we humans are trying to harness these changes. One of



success in terms of their ability to withstand major shocks to the environment and to speculate. To give you an example, in Figure 5 we see a curve representing geological time – the last 600 million years – versus extinction rate. When you plot extinction rate versus time, there is a normal level of extinction. Yet there are certain periods, certain pulses of change – marked here with the letters A, B, C, D, and E – of elevated extinction rate. Some of you may be familiar with the famous KT extinction, the demise of the nonavian dinosaurs. But there are others as well, including several large ones over two hundred million years ago that affected both land and sea.

Embracing change comes down to two things: managing the change that we are effecting in our world and dealing with the change itself as it is happening, so that we not only survive but thrive.

Salamanders and frogs have withstood enormous changes to our earth, including two of the largest known global cataclysms that removed several species from the planet. Yet 15 years ago, the herpetologists at the World Herpetological Congress discovered that frogs and salamanders were disappearing from their field sites. Despite having survived for over 160 million years, these creatures are now disappearing at an alarming rate (see Figure 6). Looking at the percentage of known species reveals that a number have become extinct in the wild in the last 50 years; others are critically endangered; others are vulnerable; and there is still quite a bit that we don't know.

Now, paleontologists are good at looking at the fossil record in the aggregate. That is, we take all the fossils we know about from particular environments and ask, statistically, what properties can we extract about species that survive over time and those that don't? Are the large events somehow different from the normal stuff that happens day to day?

the best examples is the barrier islands of New Jersey. Based on a well worked-out theory about how sand is transported along beaches, we know that the barrier islands are ephemeral. They move and they change over decades, not over hundreds of years. Yet think about the coast of New Jersey and what we have done to it. Zoom into Long Beach Island, and you see house after house. These are permanent structures in a naturally ephemeral landscape. To top it off, people living in this area have insurance on their homes. So our social structures, and our economy, are based on an isolated snapshot of an inherently dynamic system.

What does this mean for species? I also work in China, where I look at rocks that are about 160 million years old, and we find beautiful fossils like a fossil of the earliest known salamander (shown in Figure 3). In many ways, they are similar to living salamanders. We also find their larvae. In Figure 4 we see a rare and beautiful salamander larva. It is a fossil, but you can see the soft tissue of its tail. You can also see its last meal, its developing appendage, and its gill structures. It is very similar to a living larva.

About 4,000 species have been around for over 160 million years, enormously successful by almost every measure of evolutionary

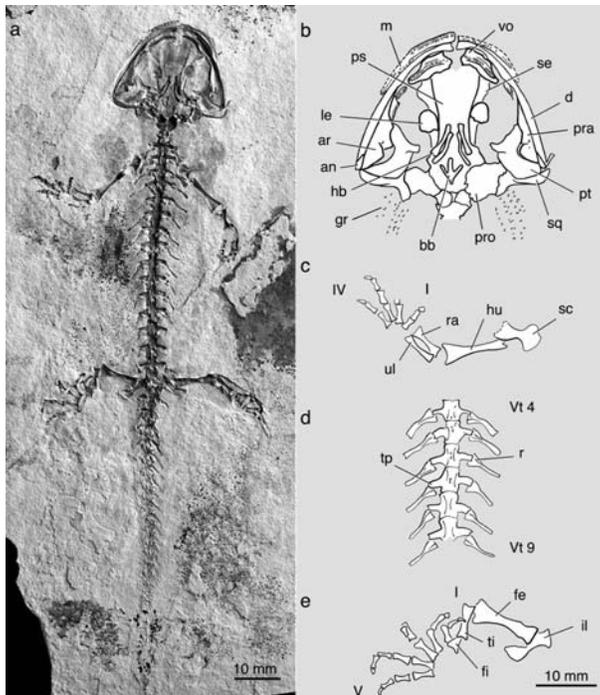


Figure 3

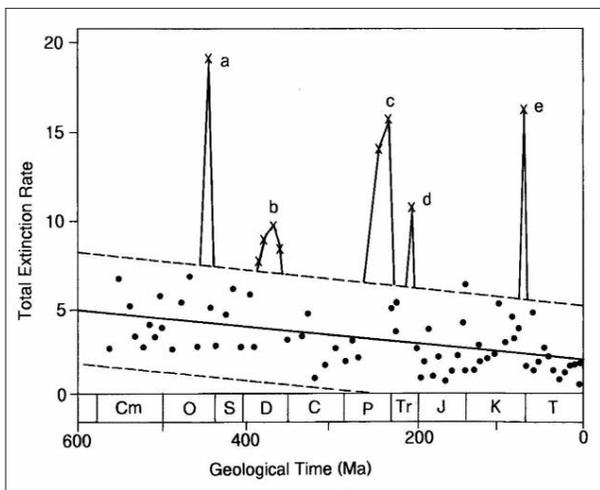


Figure 5

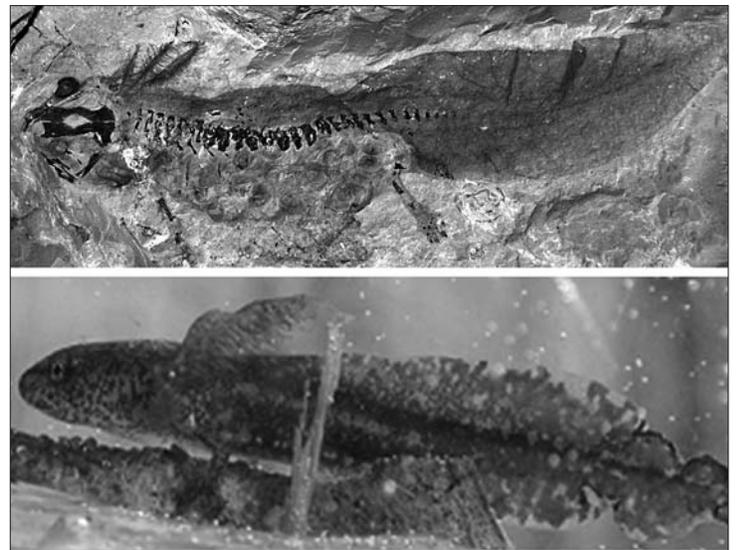


Figure 4

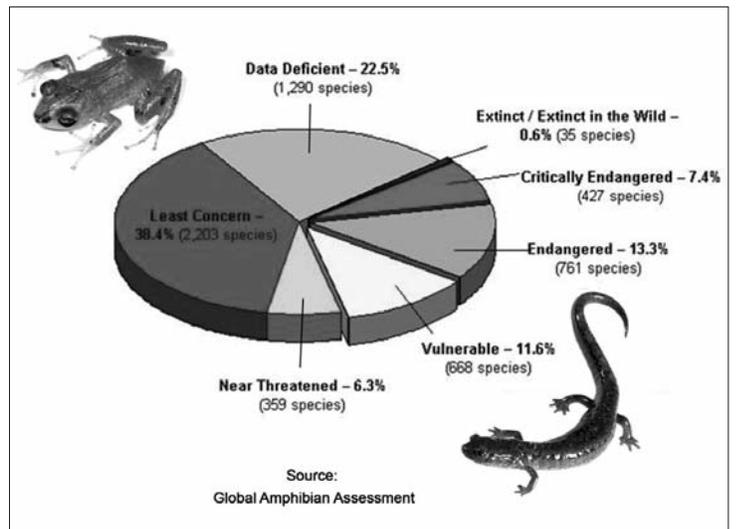


Figure 6

In a lot of these analyses, certain features have emerged that appear to confer extinction resistance. Some of them are obvious. Widespread range is one of them: species that are globally dispersed tend to survive extinctions more readily than do creatures that are endemic to a particular area. Species that have rapid dispersal abilities, particularly those that are able to increase their populations dramatically, also tend to do fairly well. Species that have the ability to colonize new or disturbed habitats are typically over-represented among the survivors of these mass extinctions. Finally, generalists tend to do better than specialists. If we put all these characteristics together – widespread range, ability to disperse rapidly, ability to colonize

new and disturbed habitats, and nonspecialization – we have basically described, for example, weeds, zebra mussels, rats, and cockroaches.

With the changes that are going on in our world today – climate change, disturbed habitats, changes in land use, species that have not been in contact before now coming into contact – what will our world look like if nature is selecting for the weediest of species? David Quammen published a wonderful essay a few years ago, “The Weeds Shall Inherit the Earth.” The obvious question is, are we a weed in some way, shape, or form? Regardless of how you view us, we come back to this essential disconnect with which I opened my

presentation. We humans, through our social structures – indeed, through our biological evolution – have adapted to a particular slice of time. Our economy – and even our immune system – is geared toward a particular kind of world. But that world is changing. The kinds of species we are likely to encounter are going to change dramatically over the next few years, and we as humans have to be able to deal with that.

Embracing change comes down to two things. The first is managing the change that we are effecting in our world, and the second is dealing with the change itself as it is happening, so that we not only survive but thrive.



May R. Berenbaum

May R. Berenbaum is Swanlund Professor of Entomology and Head of the Department of Entomology at the University of Illinois at Urbana-Champaign. She has been a Fellow of the American Academy of Arts and Sciences since 1996.

Presentation

Thank you for inviting me to speak on a topic that is of great interest and importance. I am here to talk about the birds and the bees, a concept so familiar that it doesn't bear an explanation. It is an exemplar of reproduction, how male sex cells and female sex cells get together to fuse and generate new offspring. Now plants, being firmly rooted to the ground, face a particular challenge in carrying out this arrangement. As a result, about three-quarters of all flowering plants depend on a third party, a go-between, to deliver the male sex cells, or pollen grains, to receptive female surfaces. That is basically the process implied by the use of the phrase "the birds and the bees," the process of animal-mediated pollination. Although today it is very familiar, it is surprisingly a fairly new idea in the history of science.

For millennia, no one really knew exactly what the birds and the bees were doing with the plants and the flowers; it wasn't until the eighteenth century that the scientific community recognized that plants have sexual organs at all. Rudolph Camerarius recognized that plants need two different floral parts, the stamen and pistil, in order to reproduce and that in all probability these parts represent the male and female reproductive organs. This observation inspired Carolus Linnaeus, the great chronicler of all life and the developer of the binomial system

of naming organisms that we maintain today, to use the sexual organs of plants for the purpose of classification. This practice didn't go over well at the time. Contemporaries were shocked at the prospect of botanists inspecting the private parts of plants. Reverend Samuel Goodenough, the Bishop of Carlisle, was moved to remark, "to say that nothing could equal the gross prurience of Linnaeus's mind is perfectly needless."

The role of insects in the sex life of plants was another biological reality that was slow to be recognized. Probably the first person to suggest explicitly that insects play an important role in plant reproduction was Christian Konrad Sprengel – not exactly a household name today. In 1793, he wrote *Das entdeckte Geheimnis der Natur im Bau und in der Befruchtung der Blumen* (*The Secret of Nature Revealed in the Structure and Fertilization of Flowers*), followed by a second book on the utility of bees in the reproduction of plants. The fact that he is not a household name today reflects that his suggestion did not go over well either. His idea languished for almost half a century until Charles Darwin read his book.

We now know that at least 200,000 animals are responsible for pollinating an estimated 80 percent of all flowering plants.

Darwin, like many Victorian gentlemen of the era, was interested in, among other things, the domestication of animals and the breeding of plants, particularly orchids. He was struck by the writings of Sprengel and quickly realized that the remarkable relationship between plants and the insects that pollinate them was a terrific example of the process that he described as natural selection, especially the "coadaptation of organic beings to each other and to their physical conditions of life." He introduced this idea in his *Origins of Species*, but then expounded upon it at great length in his book *On the various contrivances by which British and foreign orchids are fertilized* – even going so far as to predict that the orchid *Angraecum sesquipedale*, with the 12-inch corolla and with no known pollinator on the island of Madagas-

Today, we rely on honey bees to pollinate over 90 crops in North America; and their contributions amount to over \$14 billion.

car, had, somewhere, a pollinator with a 12-inch proboscis. And, at the turn of the century, a hawk moth was found that indeed had a 12-inch proboscis, and it was named *Xanthopan morgani* variant *praedicta* in honor of the prediction.

