



AMERICAN ACADEMY OF ARTS & SCIENCES

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Dædalus Explores a Limited Resource: Water



Restoring the Foundation: Revising the U.S. Science and Technology Enterprise

Neal Lane, Norman R. Augustine, and Steven Chu



Forty Years of Evolution in the Galápagos Finches

B. Rosemary Grant and Peter Grant

ALSO: Academy Receives \$5.85 Million Gift from the Jack, Joseph,
and Morton Mandel Foundation

Academy-WGBH Partnership

Discovering Handel's London through His Music

Teaching and the Digital Humanities

Upcoming Events

SEPTEMBER

17th

New York, NY
New York University

*The Evolving Role of Technology
in Higher Education*

OCTOBER

9th – 11th

Cambridge, MA

Induction Weekend

9th *A Celebration of the Arts
and Humanities*

10th *Induction Ceremony*

11th *Academic Symposium*

NOVEMBER

11th

Cambridge, MA
House of the Academy

Access to Justice

17th

Cambridge, MA
House of the Academy

Chamber Series in collaboration with
the Cantata Singers

*Made in America: Songs by Barber,
Copland, and Fine*

DECEMBER

4th

Washington, D.C.
Georgetown University

The Crisis in Legal Education

7th

New York, NY
Columbia University

Anxieties of Democracy

For updates and additions to the calendar, visit www.amacad.org.

From the President

During the past academic year, the Academy has hosted meetings for members in 13 cities around the country. More than 850 members have gathered to discuss topics such as the biomedical research ecosystem, the humanities and “soft power,” and excellence in and access to public higher education. The pace of activity at the House of the Academy in Cambridge has increased as well, with Stated Meetings on subjects like evolution, recent events in Russia, and the function and role of courts in the United States. Some of these meetings were simulcast to members who gathered in New York and Chicago, a practice we will expand to other cities in the coming year.

The Academy is now building a network of local program committees for members from New York to Washington to Houston to Chicago to Los Angeles and other cities in between. Among the activities the local committees may choose to sponsor are informal lunch meetings, receptions for new members, panel discussions and lectures, book talks by authors among our members, presentations by members who are leading Academy studies, and events related to Exploratory Fund projects.

In the pages that follow, you will read about a \$5.85 million gift from the Jack, Joseph, and Morton Mandel Foundation to endow the Morton L. Mandel Program for Civic Discourse and Membership Engagement. The gift has enabled the Academy to appoint Laurie McDonough as our first Morton L. Mandel Director of Membership Engagement and to support the work of local program committees. The gift will also fund state-of-the-art technological enhancements to the House of the Academy, including live, interactive, streaming capabilities and teleconferencing, which will allow the Academy to include more voices in the conversation, both members at a distance from Cambridge and the informed public.

This spirit of sharing the work of the Academy and of its members more broadly is part of a long-standing tradition. Over its history, the Academy has sponsored public panel discussions and lectures that addressed important issues of the time. In October 1852, the Academy announced a program of public lectures given by Fellows Louis Agassiz, B. A. Gould Jr., Oliver Wendell Holmes, and George Ticknor, in which they shared with the Cambridge community their expertise on the intersection of literature, education, and the natural sciences. In 1919, the Academy again organized a series of “Open Meetings” with lectures on topics of general interest, and then again in 1938 and, on occasion, ever

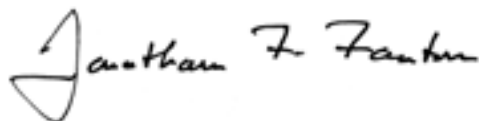
since. Our partnership with WGBH News, described on page 4, may be considered the latest instance of this tradition of sharing the expertise of the members of the Academy community with the wider world.

We invite our members to suggest topics for Academy meetings and public events. We welcome volunteers to lead discussions on important issues facing our country and the world. The Academy is a place where critical – even contentious – issues can be discussed in civil, evidence-based conversations, open to all points of view. Our membership – scholars in every field and discipline, including business, science, public life, the arts, philanthropy, the humanities, the social sciences, and more – ensures that many perspectives will be heard, and that the connections between research and policy are strengthened.

In his presidential address in December 1944, Academy President Howard Mumford Jones observed that, “rich as is New England in institutions of learning, [these institutions] will welcome some positive program to link together the interests of the learned and the problems of society in the years immediately to come.” He went on to add that he hoped that the Academy, given its history and tradition, would fill that role.

As you read about the work of the Academy in this issue of the *Bulletin*, I hope you will agree that our members are engaged in the “positive programs” that Howard Mumford Jones imagined.

I welcome your comments, questions, and suggestions about the Academy. Please feel free to write me at jfanton@amacad.org.



Academy News

- 3 Academy Receives \$5.85 Million Gift from the Jack, Joseph and Morton Mandel Foundation
- 4 Academy-WGBH Partnership

Projects and Publications

- 5 A Conversation on *Restoring the Foundation*: The Important Role of Central and Southern Plains Institutions in Driving National Change
- 8 *Dædalus* Explores the Challenges and Opportunities Associated with Increasing Demands on a Limited Resource: Water

Presentations

- 10 *Restoring the Foundation*: Reviving the U.S. Science, Engineering, and Technology Enterprise
Neal Lane, Norman R. Augustine, and Steven Chu
- 22 Discovering Handel's London through His Music
Ellen T. Harris
- 29 Forty Years of Evolution in the Galápagos Finches
An Interview with Peter Grant and B. Rosemary Grant
- 32 Teaching and the Digital Humanities
William G. Thomas III, Anne Cong-Huyen, Angel David Nieves, Stephen G. Nichols, G. Wayne Clough, and James W. Wagner

On the Professions

- 44 On Legal Services for the Poor
John G. Levi
- 46 Causes of Campus Calm : Scaling China's Ivory Tower
Elizabeth J. Perry
- 48 Philologia Rediviva?
Sheldon Pollock
- 51 Shinto Festivals and Bricolage
Helen Hardacre

Update on Members

- 53 Noteworthy
- 55 In Memoriam : John David Steinbruner
- 57 Remembrance

Academy Receives \$5.85 Million Gift to Fund The Morton L. Mandel Program for Civic Discourse and Membership Engagement

In May 2015, the Academy received its largest single donation since its founding in 1780. The Jack, Joseph, and Morton Mandel Foundation, based in Cleveland, Ohio, donated \$5.85 million to establish the Morton L. Mandel Program for Civic Discourse and Membership Engagement. The endowment will strengthen and enhance the connection among the Academy's more than 4,600 Fellows and increase its engagement with the general public.

The hallmark of the Mandel Foundation's philanthropy is its commitment to invest in people with the values, ability, and passion to change the world. The Foundation sees those values, ability, and passion in the exceptional Fellows and the substantive programming and initiatives of the Academy. With its \$5.85 million gift, the Mandel Foundation aims to provide more opportunities in which Academy Fellows can exchange knowledge and expertise and advance new ideas.

Morton Mandel is Chairman and Chief Executive Officer of Parkwood LLC and Chairman and Chief Executive Officer of the Mandel Foundation, both headquartered in Cleveland. With his brothers Joseph and Jack, he founded the Premier Industrial Corporation, where he served as Chairman and Chief Executive Officer until 2006. He was elected to the American Academy of Arts and Sciences in 2011.

The major portion of the gift, \$5 million, will be an endowment and will fund two new positions:

- **The Morton L. Mandel Director of Membership Engagement**, who will develop new collaborative forums and platforms for Academy Members. In June 2015, Laurie McDonough joined the Academy staff in this role. She is designing and implementing programs and activities that will provide Members with more opportunities to connect to the Academy – and to each other. These activities include local program committees and regional events, informal discussion groups, and the implementation of a new digital platform that will allow Members to connect, collaborate, share resources, and develop project ideas.
- **The Morton L. Mandel Presidential Fellow**, who will work directly with the President of the Academy to expand and promote public outreach, innovation, and new policy projects.

In addition, The Mandel Endowment will support the **Distinguished Morton L. Mandel Annual Public Lecture**, which will be streamed internationally, as well as a series of regional lectures. The lectures will strengthen the Academy's role in promoting discourse with the general public on important issues facing the nation and the world. The lecture series will debut in November of 2015. The activities of the first year of the initiatives listed above will be supported by \$250,000 in expendable funds.

The remaining \$600,000 will be used to fund state-of-the-art technological improvements to the House of the Academy in Cambridge, Massachusetts. These include significant upgrades to live, interactive, streaming capabilities; teleconferencing; digital audio and video recording; and networking platforms.

The Academy is grateful to Morton Mandel and the Mandel Foundation for supporting the Mandel Program for Civic Discourse and Membership Engagement. ■

Academy-WGBH Partnership

Earlier this year, the Academy announced the establishment of a partnership with Boston-based public broadcaster WGBH News. This collaboration will provide local audiences with greater access to Academy research and the expertise of its members, as well as a more comprehensive understanding of local, national, and international issues through WGBH News reporting.

The first collaboration, which aired during the week of July 13, 2015, was a special, in-depth report series on water that drew from and expanded on research and expert commentary from the Summer 2015 issue of *Dædalus* “On Water.” This five-part series, “Water Pressure: Saving a Threatened Resource,” traveled from the ports of New Bedford, Massachusetts, to drought-ridden California to examine the availability, security, and sustainability of water across New England, the United States, and the world, and the political and economic tensions that this natural resource presents to communities everywhere. The series aired locally on 89.7 WGBH Radio.

“Through this collaboration with WGBH, the Academy will have new opportunities to advance its 235-year-old mission ‘to cultivate every art and science which may tend to advance the interest, dignity, honor and happiness of a free, independent and virtuous people,’” said Academy President Jonathan Fanton. “Our story began with John Adams, James Bowdoin, and other Bostonians who created the Academy to serve the Commonwealth and the new nation. A partnership with a Boston institution like WGBH continues this long and distinguished tradition of service. We are particularly delighted that the first product of our new collaboration will be a series of reports on our changing relationship with water, an issue of real concern for New England and for the world.”

“WGBH News strives to bring a greater layer of depth and substance to our reporting,” said Phil Redo, WGBH General Manager for Radio. “With this partnership, our newsroom will have access to some of the most forward-thinking experts and research across a range of disciplines, from science and innovation to international relations, the arts and social justice. Not only will we be able to offer our audiences a greater understanding of the world around them, but we will also contribute to national conversations through a local lens. WGBH News is particularly pleased to collaborate with a local organization that reflects the unique wealth of expertise that the Boston region boasts.”

The Academy’s projects and work on the humanities, arts, and education; science, engineering, and technology; and global security and international affairs align well with WGBH News’ core coverage areas. The two organizations will work together to produce reporting features and community events that highlight world-leading discourse on these topics. WGBH’s Forum Network also will record lectures from the Academy and make them available to the public in its free online archive. ■



To listen to “Water Pressure: Saving a Threatened Resource” and to access additional resources, visit wgbhnews.org/waterpressure.

A Conversation on *Restoring the Foundation*: The Important Role of Central and Southern Plains Institutions in Driving National Change

On May 28, 2015, the Academy convened a workshop in Chicago to discuss how a regional working group of state, local, and university leaders from the plains states could help implement the recommendations from the Academy's recent report *Restoring the Foundation: The Vital Role of Research in Preserving the American Dream*. The primary objective was to identify a clear plan of action for how such a working group could collaborate to communicate the importance of the nation's science and engineering research enterprise to policy-makers.