We now know that at least 200,000 animals are responsible for pollinating an estimated 80 percent of all flowering plants, which amounts to almost a quarter of a million species. There are a few vertebrates, a thousand or so, in at least three classes. Many bird species are involved, bats are also involved, and there is even one known example of lizard pollination. But these numbers are dwarfed, of course, by the 200,000-plus species of insects, the real workhorses in the world of pollination. There are at least six orders, ranging from relatively inconspicuous Thysanoptera, or thrips, and Hemiptera, or true bugs; to the Lepidoptera, the butterflies and moths; the Diptera, the flies; and the Hymenoptera, the bees and wasps.

Knowing the nitty-gritty of pollination is a matter of considerable economic importance, and these relationships vary from extremely specialized to extremely generalized. The fig industry in California, which is second now to Turkey for worldwide production, did not get started until the late 1890s, because it took ten years for those trying to cultivate figs to figure out that they needed to import a tiny species of Agaonidae, the only species of wasp that could pollinate the figs. If you like Fig Newtons, you have a wasp to thank for it.

At the other extreme are the generalized pollinators, such as *Apis mellifera*, the Western honey bee. This nonnative species has an extraordinary ability to pollinate an enormous variety of plants and was imported early on by European colonists, at least in part for that purpose. Today, we rely on honey bees to pollinate over 90 crops in North America; and their contributions amount to over \$14

billion, both in direct results (most of the fruits, vegetables, and nuts we consume fall into this category) as well as indirect results (bees pollinate alfalfa and clover, which are used as fodder for cattle, so the dairy and beef industries also depend on bees). And even when pollination is not an absolute necessity because some plants are self-fertile, visitation by bees can enhance yields.

Managed bees in North America are dependent on beekeepers. The number of beekeepers has been in steady decline over the last 30 years for numerous reasons. Among them, and particularly devastating, is the accidental importation of two species of parasitic mites in the mid-1980s that led to a massive loss of colonies. In the late 1990s, another interloper, the small hive beetle from Africa, was accidentally introduced and also caused more localized losses. Then, the African bees, brought into Brazil to breed a better bee with more resistance to tropical conditions, escaped from management, and they have steadily made their way north. Their more aggressive behavior is causing all kinds of problems for beekeepers.

Around the world, on virtually every continent, groups concerned with biodiversity took note of the apparent decline in a number of pollinator taxa.

While all this was going on, two ecologists, Stephen Buchmann and Gary Nabhan, noticed that honey bees were not the only pollinators having problems. In fact, most of the major groups of pollinators seemed to have species in trouble. Numbers were declining; ranges were contracting. Around the world, on virtually every continent, groups concerned with biodiversity took note of the apparent decline in a number of pollinator taxa. In 2004, the United States finally became involved, and the National Academy of Sciences approved a study to determine the status of pollinators in North America. I was asked to chair this committee, and we spent 18 months reviewing what is known about pollinators in North America.

We were charged with determining which pollinators were in decline, what the causes and consequences were, what research and monitoring were needed, and what steps could be taken to prevent or reverse those declines. We identified a clear downward trend for honey bees in the United States, but for other managed pollinators we simply did not have enough data to reach any conclusion about their present status. For wild pollinators, there was evidence of decline in some pollinators – notably several bumble bees, and some butterflies, bats, and hummingbirds – but the strength of the evidence varied.

In terms of the causes of the known declines for both managed and wild species, it was clear that introduced pathogens and parasites were one factor; habitat degradation and loss were another. Central Illinois once had forests that were quite extensive; now they are postage stamps on envelopes of corn and soybean fields.

What are the consequences of these declines? For managed pollinators, those that are kept for agricultural purposes, there has been a staggering increase in the cost of pollination services. In terms of wild pollinators, it is unclear in nonagricultural systems what the consequences of pollinator loss will be, but an important one could be an increased danger of extinction of plant species that are already endangered.

Our report was released in October 2006, which was just about the time when the agricultural community announced even more disturbing news. Bees were disappearing due to what was initially called fall dwindle disease. There have been disappearances of bees in the past, going back at least to 1880, but the pattern of this particular disappearance varied from those of the past in a significant way: there were no dead bodies. There were massive losses of the older bees, the forager bees. What remained behind in the hives was a small nucleus of very young bees as well as brood and honey and pollen stores. Even more surprising, the perennial pests of beehives, such as wax moths and hive beetles, appeared to avoid the collapsed colonies, which had not been noticed before. This pattern of collapse also varied from past collapses, particularly in terms of its extent. By February 2007, it had managed to mani-

In terms of the causes of the known declines for both managed and wild species, it was clear that introduced pathogens and parasites were one factor; habitat degradation and loss were another.

fest itself in over 25 states. Rental fees increased almost tenfold for almond growers who, every spring, rent half of America's 2,400,000 colonies of honey bees expressly for the pollination of almonds. There is no way to produce almonds without honey bees to pollinate the almond flowers. People even started stealing honey bee colonies – that's how valuable they were.

This decline was so alarming that in February 2007 USDA bee researchers collected samples of afflicted bees in California and Florida to determine what was causing these problems. Because Florida and California are important agricultural states, there were two congressional hearings about what became known as "colony collapse disorder." Bee disappearances even made their way into the popular conscience. In the comic strip, *Over the Hedge*, the characters are dismayed at the disappearance of bees, along with the disappearance of Sanjaya from *American Idol*.

In April, a group of about 50 scientists, bee biologists, beekeepers, representatives from federal agencies (including the U.S. Army), and other people concerned about these disappearances gathered in the USDA bee research facility in Beltsville, Maryland, to discuss the problem. We discounted a number of hypotheses that had been circulating, including and not limited to genetically modified corn pollen, cell phones, Wi-Fi, elevated carbon dioxide, elevated UVB, Osama Bin Laden, automobile grilles, solar maxima, jet chemical contrails, mutant bee cannibalism, fluctuations in the earth's magnetic field, Chernobyl, alien abduction, and bee rapture.

Instead, we focused on three more plausible possibilities. First, neonicotinoid insecti-

cides were considered as a possible cause. These pesticides have sublethal effects on the behavior of bees, interfering with their ability to communicate, navigate, and orient, and thereby potentially preventing them from returning to the colony after exposure. A novel pathogen or parasite was another possibility. Third, we considered immune suppression related to management practices and nutritionally deficient diets. Despite the fact that it is a \$14 billion industry, beekeeping has not changed significantly since the nineteenth century. There have been – with the exception of artificial insemination in the early twentieth century – no major innovations in beekeeping technol-

Beekeeping has not changed significantly since the nineteenth century. There have been no major innovations in beekeeping technology, yet increasing demand for pollination is pushing the limits of the system in an unprecedented way.

ogy, yet increasing demand for pollination is pushing the limits of the system in an unprecedented way, with millions of bees trucked thousands of miles to deliver pollination services. We are facing this crisis situation in the apiculture industry, at least in part, because of the loss of other pollinator species. Little new technology has been developed to promote the management of alternative species.

In a perfect storm for bees in October, the honey bee genome was released. Approximately 11,000 genes had been sequenced, and the genome provided some insight into why bees might be so vulnerable. Compared to other insect genomes that had been sequenced at the time – including *Drosophila melanogaster*, *Anopheles gambiae* (the malaria mosquito), and the Japanese silkworm – honey bees, in particular, are exceedingly deficient in those gene families associated

with resistance to infectious diseases and with the ability to detoxify xenobiotics or foreign toxins in the environment. We don't know whether this is typical of all Hymenoptera, or whether just bees are at risk.

Most recently, a group of researchers led by Ian Lipkin at Columbia University used a metagenomics approach facilitated by the sequencing of the honey bee genome. Genetic material from afflicted colonies was examined and the bee genes were effectively subtracted out: what was left was an astounding number of infectious diseases, including one new to North America – Israeli acute paralysis virus. This pathogen was not thought to be the cause of colony collapse disorder, but rather a symptom of a suppressed immune system. What we are doing at the University of Illinois, the home of the annotation component of the honey bee genome project, is comparing healthy colonies to collapsing colonies to see if there are differences in patterns of expression in those gene families that could account for these losses – notably the xenobiotic metabolizing genes, which encode enzymes that break down toxins, as well as genes that encode proteins that help bees fend off diseases.

But even if we figure out the cause of colony collapse disorder, it does not mean that bees are out of the woods or into the fields. And it certainly does not reflect on the problems that other pollinators are having. Again, habitat degradation and loss, as well as accidental importation of parasites due to globalization of trade, are still affecting pollinators. It is really astonishing that we are better able, here in the United States, to land a spacecraft on the surface of Mars than we are to land a pollen grain on a stigma in a prairie. Our knowledge of this interaction upon which most of terrestrial life depends is scandalously inadequate, and if nothing else, colony collapse disorder has brought that deficiency to the attention of the nation. We cannot afford to lose our pollinators, and we certainly cannot afford not to know who they are and where they are. So if nothing else, it is probably a good time for the country to stop and smell the roses and the other 200,000 species of plants that depend on insects as pollinators.

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Academy Meetings



View of Building I (right) and Building II (left) looking west into the yard of Harvard's Allston Science Complex

Harvard University's New Allston Campus

Christopher Gordon and Stefan Behnisch

This presentation was given at the 1919th Stated Meeting, held at the House of the Academy in Cambridge on November 14, 2007.



Christopher Gordon

Christopher Gordon is Chief Operating Officer for the Allston Development Group at Harvard University.

It is a pleasure to be here. If you look at the existing Harvard campus in Cambridge, and then at Allston, all of this land represents an amazing opportunity. This isn't the first time Harvard has helped to transform a piece of property. One example is the Kennedy School that not too long ago was a rail yard. Harvard owns about 225 acres in Cambridge and about 350 acres in Allston.

Right now, Harvard owns approximately 23.4 million gross square feet of building space in Cambridge, Allston, and the Longwood medical area. If you read all the articles and books about Harvard, the growth curve has been almost linear: between 1–1.5 million square feet over 150 years. In 1962, the campus was a little less than 10 million square feet; now it is at almost 24 million square feet. Cambridge and Longwood will

always see some level of construction, but they are not going to see the significant growth that will occur in Allston, where Harvard owns about 350 acres of land (see Figure 1).

Harvard has been acquiring land in Allston since the late 1980s. The planning process has involved a series of study groups, task forces, and committees both within the university and with the Allston community. The draft master plan was announced in January 2007, and it stresses four themes (see Figure 2):

1) *Teaching and research.* This is not a real-estate project, an architectural competition, or a way to spend the endowment; interdisciplinary teaching and research are at the core of the plan.



Figure 1. Aerial photo of Allston, 2006. Photo by Peter Vanderwarker



Figure 2. Master Plan Rendering of Harvard's proposed Allston campus



Figure 3. Draft Phasing Diagram

2) *Building community.* The Harvard campus is a special place, not a sterile collection of buildings with perfectly aligned streets. The hardest part of this job is to make Allston a special place to work in and visit. We can all line up great buildings, but how do you make them feel like a great place?

3) *Environmental sustainability.* Harvard has put its foot forward and said that it hopes this campus will be the most environmentally sustainable campus in the world. We are targeting every new building to be gold-certified under the LEED system. We are making Allston a green campus not only because it is the right thing to do, but also, with advances in technology, it is the right decision financially.

The draft master plan stresses four themes: teaching and research, building community, environmental sustainability, and economic development.