The participants included twenty-two vice presidents and vice chancellors for research; five deans, provosts, and vice provosts; and six state EPSCoR (the National Science Foundation's Experimental Program to Stimulate Competitive Research) directors and associate directors, along with economic development and government relations officials. EPSCoR's mission is to strengthen science and engineering research states that are underrepresented in the National Science Foundation's funding portfolio. Of the twenty-eight states that currently qualify for the program, twelve were represented at the meeting.

These twelve states – from Louisiana and New Mexico to Iowa and the Dakotas – represent 20 percent of the nation's population and 25 percent of its federally supported scientific research. The plains states share a broad range of common research interests, particularly those related to rural concerns such as rural health and agriculture, as well as the food-energy-water nexus. Articulating

the role of research in these areas to regional stakeholders, especially governors and local businesses, will be integral to advancing the recommendations in *Restoring the Foundation*.

Joining Forces in the Plains States

The workshop, cochaired by Kelvin Droegemeier (Vice President for Research at the University of Oklahoma and Vice Chair of the National Science Board) and Kelly Rusch (Vice President of the Office for Research and Creative Activity at North Dakota State University and EPSCoR State Project Director for North Dakota EPSCoR), provided a venue for participants to discuss their common interests, challenges, resources, and capabilities. As Droegemeier said, "we can do more together than we can apart."

Rusch affirmed this observation, saying that, "Within our individual states, we are concerned about our day-to-day struggles with our own state governments. But collectively, as these twelve states,



Neal Lane (Rice University) speaks to university vice presidents of research and state and local leaders about *Restoring the Foundation*.

Successfully Navigating New Waters: Excerpts from a Speech Delivered by Sally Mason

Sally Mason is President Emeritus of the University of Iowa.

The uncertainties and challenges facing higher education are not the same as those we faced ten, twenty, or even one hundred years ago. But our public universities are one of the great achievements of American society, and today, as a century ago, they are at the very core of the American Dream.

Let me here emphasize that I don't believe that student success, teaching, economic development, and research are mutually exclusive. Even in tough economic times, we don't need to sacrifice one for the other. Rather, as in any period of change, adaptability and flexibility are key. There are ample opportunities at our institutions to implement change – even to do so quickly – despite the seemingly overwhelming nature of the task.

But in these uncertain times, how can we reimagine our approaches to the research enterprise? To begin, universities must diversify their research portfolios. This challenge requires that we build new partnerships outside of traditional government and in industry, increase interdisciplinary approaches, and better incorporate our research expertise into our core missions of undergraduate education and public engagement.

You never know when or where you might find an interesting partner. Let me encourage you not only to work with businesses in your states, but to continue to work with as many different

groups as you possibly can. We must reach out and make certain that we break down the silos that have been built within our institutions. Businesses and nonprofits reach out all the time; we as research universities must do so as well. Our systems may not incentivize it, and institutional barriers (even interinstitutional barriers) may make it challenging to work together. But it behooves us: the more we can work together, the better off we all will be.

Change is daunting; there is no doubt about it. But change has always been a fundamental part of the university: the very essence of discovery is the new. Public universities are difficult ships to steer, but if we are doing our jobs right, we as teachers, researchers, and administrators will always be directing them to new and unexplored waters. That territory must include not only the subjects we want to explore, but also the new ways in which we go about our work.

Our institutions would not be what they are today had we not planned and innovated in uncertain times. So do not let that be a stumbling block. After all, what times are not uncertain? Our public universities have successfully navigated new waters since the very beginning; indeed, that has always been our stock-in-trade.

the plains states, we are a very strong group. The question is, how do we take our individual strengths within our states, and our collective strengths, and create one voice?"

University of Iowa President Sally Mason also challenged the group to build new partnerships, while acknowledging the barriers posed by current incentive structures and institutional boundaries. She urged university vice presidents and vice chancellors for research to work with their institutions to review promotion and tenure policies and to foster a fresh research culture that encourages collaboration and rewards shared credit.

Strengthening the partnership among universities, industry, and the government is a core recommendation from *Restoring the Foundation*. The report also highlights the need for sustainable federal investments in research and for implementing policy reforms to increase the efficiency and effectiveness of America's research system.

Restoring the Foundation cochair Neal Lane (Senior Fellow at Rice University's Baker Institute, former Science Advisor

to President William J. Clinton, and former Director of the National Science Foundation) stressed the importance of gaining the attention of policy-makers across America. He urged the participants to begin with leaders in their own states: "We really must get the conversation going so that the public, their elected representatives, and leaders in all sectors understand why steady, sustainable investment and policy change are so important. The people who represent your states are in key positions right now, and if they hear from you and your colleagues, your business leaders, your university leaders, that makes a difference. Those voices are important."

Taking Action Together

One participant observed that universities from the central and southern plains operate too often like "felons on a raft," working together for immediate survival but then parting ways once the destination has been reached. Instead, they should identify the unique and enduring characteristics that bind their organizations,

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and then consider how to leverage those strengths to help lift the nation amid a rising tide of global competition.

The workshop reinforced this goal through a series of small-group discussions on challenges facing America's research enterprise, including STEM education; intellectual property and tax laws; the government-university-industry partnership; national science and technology policy; faculty workload; and the benefits of finding common cause on research issues.