4) *Economic development.* Part of it is short term. Thousands of people will be needed to design and build the campus, and thousands of people to run it. When it is completed, it will employ about 25,000 individuals. In addition, it will spur other businesses, creating a ripple effect in the economy, specifically in the life sciences.

We took the 50-year plan and divided it into two: Phase I and Phase II (see Figure 3). Phase I of the project may entail moving the Graduate School of Education and the School of Public Health and building more science facilities, some undergraduate houses, a student center, graduate housing, a number of cultural centers, some support space, and new athletic facilities. It will involve about 5 million square feet and take 15 to 20 years to complete. The second 4 to 5 million square feet is in Phase II, but no detailed decisions have yet been developed for it.

The plan calls for a professional school zone in the middle of the Allston campus (see Figure 4). In order to do that, we have to realign

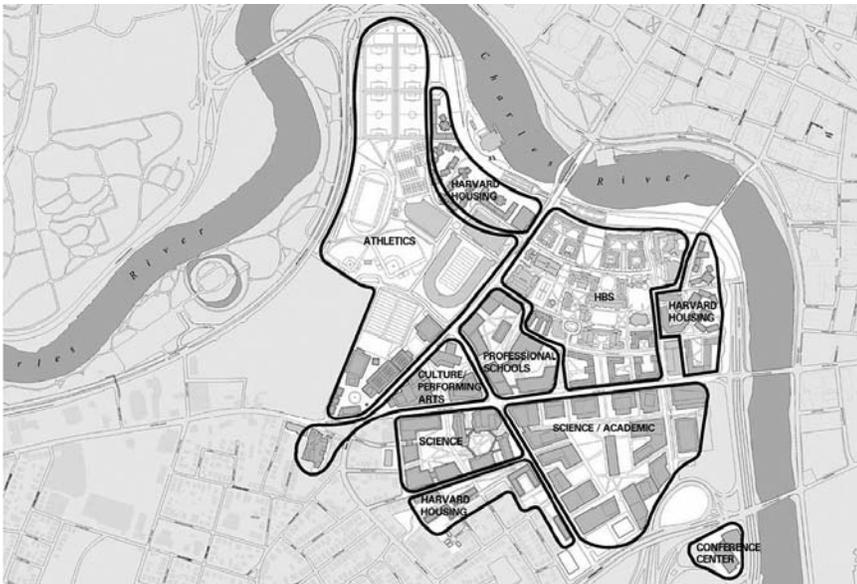


Figure 4. Proposed Harvard Allston Campus

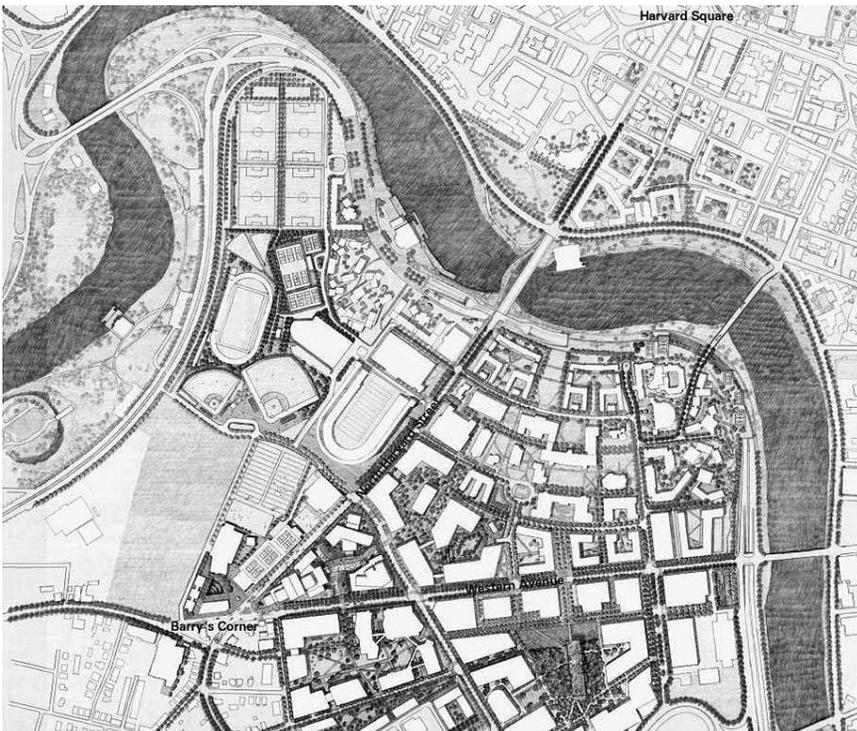


Figure 5. Draft Illustrative Plan

some of the athletic facilities and fields, add more synthetic turf, and incorporate some new technology into the athletic buildings. The leading candidates to move to the professional school zone are the Graduate School of Education and the School of Public Health. That is not a small task. We would have to pick up the entire Graduate School of Education from Cambridge and most of the School

of Public Health from Longwood and move them to Allston. Both schools desperately want new facilities. The School of Public Health, for example, is in 33 different buildings, and most of them are rented. By moving those schools to Allston, we would create a professional school corridor. The Harvard Kennedy School would remain in Cambridge, and the Harvard Business School

would stay on the Allston side. As a result, four of the top schools in the world would literally be side by side. That arrangement is much better for sharing programs, faculty, staff, and facilities, and offers much more opportunity for synergy.

We have also incorporated a cultural component, including a museum district and a performing arts center. An interesting idea for the museums going forward would be to connect aspects of the University Art Museums with the Peabody Museum and the Museum of Natural History. The performing arts center could be primarily a performance space, or it could also have practice and experimental space for everything from dance to music.

We are trying to incorporate such features as small buildings clustered around yards and interesting walkways.

To give you a sense of scale, the first science complex, consisting of four buildings, is one million square feet. The master plan calls for another entire academic space on the Harvard-owned land that is currently rail yards. The area may not be developed until the second phase of the project but we want to reserve the room now so that in the next 50 years, as Harvard grows and academic and research needs change, it can expand into this space.

There is also a provision for graduate housing and further expansion of a conference center. Finally, we will have, throughout the campus, 75 acres of green space and a number of other amenities built into it (see Figure 5).

As we lead up to Stefan's discussion of the first science building, I want to talk about several detailed design principles that we are trying to build into the campus.

Borrow the best from Cambridge. I am not trying to flatter the Harvard folks in the crowd, but every time we have traveled to look at campuses around the world, people always say, "Why are you here? Why don't you go back to Cambridge? You have the best ex-

We want to make this a place where people can enjoy the outdoors by adding a significant amount of green space.

ample of how things should be done.” So while we are still looking at other campuses, we are trying to incorporate such features as small buildings clustered around yards and interesting walkways.

Make Allston green. We mean a lot of yards, trees, and shrubs. Now, the minute you leave the Business School, you encounter almost all asphalt. We want to make this a place where people can enjoy the outdoors by adding a significant amount of green space.

Celebrate the Charles River. For years there has been this angst about having a river in the middle of Harvard if we develop Allston. Most campuses would love to have the Charles River in the middle. So we have tried to reorient the master plan, to make sure the Charles River is a key part of the plan. We are not going to hide it or apologize for it; we are going to feature it.

Assemble a variety of uses in close proximity. We don’t want to have monolithic blocks of big science buildings and big performing arts centers. If you look at the granular nature in and around successful campuses, there might be a library, a coffee shop, or an athletic facility. We are trying to marble those things into the Allston campus. It is not easy because the scientists all want to be together and the athletes all want to be together, but we want to have a creative blending. This also gets to the issue of size. We want a variety of buildings – big, small, wide, and short – so that it doesn’t feel like you are walking down a cookie-cutter space.

Create active gathering places. We want to design places where students, faculty, and staff want to spend time. Most campuses figure this out after the students figure it out. We may not get this right the first time around: we will design beautiful plazas, and people will sit somewhere else. But we are going to try to find places where people want to gather at lunch, after class, and in the evening, and I am sure our design will evolve as we go through the process.

Plan for both the campus and the community.

The North Allston neighborhood has about 9,000 residents. They are not against Harvard, but they are eager to maintain and improve the character of the community they live in. We are working closely with the community and the city of Boston. At this point, we have held 77 public meetings since the formation of the community Task Force appointed by Mayor Menino. It is a good process. The Boston Redevelopment Authority (BRA) has done a great job of trying to figure out how to make a twenty-first century campus work on 350 acres in Allston. We don’t have all of the answers yet, but between the city, and specifically the BRA, the Allston community, and Harvard, we can get there.

Ensure effective transportation to Cambridge and Longwood. Every time I talk to the faculty, they say, “If I can’t get to Allston, I’m not going. I work in Longwood; I work in Cambridge; it’s a long walk; it’s a cold winter; I don’t like shuttle buses, and I’m not going to ride my bike.” I can sympathize. If you are teaching a class in Cambridge, and you have only 20 minutes to get to Allston to teach a second class, how do you get there? The Red Line doesn’t go there, and the shuttle system is not great. If you are in Longwood, it is even worse. So we are trying to make some significant improvements, including, in the early years, a dramatically improved shuttle bus system. In the long term, we hope to have some sort of subway system, but that is a long-term project. We are already adding bike lanes and pedestrian lanes.

Use “best practices” sustainable strategies. Stefan is the best thing that has happened to us on the sustainability front for the first project, but we have also done a lot of things campus-wide, including a voluntary cap on greenhouse gas emissions from the new Allston buildings, up to 30 percent below the current baseline standards. Frank Gehry came up with the idea of a train shed over an open plaza between the museums and the performing arts center. I have been at Harvard for two years, and I have learned that the raw nerve is architecture. When I travel all over the country and the world to talk to donors, alumni, and friends of the university, I can go on for hours about the engineering and the technical aspects, but every question is about architecture.

The plan for the Allston campus is built on four frameworks: transportation, open space, development, and sustainability.

Transportation. In our proposed plan, a new road called Stadium Way would enable vehicles, driving either east or west on the Massachusetts Turnpike, to enter the campus directly, without traversing back streets, and reach the first science building in about two minutes. An on-ramp, East Drive, would lead back onto the Turnpike. One of the more controversial parts of the plan is the idea of using Weeks Bridge for shuttle buses. Weeks Bridge is a beloved landmark, long used as a footbridge, but it would also work well for shuttle buses. We have to look seriously at the historical issues involved in modifying it.

The plan for the Allston campus is built on four frameworks: transportation, open space, development, and sustainability.

Even as we discourage people from driving to Allston, we are still going to need thousands of parking spaces. The plan over the next 50 years is to design primarily underground parking garages, one adjacent to the athletics area and another near the Turnpike. They will be “interceptor” garages, where drivers coming from the main arteries can get into a garage and then walk around campus. Two types of bicycle networks are planned. In the street, there will be separate car and bicycle lanes, and on campus, there will be bike lanes between buildings and through the green spaces. I am amazed at how many people at Harvard – faculty, staff, and students – ride bikes.

Open space. This includes a new community park that will knit the campus together with the community. An idea that we have proposed is to bury part of Soldiers Field Road and put green space above it so that you could walk from the campus or the community directly to the river.

Development. The goal is to distribute different uses around the campus. We want to have places on campus where you can eat,

drink, and shop, but we are leery of over-commercializing the site and ending up with a bunch of generic chain retail stores. We are trying to figure out how you populate the campus with useful retail stores and restaurants without cheapening the effect and destroying the beauty of the plan.

Sustainability. We are looking at dramatically reducing our consumption of energy, and dramatically increasing our generation of power using everything from solar panels to windmills. We are looking at geothermal wells for all the buildings and conducting a study on deep hot-rock drilling as well as heat extraction out of the sewer lines. A sewer line, with 18 million gallons of sewage passing through it every day, runs under Allston; it is estimated that every 600 feet of the line can heat a 100,000 square foot building for free, forever. The efficiency of the campus can be improved dramatically by taking other steps, for example, in the case of the buildings Stefan has designed, we have agreed to a 50 percent reduction in greenhouse gas emissions.