These breakout discussions produced consensus agreement on a set of seven actions that would establish a unified sense of purpose for central and southern plains institutions within the national conversation. But as Droegemeier stressed, "We're not here just to talk; we're here to act." Participants thus pledged to carry out these actions on their own campuses, including:

1. signing the recent public statement "Innovation: An American Imperative" in support of several recommendations from *Restoring the Foundation* (available at www.innovation-imperative.us);
2. developing a concise and consistent message to use in encouraging sustained federal support for basic research;
3. enlisting two to four major companies in each participant's state to help communicate the value of basic research to governors, state legislators, and Congressional delegations;
4. coordinating with national university organizations to identify mechanisms for removing roadblocks to IP negotiations, and to explore their implications for both public universities and private companies;
5. in collaboration with local industry and considering the unique research challenges and institutional resources of the Midwest, summarizing successful research stories in a report that supports *Restoring the Foundation*, catalyzes collaboration in the central and southern plains, encourages state legislatures and Congress to support basic research, and fosters a greater understanding of how basic research ultimately leads to local and regional economic development;
6. engaging successful alumni in an effort to communicate the findings in *Restoring the Foundation* to state and national policymakers; and

7. identifying specific examples of how federally supported basic research at each institution is making a difference at the local, state, regional, or national level.

By establishing a unified voice among research institutions in the central and southern plains region, these actions will add considerable strength to the recommendations from *Restoring the Foundation*. The Academy is now working with the participating institutions to implement these actions and extend them to other states and regions.

More information about *Restoring the Foundation* may be found on the Academy's website at www.amacad.org/restoringthefoundation. ■



Dædalus Explores the Challenges and Opportunities Associated with Increasing Demands on a Limited Resource: Water

There is no resource more central to life on Earth than water. It is essential to the survival of people, organisms, and economies; its availability is inextricably linked to humanity's need for security, energy, food, and community. At the same time, climate change, population growth, and economic development are currently placing unprecedented demands on this limited resource, increasing the uncertainty associated with future demands on and the availability of water. (The uncertainty is not whether there is enough water on our planet, but of what state is the water that is available to us: Is it salty or fresh? Is it frozen or liquid? Is it clean or contaminated? Is it here or elsewhere? Is it available when needed, or does it arrive when it is harmful?)

The Summer 2015 issue of *Dædalus* moves beyond the failures of our tried approaches to water management. Guest editors Christopher B. Field and Anna M. Michalak instead frame contemporary events and issues within the context of the decisions we face – and the opportunities that emerge – when we are confronted with increasing demands on water resources:

Decisions about water often tell us more about our priorities than they do about the total amount of available water. Many of the trade-offs in allocating water involve three big water users: food, energy, and environment. A world with an increasing human population, burgeoning energy demands, evolving food preferences, and a rapidly changing global climate means that everything about the water equation is dynamic. The result is a complicated web of interconnections with potentially unexpected risks, but also with many points for intelligent intervention.

Christopher Field, a Fellow of the American Academy since 2010, is the Founding Director of the Carnegie Institution for Science's Department of Global Ecology and the Melvin and Joan Lane Professor for Interdisciplinary Environmental Studies at Stanford University. Anna Michalak is a faculty member in the Department of Global Ecology at the Carnegie Institution for Science and an Associate Professor in the Department of Earth System Science at Stanford.

In their essay, "Water, Climate, Energy, Food: Inseparable & Indispensable," Field and Michalak present a number of case studies illustrating the competing drivers, demands, and tradeoffs that frame the decisions humanity makes about water use. They make the case that an integrated systems approach to water issues is critical to identifying and evaluating options for sustainable solutions.

Among the other essays in the volume, Terry L. Anderson's (Hoover Institution and Property and Environment Research Center) essay, "Dynamic Markets for Dynamic Environments," examines the inability of static economic models to connect changing human demands on water systems with changing supplies that result from short-run climate variations and long-run climate change. As an alternative, Anderson advocates water markets and redefined water rights, offering examples of how novel entrepreneurial approaches more responsively meet old and new demands on water ecosystems. Also in the volume, John Briscoe (Harvard University), in his essay "Water Security in a Changing World," defines the concept of water security and explores the implications of the eternal pursuit of it. He reviews how water security is understood by wealthy and by poorer nations, and how the tensions that arise from these differing perspectives manifest in a world characterized by rapidly shifting economic and power dynamics.

In their essay, "Urban Water-Supply Reinvention," Richard G. Luthy (Stanford University) and David L. Sedlak (University of California, Berkeley) provide examples of innovative approaches to utilizing local water resources to achieve more resilient water supplies in cities in drought-prone regions of the American West and Australia. These approaches include seawater desalination, wastewater recycling, and aquifer recharge. And Katharine L. Jacobs (University of Arizona) and Lester Snow (California Water Foundation) – in "Adaptation in the Water Sector: Science & Institutions" – take on the unprecedented set of questions that climate change poses for water managers, and detail how the complexity of the water-energy-food nexus requires more flexible solutions than humans have previously developed.

Print and Kindle copies of the new issue can be ordered at: <https://www.amacad.org/publications/daedalus>. ■

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Essays in the Summer 2015 issue of *Dædalus* include:

Water, Climate, Energy, Food: Inseparable & Indispensable by **Christopher B. Field** (Carnegie Institution for Science) and **Anna M. Michalak** (Carnegie Institution for Science)

Water in Mythology by **Michael Witzel** (Harvard University)

Water Security in a Changing World by **John Briscoe** (Harvard University)

Progress on Nonpoint Pollution: Barriers & Opportunities by **Adena R. Rissman** (University of Wisconsin-Madison) and **Stephen R. Carpenter** (University of Wisconsin-Madison)

Water Unsustainability by **Jerald L. Schnoor** (University of Iowa)

Adaptation in the Water Sector: Science & Institutions by **Katharine L. Jacobs** (University of Arizona) and **Lester Snow** (California Water Foundation)

Urban Water-Supply Reinvention by **Richard G. Luthy** (Stanford University) and **David L. Sedlak** (University of California, Berkeley)