As we move forward, we are focusing on the one-million-square-foot, four-building science complex that was approved by the BRA in fall 2007. Stefan Behnisch is the lead architect for the complex.

Note: Figures 1 – 5 in Christopher Gordon’s presentation are courtesy of the Allston Development Group, Harvard University.



Stefan Behnisch

Stefan Behnisch is Founder and Principal of Behnisch Architekten in Stuttgart, Germany. He also directs Behnisch Architects, Inc., in Venice, California, and Behnisch Studio East, Inc., in Boston, Massachusetts.

I would like to structure this talk by first explaining briefly who we are, then discussing a few examples of what we have done, and finally showing you the first building in the science complex.

Behnisch Architekten has offices in three locations: Stuttgart, Germany; Venice, California; and Boston, Massachusetts. The firm was founded by my father in 1952. I joined the office in 1987, and in 1989 we found out that the best way to work together is in different locations. I founded my own office, with his support, and we were joint partners

Sustainability has been a concern since the late 1980s. Generally, the idea is not to use more resources than are produced at the same time by nature. Today, we are far from that ideal.

in both offices for more than 15 years. We gain nearly all of our commissions through architectural competitions. My father and I have worked together on 140 buildings, but we have only had four direct commissions; everything else, including the Harvard project, we earned through competitions.

For us, sustainability has been a concern since the late 1980s. Nowadays, the term sustainability doesn’t say a lot. It originally comes from forestry, from the eighteenth century, and it means nothing more than not cutting more wood than grows in the same area at the same time. Generally, the idea is not to use more resources than are produced at the same time by nature. Today, we are far from that ideal. In three seconds, we burn as much fossil fuel as the earth produces in 24 hours. Moreover, for us, sustainability is not limited to the idea of quantity. It has a qualitative aspect that focuses on the

Figure 1. Norddeutsche Landesbank, Germany





Figure 2. Terrence Donnelly Center for Cellular and Biomolecular Research, University of Toronto

usability of buildings and how people enjoy buildings. As a rather stupid example, I could design a building that uses hardly any energy by designing it so badly that nobody will use the building.

Let me consider a few of our buildings. We designed the first big corporate structure in Hanover, Germany: Norddeutsche Landesbank is close to 780,000 to 800,000 square feet and is made of glass (see Figure 1). We take 70 percent of the energy needed for heating and cooling the building out of the seasonal storage below it. The groundwater table doesn't move so we can heat it up in summer and cool it down again in winter, counterbalancing the temperatures we need above ground. Because 20 percent of electrical energy produced on this planet is used for artificial light, having more natural daylight helps save a lot of energy. We were only able to afford all of the glass in this building because we were able to capture so much energy from the seasonal storage.

Another building, the Terrence Donnelly Center for Cellular and Biomolecular Research at the University of Toronto, has an interesting history (see Figure 2). Two scientists were trying to get the university to build a new institute, but the university refused. Acting on their own, they collected enough money to construct the building and asked

the university for a site. The university gave them the worst possible site, a very narrow space between two existing historic buildings and a loading dock. We won the competition, worked with them, and turned this space around. We abutted the new structure directly against one of the buildings and made an interior garden: one of these communicative areas where people can meet and where the circulation is excellent. We can't force people to communicate, but we can create the opportunities to do it.

Architecturally, these buildings are quite different. We always try to find an appropriate solution for a given situation. The basis for sustainable architecture is always the topographical, geographical, climatic, and cultural background of where you are building. One of the biggest misunderstandings in "international architecture" was the idea that all buildings can look the same, no matter where they are on the planet. For example, Hamburg HafenCity is a new development in the harbor of Hamburg that has the most aggressive sustainable agenda I have ever encountered. It is the site of the new headquarters for Unilever which we designed, using foil, for the first time, to build a double wall to protect against noise and fumes. Everybody thinks it's beautiful there, at the waterfront. But the emissions at the harbor are worse than at any turnpike. The ships use diesel fuel, and ship diesel is still 15 percent sulfur. Harbors are not romantic places at all.

Figure 3. Genzyme Center



The basis for sustainable architecture is always the topographical, geographical, climatic, and cultural background of where you are building.

The Genzyme Center in Cambridge is another example of our work (see Figure 3). Because light is only visible if it meets a surface, we introduced big chandeliers, or heliostats, which turn slowly in an atrium, reflecting daylight into the depths of the building. They change the sensation of light in this space.

Now I want to turn to Harvard. As I said earlier, we won this commission in a competition. What amazed me most, when we came into the discussion, is the contrast between how Harvard perceives itself architecturally and how others see Harvard architecturally. To the alumni, it is all brick and ivy; in Germany, it is Corbusier's Carpenter Center. When we studied Harvard, my friend and client at Genzyme, Dan Winnie, told us, "You've got to be careful; Harvard's a bit conservative architecturally."

What will the future Harvard campus look like? There is a master plan, but the final answer is still out there. Architecturally, what



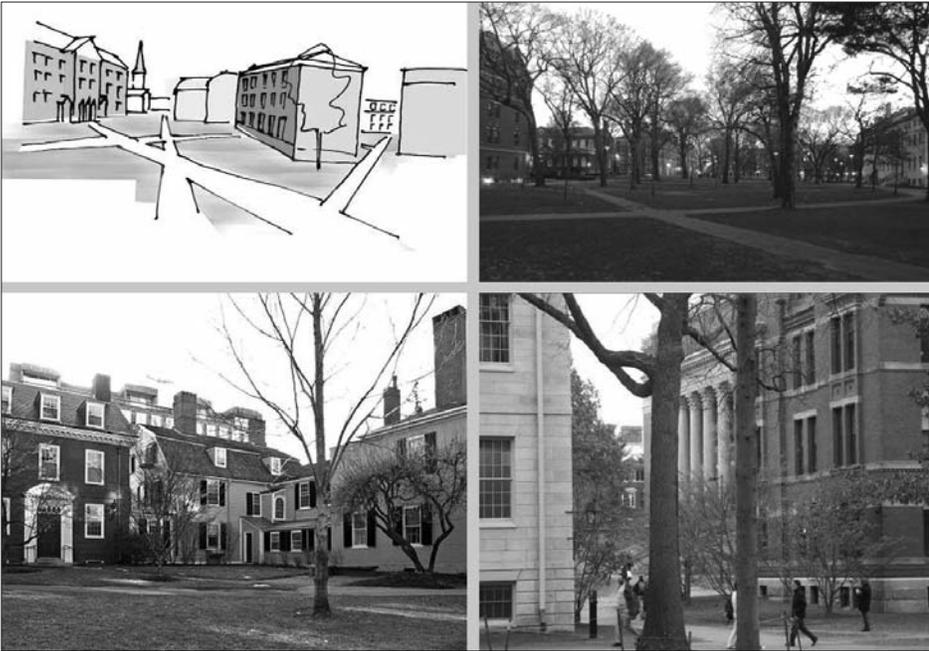


Figure 4. Yards of Harvard University

is Harvard? Is it brick, ivy, wood, stone, limestone, or concrete? Harvard has a wide range of buildings, from excellent to mediocre; that is part of the charm of the campus. But ultimately, the most important part of Harvard is the yards, and not only the yards, but the connection between the yards (see Figure 4). They are never linear, but meandering. Walking from yard to yard, usually over the diagonal, you discover a new place. It is a little bit like an old Italian city, where you go from attraction to attraction to attraction, always discovering something new. At Harvard, there can be a beautiful wooden building next to brick buildings next to limestone buildings, with concrete in the middle. It is a very mixed portfolio. But an important feature is the connecting green.

As Chris explained, the science complex, divided into four buildings, will be built first (see Figure 5). In our design, we were concerned that scale be respected. Buildings should have a manageable size where humans feel comfortable. It is not about height but about length and distance. People want to feel in control of a space somehow, and not like an ant somewhere in a big soccer field. Our second goal was flexibility, within the complex as a whole and in the individual labs. We don't know what is going to happen in the next 15 – 20 years in the sciences, so we want to build in the ability to convert to whatever is necessary. Bridges will con-

The most important part of Harvard is the yards, and not only the yards, but the connection between the yards.

nect the buildings, helping to create an architectural freedom that will promote communication and interdisciplinary work. The plan will incorporate winter gardens; retail, cafeteria, and conference space; libraries; and a child care center.

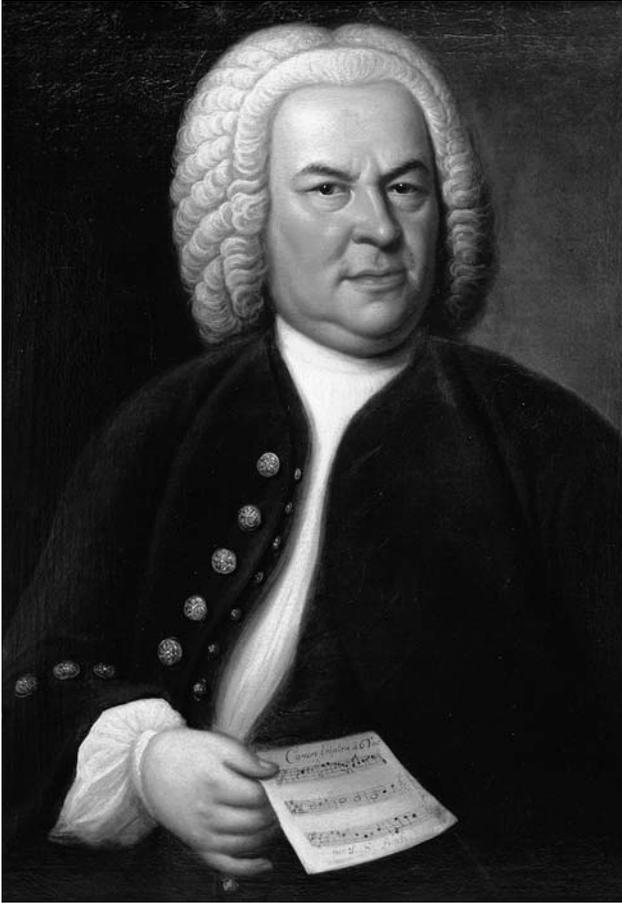
Figure 5. Harvard's Allston Science Complex design



The elevation of the buildings has been a topic of discussion for a long time. It was already clear in the competition itself that we were not the right architects for neo-Georgian, and that was accepted. Neither the high-rise Norddeutsche Landesbank nor the Genzyme building would be appropriate for the Harvard campus. So we designed buildings that have a rather rigid limestone facade, a big canvas. But a facade nowadays is more than just a nice exterior. If you want to do a sustainable building, it is a highly technical undertaking. You can incorporate light enhancement, natural ventilation, sun-shading devices, high-insulating glasses, opening flaps, everything. For example, on top of an atrium, we can use an epic lens that follows the sun constantly and reflects daylight into the building. Most people think that the mechanical penthouses of science buildings are just a functional element. Actually, they are about 25 percent of the facades of science buildings, and they have to be treated like facades, the most visible element of these buildings

There could quite possibly be a million other designs for this site, but I feel that our concept is both aesthetically pleasing and environmentally sound, incorporating the flexibility at all levels that will be so important in the future. ■

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Johann Sebastian Bach. Portrait property of William H. Scheide, Princeton, NJ.

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

Margot E. Fassler

Introduction by Kay Kaufman Shelemay

This presentation, cosponsored by the Yale Institute of Sacred Music, was given at the 1922nd Stated Meeting, held at the House of the Academy on December 12, 2007. It included musical performances by vocalists Abigail Haynes Lennox, soprano, and Ian Howell, counter-tenor, as well as clips from the film *Performing the Passion: J.S. Bach and the Gospel according to John*, featuring the Yale Schola Cantorum, directed by Simon Carrington, and the Yale Collegium Players, led by Robert Mealy. The film is coproduced by Margot Fassler and Jacqueline Richard. In the demonstration, the performers were led by Robert Bolyard and accompanied by Avi Stein on the organ.