Dynamic Markets for Dynamic Environments: The Case for Water Marketing by **Terry L. Anderson** (Hoover Institution and Property and Environment Research Center)

Impair-then-Repair: A Brief History & Global-Scale Hypothesis Regarding Human-Water Interactions in the Anthropocene by **Charles J. Vörösmarty** (City University of New York), **Michel Meybeck** (French National Center for Research), and **Christopher L. Pastore** (University at Albany, State University of New York)

Restoring the Foundation: Reviving the U.S. Science, Engineering and Technology Enterprise

On April 30, 2015, Rice University's Baker Institute for Public Policy hosted a Civic Scientist Lecture on *Restoring the Foundation: Reviving the U.S. Science, Engineering and Technology Enterprise*, featuring Norman R. Augustine (Cochair of the Academy's *Restoring the Foundation* report; retired Chairman and CEO of Lockheed Martin Corporation; and former Under Secretary of the United States Army) and Steven Chu (William R. Kenan, Jr., Professor of Physics and Professor of Molecular and Cellular Physiology at Stanford University; and former U.S. Secretary of Energy). Neal Lane (Cochair of the Academy's *Restoring the Foundation* report; and Senior Fellow in Science and Technology Policy at Rice University) moderated the discussion. The program also included a welcome from Academy President Jonathan F. Fanton. The following is an edited transcript of the discussion.



Neal Lane

Neal Lane is Senior Fellow in Science and Technology Policy at the Baker Institute for Public Policy, Malcolm Gillis University Professor Emeritus, and Professor of Physics and Astronomy Emeritus at Rice University. He is former Assistant to the President for Science and Technology, former Director of the White House Office of Science and Technology Policy, and former Director of the National Science Foundation. He was elected a Fellow of the American Academy in 1995 and serves as Cochair of the Academy's *Restoring the Foundation* report.

Welcome to Rice University and to Rice University's Baker Institute for Public Policy and today's Civic Scientist Lecture. This evening we will hear from two of the nation's best-known and most distinguished civic scientists, Steven Chu and Norman Augustine.

This evening's lecture is part of the Baker Institute's Civic Scientist Program, one of the institute's Science and Technology Policy initiatives, which highlights outstanding scientists and engineers and technical professionals who, in addition to making significant contributions in their fields, also devote a portion of their careers to public service, either by serving in government or in other ways engaging the public and policymakers on the important role of science, engineering, and technology in American society. A goal of our program is to encourage others to follow the example of our civic scientists and more generally to promote a dialogue to help bridge what seems to still be a gap in our society between science and rational public policy-making.

We are endeavoring to spread the word about the link between science and technology and the public good through both this lecture series and our K-12 school outreach program, which is coordinated with Rice University's larger outreach effort. Last year we sent dozens of scientists and engineers, including both of today's speakers, to local

middle and high schools, reaching more than 1,500 students.

The Civic Scientist Program would not be possible without the generous support of our sponsors. The program has received enthusiastic support from Rice, specifically from the Brown School of Engineering, the Wiess School of Natural Sciences, and the Department of Physics and Astronomy – all of which are co-organizers for tonight's event. I want to give special thanks to Benjamin and Winifer Cheng for their considerable support of the program and to Shell Oil Company for supporting this lecture series, which is part of the Baker Institute Shell Distinguished Lecture Series. In addition, this special event is being jointly sponsored by the Baker Institute Center for Energy Studies, its Science and Technology Program, and the American Academy of Arts and Sciences.

Last September the Academy published a report entitled *Restoring the Foundation: The Vital Role of Research in Preserving the American Dream*. The report is a call to the public, business leaders, community leaders, and policymakers at all levels to recognize that the discoveries that come out of basic research in all fields of science, engineering, and medicine are vital to the development of new knowledge, new innovative technologies, new diagnostics and cures, new industries, new jobs, and the economy as a whole.

Our first speaker this evening is a one-of-a-kind aeronautical engineer, Norman Augustine. He is the author of several books, including a funny book on management called *Augustine's Laws*. Born in Colorado, he went to Princeton, where he received a degree in aeronautical engineering and later served on the faculty there as a lecturer with the rank of professor. He enjoyed a long, distinguished career in the aerospace industry, capping it off as President, CEO, and Chairman of Lockheed Martin. In the 1970s, Mr.

Augustine served in the federal government as Under Secretary – and, at one point, acting Secretary – of the Army. Throughout his career he has advised universities, companies, government agencies, the White House, Congress, and other organizations. He served on the President's Council of Advisers on Science and Technology for all sixteen years of the Bill Clinton and George W. Bush administrations. He has chaired influential blue-ribbon advisory committees on topics as varied as energy, national domestic security, the future of the U.S. space program, and the U.S. Antarctic program. I am personally grateful to Norm for helping me convince Congress to fund a new South Pole research station when I was director of the National Science Foundation. Norm also led the National Research Council study *Rising above the Gathering Storm*, which warned of the nation's loss of leadership in science, technology, and innovation and has been one of the National Academy of Sciences' most influential reports.

Norm has a long list of honors, including election to the American Academy of Arts and Sciences, the American Philosophical Society, and the National Academy of

***Restoring the Foundation: The Vital Role of Research in Preserving the American Dream* is a call to the public, business leaders, community leaders, and policy-makers at all levels to recognize that the discoveries that come out of basic research in all fields of science, engineering, and medicine are vital to the development of new knowledge, new innovative technologies, new diagnostics and cures, new industries, new jobs, and the economy as a whole.**

Engineering, where he served as chairman. In 1997, he received the National Medal of Technology.

I have had the pleasure of cochairing with Norm the American Academy of Arts and Sciences Study Committee that created the *Restoring the Foundation* report you will hear about this evening, and I personally benefited from his wisdom, intelligence, political savvy, and humor. We are delighted to have Norm with us today.

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Norman R. Augustine

Norman R. Augustine is retired Chairman and Chief Executive Officer of Lockheed Martin Corporation. He is also former Under Secretary of the U.S. Army. He was elected a Fellow of the American Academy in 1992 and serves as Cochair of the Academy's Restoring the Foundation report.

We started work on *Restoring the Foundation* by talking about the American Dream, which has inspired so many people not only in America but throughout the world. I myself have lived the American Dream. Nobody in my family ever had the opportunity to go to college. Only one had gone to high school. My wife has lived the American Dream to a far greater extent. She came to America on a boat from Scandinavia alone when she was nineteen years old with two suitcases, \$50, and a job she found in the *New York Times* want ads. The concern of the Academy committee was that today the American Dream is very brittle and in existential danger. That was what brought many of us together to work on this study.

Almost a decade earlier, I had worked on the *Gathering Storm* study conducted by the

Basic research is endangered because it is the most difficult form of research to defend outside of the research community itself.

National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine. Among the twenty recommendations we made, the top one had to do with education, the second had to do with research – despite this being a study not of research and education but of America's economic competitiveness.

When we began work on *Restoring the Foundation*, we were particularly interested in research, thanks in part to the *Gathering Storm* report. We ended up focusing on basic research, because basic research is probably the most endangered form of research, yet is arguably the most important.

Basic research is endangered because it is the most difficult form of research to defend outside of the research community itself. I have tried mightily many times, particularly on Capitol Hill. The trouble is that even those performing purely curiosity-driven research cannot say what benefit will be derived from their efforts.

Another difficulty in trying to defend such research is that the average person frequently doesn't connect his or her personal well-being with what scientists in white robes are doing in the back of some laboratory. Why is this important to me, they ask? The fact, of course, is that it is terribly important, but much of the public doesn't seem to realize that.

I recall one congressional hearing where a major argument took place about research being conducted on the color and chemistry of butterfly wings, which some members thought was a waste of money. Well, out of that study unexpectedly came an ingredient used in the treatment of cancer.

At another hearing I sat beside a witness who had been studying the behavior of

Weddell seals under the ice pack in Antarctica. The question was asked about this research, "What does that have to do with any taxpayer?" According to the witness's testimony, what they learned during that research project is now helping save the lives of thousands of children undergoing respiratory surgery.

Who else should care about the well-being and the health of research in America? Well, almost anyone who wants to have a job. Surveys conducted around the world asking what is the most important factor in determining your well-being overwhelmingly find the answer is "to have a good job." And what does it take to create jobs? The first step is to grow the gross domestic product. To increase the number of jobs in America by one percentage point, you have to add about 1.7 percentage points to the GDP. But where does that latter growth come from? Well, numerous studies, one of which led to a Nobel Prize, show that up to 87 percent of GDP growth in this country comes from advances in just two closely related disciplines: science and technology. Yet only 5 percent of the workforce in America are scientists or engineers! The important thing is that these individuals create a disproportionate number of jobs compared to the other 95 percent. By my calculations, the multiplier for engineers in job creation is almost ten to one.

Who else might care about the health of the research enterprise? Without the building blocks that scientists provide from basic research, engineers could not address such problems as providing clean, sustainable energy; preserving the environment; providing national security; and much more.

That would be like asking engineers to build a wall without providing bricks.

Then there are, of course, those of us in this room who would not be alive today were it not for the accomplishments of the research enterprise. When my parents were born, the life expectancy in America was forty-seven years. When they passed on, it was seventy-nine years. Much of that gain can be attributed to work that took place in research laboratories in universities, in government and elsewhere. A large part of the gain was of course the result of reductions in infant mortality, but that made it no less important to people like my sister, who died shortly after she was born.

Then there are those of us who care about today's lifestyle. Without basic research we wouldn't have computers or global positioning systems or global communications or TVs or weather satellites to warn of storms. Consider Apple, which deserves great credit for the iPod, the iPad, and the iPhone. But it wasn't Apple that made these products possible. The things Apple produces today that create jobs for so many people and add to one's lifestyle were made possible by scientists working decades ago in fields such as solid-state physics and quantum mechanics. Presumably they had no inkling of the profound impact their work would have on society. Further back in time, it is worthy of note that Roentgen did not have a contract to produce an X-ray machine – and Flemming was not working on a project to produce antibiotics.

Finally, how about those among us who care about national security and homeland security? The United States today has the eighth-largest military force in the world in terms of overall personnel count. Every Secretary of Defense I have known has said that a major part of the margin of victory possessed by our military forces must be attributed to advancements in science and technology.

So if research and technology are so important, how are we doing in this country at supporting them? One of the measures used in the Academy's report is the percentage of GDP devoted to research, sometimes referred to as research intensity. A couple of decades ago, the United States ranked first in this measure. Today we are seventh. In the case of research and development, we have fallen from first to tenth place. Even an organization as highly regarded by the public as the National Institutes of Health has seen its budget cut by 22 percent in real dollars the last few years, offsetting an earlier effort to increase its resources.

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The enabling question is who should fund research.

Our universities, particularly our great state universities, perform much of the research that is accomplished, so perhaps they should provide most of the funding. But our public colleges and universities are also responsible for educating 70 percent of our young people and are in no position today to fund research while states disinvest in higher education and tuition soars. The states now provide a smaller percentage of the operating budgets of our state universities than at any time in the last quarter century, and the percentage has been declining steadily.

Philanthropy is of course important, but the aggregate amount tends to be relatively small and tends to be directed toward specific areas of personal interest to the philanthropist.