Kay Kaufman Shelemay

Kay Kaufman Shelemay is the G. Gordon Watts Professor of Music and Professor of African and African American Studies at Harvard University. She has been a Fellow of the American Academy of Arts and Sciences since 2000.

Introduction

In his impressive biography of the composer Johann Sebastian Bach, musicologist Christoph Wolff has noted that “the complex genesis and transformation of Bach’s first Leipzig Passion – one is tempted to speak of St. John “Passions” – demonstrate a degree of continuing freshness, originality, and experimental radiance that makes the work stand out in many ways”¹ I would like to borrow Christoph Wolff’s description of Bach, as “the Learned Musician,” and apply it to our speaker tonight, who is a very learned musicologist. It is clear that Professor Margot Fassler has exhibited “freshness, originality, and experimental radiance” throughout her distinguished career. That Professor Fassler will guide us tonight through one of Bach’s most complicated compositions sure-

ly marks an experimental turn in her work. Let me trace a few of the highlights of Margot Fassler’s professional path, scholarly contributions, and leadership across several fields of knowledge.

Trained at Cornell University, where she received her Ph.D. in 1983 in medieval studies with a specialization in music history, Margot Fassler is today the Robert S. Tangeman Professor of Music History and Liturgy at Yale University. She has taught at Yale since 1994, when she was wooed away from Brandeis University back to Yale, where she had earlier spent five years as an assistant professor. Margot Fassler’s departure from the ‘Hub of the Universe’ left a great hole in the Boston musicological community. It had long been clear that Fassler’s work crossed disciplinary boundaries in exciting new ways – for instance, in 1985, when she was awarded the Elliot Prize from the Medieval Academy

¹Christoph Wolff, *Johann Sebastian Bach: The Learned Musician* (Oxford and New York: Oxford University Press, 2002), 296.

of America for the best first article on a medieval subject, titled “Who Was Adam of St. Victor? – The Evidence of the Sequence Manuscripts.”²

Fassler’s epic monograph (478 pages!) *Gothic Song: Victorine Sequences and Augustinian Reform in Twelfth-Century Paris* was published by Cambridge University Press in 1993. In 1994, this extraordinary book that brought together musical, liturgical, historical, and memory studies garnered the Otto Kinkeldey Award from the American Musicological Society. In 1997, *Gothic Song* won yet another award, the John Nicholas Brown Prize from the Medieval Academy of America; the book will appear in a second edition next year.

Professor Fassler has edited several other important volumes. *The Divine Office in the Latin Middle Ages*, co-edited with Rebecca Baltzer in 2000 and published by Oxford University Press, received one of the two honorable mention awards from the American Association of Publishers in the Religion and Philosophy category. Professor Fassler has also edited *Musicians for the Churches, Reflections on Formation and Vocation*, which appeared in 2001, and *Psalm in Community: Jewish and Christian Textual, Liturgical, and Artistic Traditions*, co-edited with Harold Attridge in 2003. We are awaiting her next monograph, *Making History: The Liturgical Framework of Time and the Virgin of Chartres*, forthcoming from Yale University Press. Two other books are in progress: a volume on *Hildegard von Bingen: Approaching the Composer as Theologian in the Twelfth Century*, and a monograph on *Music in the Middle Ages*. All of this in addition to some thirty-five major articles and reviews that Professor Fassler has published or currently has in press, spanning topics relating to music, liturgy, and sacred history, in the Middle Ages and beyond.

Lest you think that Professor Fassler left Boston for New Haven in order to devote every spare moment to producing this extraordinary list of publications, you should know that she went to Yale to direct the Institute of Sacred Music. She occupied this position with brilliance and energy until 2004, while simultaneously holding joint appoint-

ments in Yale’s School of Music, Divinity School, and Department of Music, and is affiliated with the Program in Medieval Studies. In 2001, Professor Fassler took on the role of Principal Investigator for a grant from the Lilly Endowment to support a project titled “Experiments with a New Model for Scholarship, Teaching, and Learning in Liturgical Practice and the Theological Disciplines.” During these years, too, Professor Fassler held a fellowship from the Princeton Institute for Advanced Studies.

Tonight we will get a glimpse of Margot Fassler’s ability to apply her historical, musical, and liturgical knowledge to a composition and historical epoch outside her medieval music specialization. We will also get a glimpse of Professor Fassler’s recent work in media beyond print: the world of film with which she is increasingly engaged. In recent years, Professor Fassler has also produced and directed performances of early dramas, including “The Play of Adam” and works of Hildegard von Bingen.

Music, history, and theology elucidated through film and live performance thus await us this evening. It brings to mind the epigraph to Johann Sebastian Bach’s *Little Organ Book* (1717), which has been translated: “For the glory of the highest God alone, and for my neighbour to learn from.” Tonight we are the fortunate neighbors of the American Academy, who will learn from Professor Margot Fassler as she speaks about “Performing the Passion: J.S. Bach and the Gospel of St. John.”



Margot E. Fassler

Margot E. Fassler is Robert S. Tangeman Professor of Music History and Liturgy at Yale University. She has been a Fellow of the American Academy of Arts and Sciences since 2007.

Sing Faster by Jon Else is one of the few documentary films made about the traditions of Western European and North American art music: it, like the use of cuts from operatic scenes found in Disney cartoons, is not made by or with scholars. Like operatic Disney cartoons, it offers a lighthearted spoof of

One of technology’s blessings, at least for ethnomusicologists and musicologists and their students, may be the use of film in research, teaching, and scholarly productions.

high culture, a typically American stance. The stagehands lust after the Rhine maidens like modern-day Alberichs; later Brunhilde yucks it up offstage, and the real tension is in whether or not the fog machines will overproduce and choke the singers.

[Editor’s note: film clip from *Sing Faster*]

Scenes from a rehearsal in San Francisco viewed in Cambridge, Massachusetts? Not surprising. The technological changes witnessed since World War I are as dramatic as shifts from papyrus to parchment, or from horses to cars, trains, and planes. These transformations have been gradual, until we

² *Journal of the American Musicological Society* 37 (2) (1984): 233 – 269.

come to the Internet; there the changes are upon us so quickly that we must engage with them every day. Musicologists, like all scholars in the humanistic disciplines, are coming to terms with JSTOR and the ever-growing lists of audio databases for our classes, and students who offer us PowerPoint presentations rather than papers. As for media, those of us in music now regularly publish in conjunction with clips on YouTube or through podcasts of performances; Naxos, the most important of the audio databases, will surely include video in the next few years. I teach a course on music in the documentary and I use the database Folkstreams.net, organized by Tom Davenport. In a presentation a few years ago, composer Libby Larson discussed “the concert hall that fell asleep and woke up as a car radio.” The car, she claimed, is where most people experience music. Today recent developments provoke a related query:

The greatest visual aid for understanding how a piece of music works and its emotional content remains the expert performer’s face and body.

“What if libraries fell asleep and woke up as laptops?” Technology blesses with one hand and curses with the other. One of its blessings, at least for ethnomusicologists and musicologists and their students, may be the use of film in research, teaching, and scholarly productions.

Film goes against the grain of the car radio concert hall; of performances without performers; of music that can only be heard, and not seen; of music that can be intensely edited from what it was when a human being originally sang or played it. Of course performances of music on film can be manipulated. But no matter how extreme the edits, what you see of a filmed performance usually involves bodies, mouths, hands, faces, feet. During the course of the twentieth century, the technology of recordings and radio disembodied music; producers of rock DVDs have led the fight against this trend.

The greatest visual aid for understanding how a piece of music works and its emotional content remains the expert performer’s face and body. One thing that will not work in film (I know this from painful experience) is audio that is out of sync with the visual. The human connection is, fortunately, still too powerful to allow it. When Dan Stepner, first violinist of the Lydian String Quartet, gives us a downbeat at a crucial structural place in the piece, we know it; he tells us with his body where we are in the work, even if we have never studied sonata form. The over-produced sounds of contemporary recordings, on the other hand, can sound perfect, and the musician’s effort effortless. The possibilities for fooling the public are endless, as witnessed by the recent case of pianist Joyce Hatto and her now-notorious spouse and spin doctor.

Our project films music, both in concert and ritual settings, for the purpose of bringing embodied music into the classroom, a place where it is too often missing. Among our several goals, I mention two that particularly relate to this film *Performing the Passion*.¹ First, we engage with problems of music and music making in our society, through the voices of people who both know and care about the issues, especially in the realm of sacred music. Second, we experiment with what happens when students are taught by their peers. A new pedagogical dimension opens up when we bring high-quality student performances into the classroom, and students hear people their own age talk about what they do. We involve our students as performers, researchers, community leaders, production assistants, and filmmakers. Of course, it’s all the better when we can bring together the performers and the authorities on the works we teach, but few of us have the resources to do this on a regular basis. Our tiny studio, with its simple equipment, is a laboratory, dedicated to the study of the contemporary practice of sacred repertoires and connected in many ways to courses I teach in sacred music and documentary film. Film is the product of our work. We are especially attentive to the power of filmmaking to engage students

¹Relevant clips from *Performing the Passion* can be found in the order mentioned in this article on the website of the Yale Institute of Sacred Music: <http://www.yale.edu/ism>.

Our project films music, both in concert and ritual settings, for the purpose of bringing embodied music into the classroom, a place where it is too often missing.

with local faith communities and in field-work that requires close attention to group dynamics and the leadership qualities in musicians who lead congregational chant and song.

We have made films about Gregorian chant within a monastic community and about styles of psalm singing in the Western Christian tradition, now distributed by the Society of Biblical Literature. We are engaged in filming a Coptic cantor from Jersey City, New Jersey, and gospel music in an African American church in Bridgeport, Connecticut. Today we will share clips from a film of a performance of J. S. Bach’s *St. John Passion*, the 1725 version, that we are just finishing. You will have a sneak preview, and you may notice a few things that still need work. This is not the final version, but it is close.

When planning the performance, Simon Carrington and Markus Rathey chose the 1725 version of Bach’s *St. John* because it is slightly more dramatic than Bach’s other versions of the same work; as a result, the theology is somewhat different and distinct. Background study began well over a decade ago at a session on “Anti-Jewish Themes in Western Sacred Repertoires” at an annual meeting of the American Musicological Society. In those days, scholars were talking about revising musical works or not performing Bach’s *Passions* at all anymore. I argued in this session for performances that unfolded within the company of Biblical scholars and musicologists – Jewish and Christian – who were equipped to deal with hard issues. Fifteen years ago, I had no idea how I would bring that off. Today, our film attempts to do this. We study this challenging piece with the help of Biblical scholars, performers, and musicologists, whose comments punctuate the scenes. In addition to clips from the film, we will present live perform-

ances by two of the soloists – then students at Yale, now graduated – who explain their ideas within the film. Colleagues who worked with me on the film are here, too: coproducer Jacqueline Richard and musicologist Markus Rathey.

Bach's setting of the Passion is part of a long tradition of chanting scriptural texts during the liturgical time just before Easter that depict Jesus's suffering and death as found in the three Synoptic Gospels – Matthew, Mark, and Luke – and in the Gospel of John, which is considered the latest of the four canonic

Bach's setting of the Passion is part of a long tradition of chanting scriptural texts during the liturgical time just before Easter that depict Jesus's suffering and death.

Gospels and stems from a somewhat different, although related, tradition. In our film, which is 1 hour and 13 minutes long, we work with difficult issues in concentrated ways, allowing the visuals to speak with power and efficiency and offering material for discussion and research projects. The special features section of the DVD will include several longer selections – chorales, arias, and choruses without any cuts – as in the performance. In the film itself, we have adopted a visual grammar that we hope will make points in richly textured ways. We have several kinds of footage: interviews of both scholars and performers; footage from a rehearsal at school; footage from the dress rehearsal in St. Mary's Church, where the performance took place; and footage of the actual performance by the Yale Schola Cantorum, an all-student group conducted by Simon Carrington (the Yale Collegium Players, a town and gown group conducted by Robert Mealy, joined in the dress rehearsal).

When interviewees are talking about the music, we try to use rehearsal footage to underscore points, with students in street clothes; when we offer longer "cameos," we generally use concert footage, proclaiming that we are being quiet at that point, that the

music itself needs room to carry the ideas, and that the viewers should focus attention on the embodied music, just as the audience did on the night of the actual performance. You will see examples, including one that moves directly from Simon Carrington conducting at school to the performance itself. By cutting back and forth, we demonstrate that behind every performance stand hours and hours of work, reflective and scholarly as well as physical.

In addition to pictures of historic scores as well as modern scores with the markings of the performers within them, we have enriched the visual language of the film through use of engravings from the very Bibles that people in Bach's congregation would have read from at home, offering a glimpse of the visual imaginations of biblical events found in audiences of the time. Thanks to the kindness of Concordia College, we have been able to use photographs of Bach's own Bible as well, with his annotations in the margins.

There are three major "characters" in Bach's *Passion*, and the first is by far the most complex: 1) "the people," 2) "the Evangelist," John himself, who tells the story and brings other biblical characters to life in recitative, and 3) Jesus, who also sings in the same style as the Evangelist John, allowing for emphasis on the declaimed biblical text. In the conventions of composing settings of the *Passion*, the Evangelist is a tenor and Jesus is a bass.

In editing the film, we worked the hardest to depict "the people," which is a complicated idea in Bach's setting. They sing as a group in many guises, first of all in the Lutheran chorales, simple four-part hymns that all of Bach's audience would have known and recognized. Second, "the people" are found in the large, concertized choruses that in part employ melodies and texts Bach borrowed from the chorale tradition and other liturgical works known to the Lutheran audiences. He wrote this version of the *St. John* when he was especially engaged with the choral cantata, and this interest shows in the opening chorus, "*O Mensch beweine*." By using both of these materials throughout his setting, Bach brings the audience into the *Passion*: they are there, they comment, they are both the historic crowds of Jews and onlookers as well as the Lutheran congregation. The arias, too, frequently relate to the emotions and

There are three major "characters" in Bach's Passion, and the first is by far the most complex: 1) "the people," 2) "the Evangelist," John himself... and 3) Jesus.

ideas found in the crowds, but through the reflective voice of an individual. Bach, in his extraordinary creativity, makes the point by sharing musical material between arias and crowd scenes in the *St. John Passion*.

The opening chorus of the 1725 version is one of the major differences between this and the 1724/1749 version. It is a powerful opening gesture based on the old Lutheran hymn "*O Mensch beweine*" ("Oh People, Bewail"), a text and tune that everyone would have known. In his 2006 concert program notes, Markus Rathey says that it was part of the style to lay out major thematic concerns in the first movement of a *Passion* setting, and Bach proclaims here the charge of sinfulness, one that demonstrates the need for the redemption that will ultimately resolve the long struggle lying ahead.

[Editor's note: film clip from *Performing the Passion*]

Bach creates arias that allow points of repose, moving us from the group to the individual member of the crowd, and pinpoints emotional states through these solos. We can take as an example the character of Peter, the disciple who denies Christ three times as Jesus predicted he would. Peter does not walk around onstage; we only see him in the chorus for a second when he sings his one line, but his emotional story is told through the music, first by the Evangelist and then in the guise of the Lutheran believer who denies Jesus, who will not confess who He is, and who is in need of redemption as a result of his failure and his sin.

The way in which Peter's character was developed is summed up through the soprano aria "*Ich folge dir gleichfalls mit freudigen schritten*." The dramatically brilliant piece shows Peter's inner emotionality. This sad love

song, as Markus Rathey puts it in an interview, is hopeful at first, but the B part of the aria contains a chromatic, upward climb, which is devilishly hard to sing: the naive Peter, perhaps, does not yet suspect in these foreshadowing moments that he is doomed to repeated denial rather than to joyful following. So Peter, so too the believer who starts out thinking he can make it on his or her own, but who will not, and cannot, and must rather be redeemed. Bach takes music from this aria that represents Peter's struggles and failures and reemploys it in crowd scenes that show the Jews crying for Jesus's death and insisting that He not be called their king. Through this skillful reuse, Peter is in the midst of the crowd denying, and so are the Christian believers he represents.

[Editor's note: film clip from *Performing the Passion* followed by a performance by soloist Abigail Haynes Lennox, soprano]

On some level all music belongs to all people, no matter what the belief system may be.

Every documentary film builds tension, and our film, which follows the structure of Bach's work, has an additional tension that his does not. We are deeply concerned with the ways in which audiences today hear this piece. The scholars – some are Jewish or Christian, and some are not practitioners within either faith tradition – are not identified by their affiliations. We thought about identifying them and decided to leave it ambiguous. But it is clear that they have different viewpoints and that they speak from the authority of their disciplines. Viewers could figure out with simple research that Wendy Heller is a cantor as well as a musicologist, and that A. J. Levine is a practicing Jew who teaches the New Testament in a Divinity School and was a major spokesperson concerning the anti-Jewish content of Mel Gibson's film on the Passion. Michael Marissen emerges as a scholar who has concentrated most of his work on the anti-Jewishness of stock repertory, having turned his sights most recently on Handel's *Messiah*. Each scholar provides his or her own biography

for the film, and it is interesting to hear what they say. What would you want to know, and what would you want your students to know? Does it matter? That in itself is a worthwhile question, and our film asks as many questions as it answers. [The idea that Jews were killers of Christ has been denied repeatedly by many Christian denominations in recent times, and some members of the audience had wanted us to say this more explicitly in the film; I came away from the presentation wishing the point had been made even more strongly than it is.]

In the film, the conversation begins with the work scholars have done on the anti-Jewishness of John's Gospel, for this is the text Bach received. The nature of the fourth gospel is studied with some care. We then move to Bach's treatment of the text: it is not an easy subject either. Marissen and others posit that Bach actually softened the eighteenth-century stance regarding the treatment of Jews in comparable works; most importantly he has turned the guilt onto the Lutheran congregation who, like Peter, denies who Jesus is. Prior to the selection we will watch, A. J. Levine says that the Gospel of John is a work of art, as Bach's setting is a work of art, and that what one thinks of it depends on many factors.

[Editor's note: film clip from *Performing the Passion*]

Jesus's death in the Gospel of John is far removed from the scenes of Mel Gibson's *The Passion of the Christ*; the theology expressed in John's Gospel puts Jesus in control of the end of his life, directing the scenes himself and realizing that he is the Lamb of God who goes willingly to die in order to redeem. The emphasis that Bach places on sin in the opening is borne out in the scene of Jesus's crucifixion and in what follows. We devote one portion of the scene to discussion of the reasons why excessive violence is inappropriate to the narrative, especially as found in the Gospel of John. In this text, Jesus shows no weakness; he dies only when all is accomplished, and he makes the decision himself. The effect his death will have upon the believer is conflicted, and this is established in the moving aria "*Es ist vollbracht*" ("It is finished").

[Editor's note: film clip from *Performing the Passion* followed by a performance by soloist Ian Howell, countertenor]

When we walk home after a performance of a major work, even one that troubles us deeply, there is also a voice of hope in the midst of questions that still remain.

Constructing the end of the film posed special difficulties for us. The conclusion of Bach's *Passion* is lengthy and complicated: much material unfolds long after the dramatic climax, and so too in our film. This is not the way films are conventionally structured. Usually, after the climax, the resolution follows quickly and the end immediately thereafter. Bach ended the *Passion* in three ways at the Vespers service in Leipzig on Good Friday, 1725: first, with a lullaby-like chorus that sings to the holy bones of the dead and that comforts the sorrow of the individual; second, through a choral setting of the German *Agnus Dei*, transporting the believer to liturgical time; and third, as was convention, by the singing of a sixteenth-century Passion motet, which pushes beyond the boundaries of the familiar. We wanted to be faithful to this, and so included long sections from both choruses and the complete motet, trusting that by the end the audience will be ready to listen and understand that the music is the star of our film. We also needed to tie up themes that Bach didn't: theological ideas and the feelings of the performers – our work is a play within a play.

The clip you will hear includes only the last two pieces. The first is the Lutheran *Agnus Dei* (*Lamb of God*), not found in other versions of the *Passion*, but especially appropriate to the *St. John Passion* of 1725. Through this music, the *Passion* is lifted out and into the Mass, where the liturgical celebration continues to make the theological points throughout the church year. The resolution has a meaning outside the feast and in the week-to-week liturgical life of the church, a point underscored through the appearance of the performers who played Jesus and John singing within the chorus, mingling the holy with the commonplace.

Then, we end our film, as Bach would have ended a performance of the *St. John Passion*, with the traditional Passion motet by the sixteenth-century composer Jacob Handl. This motet takes the listener to a land that is sonically far removed from anything else in the entire film, in the entire setting of the Passion. Eighteenth-century Lutherans would have experienced this piece as a different style, as surely as we do. The music creates a sense of the eternal appropriate for the immensity of the themes treated and resolved at the close. The individual solos of the arias, the busy independent voices of the choruses, even the moving, often piquant harmonies of the chorale settings are resolved within the texture of this earlier counterpoint. The characters dissolve; the instruments fall completely silent: no individual sound stands out in the homophony of this motet, and the sharp dissonances of voice leading so apparent in Bach's harmonic language are replaced by an equally robust but utterly different texture and practice, one reflecting a far-removed age and the gentle turning of the spheres.

The complexities of living in a society where many faith traditions co-exist, alongside a painful history, are central not only to American culture but to teaching and learning about music from the past, especially pieces like the *St. John Passion* of J. S. Bach. Performance practice is not only about which reed to choose or how to hold the bow. It illustrates the importance of music and historical musicology in trying to understand major religious topics from the past, especially when performance is the intention. On some level all music belongs to all people, no matter what the belief system may be. When we walk home after a performance of a major work, even one that troubles us deeply, there is also a voice of hope in the midst of questions that still remain.

[Editor's note: film clip from *Performing the Passion*] ■

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St. John Passion

(1725 version)

Johann Sebastian Bach

1685 – 1750

9. Aria (Soprano) *Abigail Haynes Lennox*

Ich folge dir gleichfalls mit freudigen Schritten
Und lasse dich nicht,
Mein Leben, mein Licht.
Befördre den Lauf
Und höre nicht auf,
Selbst an mir zu ziehen, zu schieben, zu bitten.

*I will follow you likewise with joyful steps
and will not let you [go],
My Life, my light.
Pave the way,
and do not stop
drawing, shoving, imploring me yourself.*

30. Aria (Alto) *Ian Howell*

Es ist vollbracht!
O Trost vor die gekränkten Seelen!
Die Trauernacht
Läßt nun die letzte Stunde zählen.
Der Held aus Juda siegt mit Macht
Und schließt den Kampf.
Es ist vollbracht!

*It is accomplished!
O comfort for the afflicted souls!
The night of mourning
now counts the final hour.
The hero from Judah triumphs with power
and brings the battle to a close.
It is accomplished!*

Translation: Michael Marissen

A Note about John Voss, Academy Executive Officer (1964–1986)



John Voss, Executive Officer of the American Academy of Arts and Sciences from 1964–1986, died on March 11, 2008, at the age of 90. During his 22-year tenure, he served under six presidents: legal scholars Paul Freund and Milton Katz; sociologist Talcott Parsons; physicists Victor Weisskopf and Herman Feshbach; and applied physicist and authority on science policy Harvey Brooks. Working closely with each president, he helped to expand the range of the Academy's activities and its visibility, both nationally and internationally.