What about industry, which is a major beneficiary of basic research? The U.S. government used to fund two-thirds of the R&D conducted in this country while industry funded most of the other one-third. As government reduced its investment over the years, that ratio has flipped.

The problem is that industry mostly funds "D" and not "R." And while I don't agree that this is a sound long-term strategy, industry does have a very good reason for doing what it does: most of today's shareholders own a given company's stock for an average of four months, and they have little interest in seeing their money spent

on things that won't have an impact for another ten years. In contrast, when I first entered the business world the retention period was eight years.

That leaves the federal government as the funder of last resort for research. So how is the federal government doing in this regard today? Well, the U.S. government ranks twenty-ninth in the world in the fraction of research conducted within the country that is funded by the government.

So what can we do? Answering that question takes up the main part of the Academy's report. The first and broadest recommendation has to do with, as you might expect, the funding of basic research. Much of the research that American industry has built on to create jobs during the last two decades was performed in the 1970s and 1980s. During the period spanning from

Every Secretary of Defense I have known has said that a major part of the margin of victory possessed by our military forces must be attributed to advancements in science and technology.

1975 to 1992, basic research grew steadily at 4.4 percent per year, in real dollars. Despite this being a time of many challenges to the nation, we remained committed to funding basic research. But since 1992, our investment in R&D as a percentage of GDP has flat-lined.

Many presidents have said the goal of America should be to spend 3 percent of the GDP on R&D. Today it is around 2.7 percent. The Academy's report recommends that we move toward 3.3 percent, that we spend a tenth of that on basic research, and that we do this by the year 2032.

Why 2032? There are two reasons. One is that the youth born today will begin college in 2032. The other is that if we increase our spending at the rate recommended by the Academy – namely, 4 percent per year, as was the case during America's economic ascent – we will, by 2032, get our R&D funding to where it would have been had we not flat-lined in 1992.

The bad news is that to achieve the increase we recommend we will have to find money to support a 75 percent increase in basic research over the next seventeen years. The good news is that the amount we currently spend on basic research is so *de minimis* in the grand scale of federal budgets that to do so would require an increase of only 0.15 percent of the GDP.

The Academy's report makes a number of other recommendations. One is that we reaffirm the importance of peer review in determining what research should be conducted. Determining which specific research projects are selected for funding

should not be prescribed by policies enacted by the U.S. Congress.

Another recommendation is that we adopt a five-year rolling capital budget for basic research in order to give at least some idea of where we are headed in the long term and to prevent the sort of uncertainty that comes from not knowing whether the budget will go up or go down from one year to the next. Pulling up the roots once a year to see if the flowers are growing is generally not a constructive practice. I know of no successful company in this country that doesn't have a capital budget.

We recommend streamlining the proposal process for determining what grants are awarded by the government agencies

The Academy's report makes a number of recommendations. One is that we reaffirm the importance of peer review in determining what research should be conducted.

that oversee research funding. Today, research proposals to government agencies have about a 20 percent overall chance of being accepted, and a proposer will often have to wait a year to find out whether a specific proposal will in fact be funded.

The Academy's study also proposed practices that should make for better cooperation between industry, government, and academia. In most countries these institutions work in harmony, but in America we build barriers between them, such as intel-

lectual property rules, regulatory policies, and well-meaning conflict-of-interest rules that lead to an adversarial relationship.

We propose that the research and development tax credit be made permanent. Congress renews it each year and has been doing so for over fifteen years, but industry can't plan on it, so it doesn't make full use of it.

Then there's the matter of H1B visas. America's science and engineering enterprise would barely function today without foreign-born individuals who come to this country, receive their education here, and stay here. But our immigration laws do everything they can to keep these people out or to drive them back out once they receive their education. That, too, is counterproductive.

Generally the reaction to recommendations like these – especially when made at a congressional hearing – is that we don't have enough money. But, frankly, that is not true. The issue is not money. The issue is priority.

Take the NIH. The average American spends twenty-five cents a day to fund the

NIH. Yet each year the average American spends about seven times that amount on store-bought alcoholic beverages, legal tobacco products, and Halloween costumes for dogs. We could afford more for research; we simply need to ask what is important to us. That is what the funding question boils down to.

And that brings us back to the American Dream, which depends on having good jobs; and the secret to good jobs is education. A few years ago I was testifying before Con-

The engines that drive our nation are education, research, and technology.

gress on these very subjects, and one of the members became impatient with me and said, “Mr. Augustine, don’t you understand that this country has a funding problem?” Probably more succinctly than judiciously I replied, “Senator, I do realize that we have a budget problem. But I was trained as an aeronautical engineer, and during my career I worked on many airplanes that during their development program were too heavy to fly, and never once did we solve the problem by taking off an engine.”

The engines that drive our nation are education, research, and technology. Put simply, that is the message we need to carry to our nation’s leaders; I hope you will help.

Neal Lane

Our second speaker this evening is Steven Chu. He is a distinguished scientist, a Nobel laureate in physics, who took time out to serve in the Obama administration as the twelfth Secretary of Energy from 2009 to 2013. He was the first Nobel laureate to serve on a U.S. President’s cabinet. Dr. Chu shared the 1997 Nobel Prize in Physics for work he carried out while at Bell Labs on laser cooling and trapping of atoms, a technique that allows scientists to study individual atoms with remarkable accuracy and that has many applications, including atomic clocks, which are now the standard for time and frequency. Technologies such as GPS or the Internet would not be possible without them.