With a graduate degree in religion and an earlier career at the pioneering management consulting company, Arthur D. Little, Voss brought to the Academy a dedication to the advancement

of learning as well as the organizational skills to support Academy leadership in building projects and studies. During his tenure, the Academy produced authoritative analyses in a number of areas, including poverty and ethnicity, immigration and the environment, strategic arms limitation, and the history of institutions for the promotion of knowledge in America. With architect and architectural critic Robert Campbell, Voss oversaw the planning and construction of a new House of the Academy in Cambridge.

Institution-building was also an important part of Voss's work. He helped to organize a joint American Academy–National Academy of Sciences committee that led to the 1970 establishment of the International Centre of Insect Physiology and Ecology (ICIPE) in Nairobi, Kenya. Voss considered the creation of the National Humanities Center (NHC) at Research Triangle Park, North Carolina, to be his most important professional accomplishment. His first step was to invite Steven Marcus, George Delacorte Professor in the Humanities at Columbia, to serve as Director of Planning. At a recent meeting of the Center's Board of Trustees, Marcus recalled that Voss "was present at the core of things: planning, advising, visiting prospective

sites, always encouraging further efforts and explorations. In establishing the American Academy as the sponsoring and nurturing organization for the new institution, he provided us with the authority and visibility of a highly regarded, historic learned society; without that, I cannot imagine how the Center could have come into existence and operation within four years."

From 1976–1990, Voss served as Secretary-Treasurer of the Center and as an active trustee; he was a trustee emeritus until his death. Today, the Academy continues its association with the Center, with two Academy Fellows serving as our representatives on the NHC Board of Trustees.

Voss's term as Executive Officer was marked by a number of extraordinary accomplishments that are reflected in many of our current programs. We extend our sincere condolences to his family and friends. ■

Noteworthy

Select Prizes and Awards

Kavli Prizes

Established by the Kavli Foundation and Academy Fellow Fred Kavli

Astrophysics

Donald Lynden-Bell (Cambridge University)

Maarten Schmidt (California Institute of Technology)

Nanoscience

Louis E. Brus (Columbia University)

Sumio Iijima (Meijo University)

Neuroscience

Sten Grillner (Karolinska Institute)

Thomas Jessell (Columbia University)

Pasko Rakic (Yale University School of Medicine)

Other Awards

David Attenborough (Richmond, Surrey, United Kingdom) received the Linnean Tercentenary Medal from the Linnean Society of London.

Albert Bandura (Stanford University) is among the recipients of the 2008 University of Louisville Grawemeyer Awards.

Timothy Berners-Lee (Massachusetts Institute of Technology) received the Pathfinder Award from the Leadership for a Networked World Program at Harvard University's Kennedy School of Government.

Mina J. Bissell (Lawrence Berkeley National Laboratory) was honored by the Institute of Molecular Pathology and Immunology of the University of Porto with a lifetime achievement award in her name: The Mina J. Bissell Award. She is also the recipient of the 2008 Medal of Honor in Basic Research from the American Cancer Society.

Elizabeth Blackburn (University of California, San Francisco) is a corecipient of the Albany Medical Center Prize in Medicine and Biomedical Research.

Allan M. Brandt (Harvard University) was awarded a 2008 Bancroft Prize from Columbia University, the Arthur Visellear Award from the American Public Health Association, the Albert J. Beveridge Award from the American Historical Association, and the Sybil G. Jacobs Award by the American Legacy Foundation for *The Cigarette Century: The Rise, Fall and Deadly Persistence of the Product That Defined America*.

John A. Clements (University of California, San Francisco) is the recipient of the 2008 Pollin Prize.

Sheldon Danziger (University of Michigan) was named a 2008 Guggenheim Fellow.

Mitchell Feigenbaum (Rockefeller University) was awarded the 2008 Dannie Heineman Prize for Mathematical Physics.

Saul Friedländer (University of California, Los Angeles) was awarded a Pulitzer Prize for general nonfiction for *The Years of Extermination: Nazi Germany and the Jews, 1939 – 1945*.

Herbert Gleiter (Institut für Nanotechnologie) is the recipient of the 2007 Gold Medal of Acta Materialia.

Shafi Goldwasser (Massachusetts Institute of Technology) has been named the 2008 – 2009 Athena Lecturer by the Association for Computing Machinery's Committee on Women in Computing.

Albert Gore (Generation Investment Management U.S. LLP) was awarded the Dan David Prize by the Dan David Foundation.

Philip Gossett (University of Chicago) received the 2008 Gordon J. Laing Prize from the University of Chicago Press and the Kinkadey Award from the American Musicology Society for *Divas and Scholars: Performing Italian Opera*.

Hanna Holborn Gray (University of Chicago) is the recipient of the Robert Maynard Hutchins History Maker Award for Distinction in Education, given by the Chicago Historical Society.

Robert M. Greenstein (Center on Budget and Policy Priorities) is the recipient of the 2008 John W. Gardner Leadership Award.

John Groves (Princeton University) is among the recipients of the 2008 Grand Prix de la Fondation de la Maison de la Chimie.

Michael S. Harper (Brown University) was awarded the 2008 Frost Medal from the Poetry Society of America for lifetime achievement in American poetry.

Robert Hass (New York, New York) was awarded a Pulitzer Prize for poetry for *Time and Materials*.

David Haussler (University of California, Santa Cruz) is the recipient of the Senior Scientist Accomplishment Award, given by the International Society for Computational Biology.

F. Warren Hellman (Hellman & Friedman LLC) is among the recipients of the 2008 UCSF Medal.

Jeremy Jackson (University of California, San Diego) is the recipient of the 11th annual Roger Tory Peterson Medal.

Rudolf Kalman (Eidgenössische Technische Hochschule Zürich) received the 2008 Charles Stark Draper Prize.

Takeo Kanade (Carnegie Mellon University) is the 2008 recipient of the Bower Award and Prize for Achievement in Science from the Franklin Institute.

John A. Katzenellenbogen (University of Illinois at Urbana-Champaign) is the recipient of the 2008 Gustavus John Esselen Award for Chemistry in the Public Interest.

Laura L. Kiessling (University of Wisconsin-Madison) was named a 2008 Guggenheim Fellow.

Yuan Tseh Lee (University of California, Berkeley) was awarded the 2008 Othmer Gold Medal by the Chemical Heritage Foundation.

Jay Levy (University of California, San Francisco) received the Gold Medal for Outstanding Achievement in Medical Research from Columbia University College of Physicians and Surgeons.

Yuri Manin (Max-Planck-Institut für Mathematik) was awarded the German Order Pour le mérite in Arts and Sciences.

Martin E. Marty (University of Chicago) received a Wilbur Award, given by the Religion Communicators Council.

Douglas Melton (Harvard University) received the Nancy Jones Diabetes Champion Award, given by the Juvenile Diabetes Research Foundation.

Paul R. Milgrom (Stanford University) was awarded the Erwin Plein Nemmers Prize in Economics.

David A. Patterson (University of California, Berkeley) is the recipient of the 2007 Distinguished Service Award by the Association for Computing Machinery.

Burton Richter (Stanford University) was awarded the 2007 AAAS Philip Hauge Abelson Prize by the American Association for the Advancement of Science.

Janet Davison Rowley (University of Chicago) is among the recipients of the 2008 UCSF Medal.

John Gerard Ruggie (Harvard University) was named a 2008 Guggenheim Fellow.

Kathryn A. Sikkink (University of Minnesota) was named a 2008 Guggenheim Fellow.

Joan Steitz (Yale University) is a corecipient of the Albany Medical Center Prize in Medicine and Biomedical Research.

John Updike (Boston, Massachusetts) delivered the 2008 Jefferson Lecture in the Humanities.

Noteworthy

Alexander Varshavsky (California Institute of Technology) was awarded the first Gotham Prize for Cancer Research.

Inder Verma (Salk Institute) is the recipient of the 2008 Vilcek Prize in Biomedical Science.

Brian Vickers (University of London) was appointed Knight Bachelor in the Queen's New Year's Honors List.

Leslie H. Wexner (Limited Brands, Inc.) is the recipient of the Renaissance Award given by Hillel.

Edward O. Wilson (Harvard University) received the Linnean Tercentenary Medal from the Linnean Society of London. He also received the Robin W. Winks Award for Enhancing Public Understanding of National Parks from the National Parks Conservation Association.

Peter G. Wolynes (University of California, San Diego) received the 2008 Founders Award from the Biophysical Society and has been elected to the German Academy of Sciences Leopoldina and the Royal Society in the United Kingdom.

Edward F. Zigler (Yale University) is among the recipients of the 2008 University of Louisville Grawemeyer Awards.

New Appointments

Richard N. Aslin (University of Rochester) has been named President of the International Society on Infant Studies.

Edward L. Ayers (University of Richmond) was named President of the University of Richmond.

Mary Catherine Beckerle (University of Utah) has been appointed to the Advisory Committee to the Director of the National Institutes of Health.

Gunter Klaus-Joachim Blobel (Rockefeller University) was appointed to the Scientific Advisory Board of MDRNA, Inc.

David DeWitt (University of Wisconsin-Madison) has been named Director of the Microsoft Jim Gray Systems Lab in Madison, Wisconsin.

Michael V. Drake (University of California, Irvine) has been elected to the Commonwealth Fund Board of Directors.

Herbert Gleiter (Institut für Nanotechnologie) was elected Vice President of the German Academy of Sciences Leopoldina.

Barbara Grosz (Harvard University) has been appointed Dean of the Radcliffe Institute for Advanced Study.

Leroy Hood (Institute for Systems Biology) was appointed to the Advisory Committee of InterWest Partners.

Elena Kagan (Harvard Law School) has been named an Advisory Board Member of the American Indian Empowerment Fund.

Thomas J. Kelly, Jr. (Memorial Sloan-Kettering Cancer Center) has been appointed to the Advisory Committee to the Director of the National Institutes of Health.

Arthur Kleinman (Harvard University) has been appointed Director of the Harvard University Asia Center.

Stephen Kosslyn (Harvard University) has been named Divisional Dean for the Social Sciences at Harvard University.

Alan I. Leshner (American Association for the Advancement of Science) has been appointed to the Board of Directors of Public Agenda.

James Poterba (Massachusetts Institute of Technology) has been appointed President and Chief Executive Officer of the National Bureau of Economic Research.

Myriam P. Sarachik (City College of New York) has been elected to the governing council of the National Academy of Sciences.

Lucy Shapiro (Stanford University) has been elected to the Board of Directors of Gen-Probe, Inc.

Hans Lennart Rudolf Wigzell (Karolinska Institute) has been named Chairman of AVI BioPharma's Corporate Strategy Board.

Keith Robert Yamamoto (University of California, San Francisco) has been appointed to the Advisory Committee to the Director of the National Institutes of Health.

Pauline Yu (American Council of Learned Societies) was named Vice Chair of Harvard University's Board of Overseers.

Select Publications

Poetry

John Hollander (Yale University). *A Draft of Light*. Knopf, May 2008

Charles Simic (University of New Hampshire). *Sixty Poems*. Harvest Books, January 2008

Charles Simic (University of New Hampshire). *That Little Something*. Harcourt, April 2008

C. D. Wright (Brown University). *Rising, Falling, Hovering*. Copper Canyon, April 2008

Fiction

Louise Erdrich (Minneapolis, Minnesota). *The Plague of Doves*. HarperCollins, April 2008

Michael Hofmann (University of Florida), trans. Peter Stamm. *On a Day Like This*. Other Press, July 2008

Nonfiction

Walter Alvarez (University of California, Berkeley). *The Mountains of Saint Francis: Discovering the Geologic Events that Shaped Our Earth*. W. W. Norton, August 2008

Aharon Barak (Supreme Court of Israel). *The Judge in a Democracy*. Princeton University Press, April 2008

Francis Bator (Harvard University). "No Good Choices: LBJ and the Vietnam/Great Society Connection." *Diplomatic History*, June 2008

William G. Bowen (Princeton, New Jersey). *The Board Book: An Insider's Guide for Directors and Trustees*. W. W. Norton, April 2008

G. W. Bowersock (Institute for Advanced Study), trans. Lorenzo Valla. *On the Donation of Constantine*. The I Tatti Renaissance Library, Harvard University Press, April 2007

James Cuno (Art Institute of Chicago). *Who Owns Antiquity? Museums and the Battle over Our Ancient Heritage*. Princeton University Press, April 2008

Avinash K. Dixit (Princeton University) and Barry J. Nalebuff (Yale University). *The Art of Strategy: A Game Theorist's Guide to Success in Business and Life*. W. W. Norton, July 2008

Daniel Farber (University of California, Berkeley). *Security v. Liberty: Conflicts between National Security and Civil Liberties in American History*. Russell Sage Foundation, March 2008

William Fash (Harvard University) and **Jeremy A. Sabloff** (University of Pennsylvania), eds. *Gordon R. Willey and American Archaeology: Contemporary Perspectives*. University of Oklahoma Press, May 2007

Michael S. Gazzaniga (University of California, Santa Barbara). *Human: The Science Behind What Makes Us Unique*. Ecco, July 2008

Claudia Goldin (Harvard University) and **Lawrence F. Katz** (Harvard University). *The Race between Education and Technology*. Harvard University Press, June 2008

Kent Greenawalt (Columbia University). *Religion and the Constitution, Volume 2: Establishment and Fairness*. Princeton University Press, May 2008

Ian Hacking (University of Toronto), Stanley Cavell (Harvard University), Cora Diamond (University of Virginia), **John McDowell** (University of Pittsburgh), Cary Wolfe (Rice University). *Philosophy and Animal Life*. Columbia University Press, June 2008

Lynn Hunt (University of California, Los Angeles). *Inventing Human Rights: A History*. W. W. Norton, March 2007

Kathleen Hall Jamieson (Annenberg Public Policy Center, University of Pennsylvania) and Joseph N. Cappella (Annenberg School for Communication, University of Pennsylvania). *Echo Chamber: Rush Limbaugh and the Conservative Media Establishment*. Oxford University Press, July 2008

Tony Judt (New York University). *Reappraisals: Reflections on the Forgotten Twentieth Century*. Penguin Press, April 2008

Donald Keene (Columbia University). *Chronicles of My Life: An American in the Heart of Japan*. Columbia University Press, May 2008

Donald Kennedy (Science Magazine) and Darryl Wheye (Woodside, California). *Humans, Nature, and the Birds: Science Art from Cave Walls to Computer Screens*. Yale University Press, June 2008

Yuri Manin (Max-Planck-Institut für Mathematik). *Mathematics as Metaphor*. American Mathematical Society, November 2007

Charles F. Manski (Northwestern University). *Identification for Prediction and Decision*. Harvard University Press, January 2008

Douglas Massey (Woodrow Wilson School of Public and International Affairs, Princeton University), ed. *New Faces in New Places: The Changing Geography of American Immigration*. Russell Sage Foundation, February 2008

Martha Minow (Harvard Law School), **Richard A. Shweder** (University of Chicago), and **Hazel Rose Markus** (Stanford University), eds. *Just Schools: Pursuing Equality in Societies of Difference*. Russell Sage Foundation, April 2008

Newton W. Minow (Sidley, Austin, Brown & Wood LLP) and Craig L. LaMay (Northwestern University). *Inside the Presidential Debates: Their Improbable Past and Promising Future*. University of Chicago Press, April 2008

K. C. Nicolaou (The Scripps Research Institute/University of California, San Diego) and Tamryn Montagnon (University of Crete). *Molecules That Changed the World*. Wiley, VCH, March 2008

William Nordhaus (Yale University). *A Question of Balance: Weighing the Options on Global Warming Policies*. Yale University Press, June 2008

Joseph S. Nye (John F. Kennedy School of Government, Harvard University). *The Powers to Lead*. Oxford University Press, March 2008

Nicholas Penny (National Gallery of Art, Washington, D.C.) and Eike D. Schmidt (J. Paul Getty Museum). *Collecting Sculpture in Early Modern Europe*. Yale University Press, May 2008

Donald Pfaff (Rockefeller University). *The Neuroscience of Fair Play: Why We (Usually) Follow the Golden Rule*. Dana Press, December 2007

Richard L. Revez (New York University School of Law) and Michael A. Livermore (U.S. Court of Appeals, D.C. Circuit). *Retaking Rationality: How Cost-Benefit Analysis Can Better Protect the Environment and Our Health*. Oxford University Press, May 2008

George P. Shultz (Stanford University) and John B. Shoven (Stanford University). *Putting Our House in Order: A Guide to Social Security and Health Care Reform*. W.W. Norton, April 2008

Theodore E. Stebbins, Jr. (Harvard University Art Museums), Kimberly Clark (Harvard University Art Museums), and Virginia Anderson (New York Historical Society), eds. *American Paintings at Harvard, Volume 2: Paintings, Watercolors, Pastels, and Stained Glass*. Yale University Press, May 2008

Richard H. Thaler (University of Chicago) and Cass Sunstein (University of Chicago). *Nudge: The Gentle Power of Choice Architecture*. Yale University Press, May 2008

Charles Tilly (Columbia University). *Credit and Balance*. Princeton University Press, May 2008

Sheldon S. Wolin (Princeton University). *Democracy Incorporated: Managed Democracy and the Specter of Inverted Totalitarianism*. Princeton University Press, April 2008

James Wood (*The New Yorker*/Harvard University). *How Fiction Works*. Farrar, Straus & Giroux, August 2008

Exhibitions

Jeff Koons (New York, New York): *Jeff Koons on the Roof* at the Metropolitan Museum of Art, New York, April 22, 2008 – October 26, 2008.

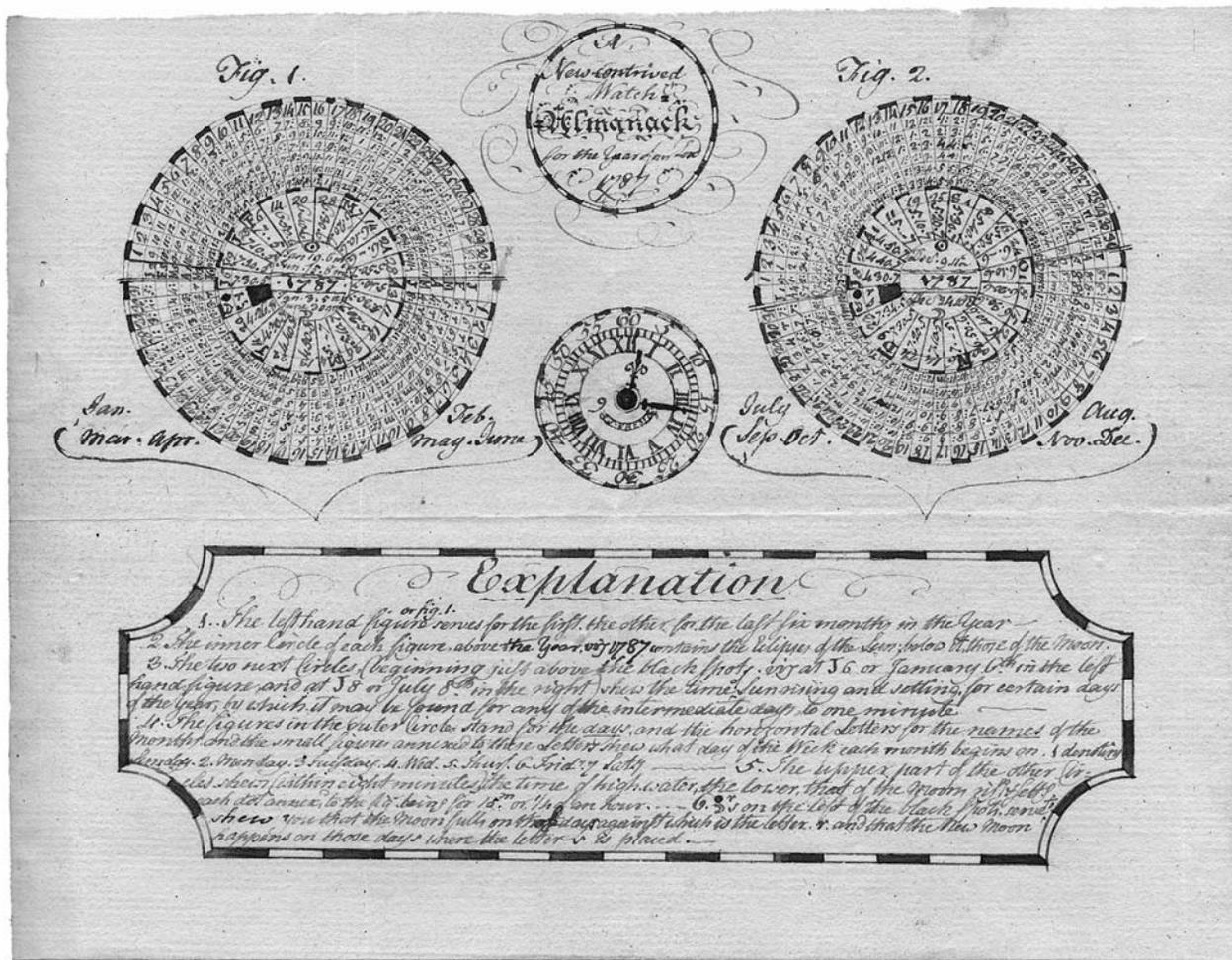
Maya Lin (Maya Lin Studio): *Maya Lin: Systematic Landscapes* at the de Young Museum of the Fine Arts Museums of San Francisco, October 25, 2008 – January 18, 2009.

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

In July 1787, Samuel Freeman (1743 – 1831), a prominent citizen of Portland, Maine, sent the American Academy a description and drawing for a new device that he called a “watch almanack.” This device, designed to fit into the case of a watch, provided a yearly calendar as well as information about sunrises, sunsets, lunar cycles, and tides.

In his letter to the Academy, Freeman wrote that he found the almanacks “convenient myself and wish to afford a like Convenience to others.” His communication was read at an Academy Stated Meeting on August 22, 1787.



A New Contrived Watch Almanack for the Year of our Lord 1787

Explanation

“1. The lefthand figure or fig. 1 serves for the first, the other for the last six months in the Year — 2. The inner Circle of each figure above the Year viz 1787 contains the Eclipse of the Sun, below it, those of the Moon. 3. The two next Circles, beginning just above the black spots viz at J 6 or January 6th in the left hand figure and at J 8 or July 8th in the right shew the time of Sun-rising and setting for certain days of the Year, by which it may be found for any of the intermediate days to one minute — 4. The figures in the outer Circle stand for the *days* and the horizontal Letters for the *names* of the Months and the small figures annexed to these Letters shew what day of the Week each month begins on, S denoting Sunday, 2. Monday, 3. Tuesday, 4. Wed. 5. Thurs. 6. Frid. 7. Saty — 5. The upper part of the other Circles shew (within eight minutes) The time of high water, the lower that of the Moon rise & Sett. each dot annexd to the fig. being for 15^m or 1/4 of an hour — 6. [4 symbols: • D r s] on the Left of the black spots serve to shew you that the Moon falls on the those days against which is the letter *r* and that the New Moon happens on those days where the letter *s* is placed —”