Dr. Chu was born in St. Louis and studied at the University of Rochester and then the University of California, Berkeley, where he received his Ph.D. He has held faculty posi-

tions at Stanford and at the University of California, Berkeley, where he served as director of the Lawrence Berkeley National Laboratory, which became a center for biofuels and solar energy research. In this brief introduction, I cannot adequately convey the impact Steve Chu had as Secretary of Energy, so I’m just going to use a brief quote from the *MIT Technology Review* of February 9, 2015: “Steven Chu broke the mold. In his four years of service, he made the Department of Energy more innovative, launching the Advanced Research Project Agency for Energy, ARPA-E, to support projects that are not yet ready for private investment. He also created innovation hubs to bring people from different disciplines together on energy problems, and he rejuvenated funding for solar research.” And, of course, he did many other things. Along the way, he was also a key figure in the federal response to the April 20, 2010, Deepwater Horizon accident, making sure that decisions about the response and cleanup were informed by science.

After stepping down as Secretary of Energy in 2013, Dr. Chu returned to Stanford University, where he is continuing his pathbreaking physics research, with a focus on biology, biomedicine, new energy technologies, and many other important applications. Dr. Chu has a long list of honors beyond the Nobel Prize, including election to the American Academy of Arts and Sciences, the American Philosophical Society, and the National Academy of Sciences; and election to several foreign honorary organizations, including the Royal Society. Dr. Chu is a member of the American Academy Study Committee that wrote the *Restoring the Foundation* report.



Steven Chu

Steven Chu is William R. Kenan, Jr., Professor of Physics and Professor of Molecular and Cellular Physiology at Stanford University. He is former U.S. Secretary of Energy and former Director of the Lawrence Berkeley National Laboratory. He was elected a Fellow of the American Academy in 1992.

The way the public envisions research – a lone, gifted person working in seclusion and coming up with brilliant ideas – is not how it usually happens. Research typically is done with teamwork, a lot of joint stimulation. At times in the history of science, institutions remained at the forefront of knowledge creation for several generations of scientists. Some of these led to what we might call golden moments in science. Two examples that stand out are the Medical Research Council’s Laboratory of Molecular Biology or LMB (an offshoot of the Cavendish Laboratory at the University of Cambridge) and AT&T Bell Laboratories.

Among the scientists who have worked at the relatively small Laboratory of Molecular Biology over the years, thirteen have been awarded Nobel Prizes, as have at least seven

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postdocs and scientists who trained there. At the LMB, structural molecular biology was developed that led to our ability to determine the atomic structure of proteins. Perhaps the most famous discovery made by scientists who worked at this legendary laboratory is the structure of DNA.

Bell Labs also had an extraordinary number of scientists and engineers who were awarded Nobel Prizes, fifteen in all. What is remarkable about this track record is that Bell Labs liked to hire young scientists instead of established stars. The vast majority were freshly minted Ph.D.s or young scientists who had just completed a post-doctoral position.

The wealth of scientific discoveries and engineering marvels that came out of Bell Labs was remarkable. Bell Labs invented the negative feedback electronic amplifier needed for long-distance transmission. Their engineers and mathematicians defined the very concept of “information,” proved the fundamental limits of information transfer, proved that perfect information transfer is possible even in the presence of noise and loss of data, and established the theoretical limit to *any* error correcting scheme. They developed a telephone network based on electronic rather than mechanical switches, invented the transistor that became the basis of computer switching, the laser, the silicon solar photovoltaic cell, the CCD (charged coupled device) that replaced film cameras, and functional magnetic resonance imaging that has revolutionized behavioral psychology

and neuroscience. They also invented the underlying programming language used by Apple and Google, by cell phone technology, by undersea transatlantic transmission, and by satellite communications.

Many of these inventions grew out of “basic research” at Bell Labs, but what was basic research and how was it incorporated in an industrial laboratory? As an example, consider Clinton Davisson, who came to Bell Labs during World War I to work on vacuum tubes for the military. He was a young scientist going places, an instructor at Princeton who could easily have had an academic career in one of the best universities, but he liked the atmosphere at Bell Labs, and Bell Labs liked him. They recognized that Davisson was brilliant, and they gave him freedom to explore, so he stayed.

Beginning in the early 1920s, Davisson and his assistant Lester Germer were investigating the angular dependence of electrons in a vacuum tube scattering from a nickel plate. They knew about a development in a new theory called quantum mechanics that suggested that particles, like electrons or atoms, could act as waves. They constructed a vacuum tube containing a collimated and variable energy electron source, an annealed nickel target, and an electron detector that could be rotated with respect to the surface. In 1927, they reported that the electrons scattering from the surface were described by wave diffraction used to describe X-ray scattering from periodic crystals. This seminal experiment confirmed this fundamental property of the quantum nature of matter. A

decade later, Davisson became the first Bell Labs scientist to be awarded a Nobel Prize.

A number of aspiring scientists were drawn to Bell Labs to work with the great man. One of these people was a young physicist named Bill Shockley. Shortly after Shockley joined Bell Labs in 1936, he recalls a conversation with the director of AT&T Research, Mervin Kelly. As Shockley writes in his Nobel lecture,

Upon my arrival I was assigned by Dr. M. J. Kelly to an indoctrination program in vacuum tubes. In the course of this program Dr. Kelly spoke to me of his idea of doing all telephone switching electronically instead of with metal contacts. Although I did not choose to continue work on vacuum tubes and was given freedom to pursue basic research problems in solid-state physics, Dr. Kelly's discussion left me continually alert for possible applications of solid-state effects in telephone switching problems.

The vision of the management at Bell Labs and a team of brilliant scientists led to the invention of the transistor in 1949. Apart from the time Shockley spent working on radar during World War II, he devoted most of his time working on theoretical studies in solid state physics. In 1945, Kelly formed the Solid State Group with Shockley as the leader. John Bardeen, Walter Brattain, and Bill Shockley were awarded another Nobel Prize in 1956. For the next half century, Bell Labs remained a leader in semiconductor physics, semiconductor materials science, and devices based on semiconductors.

The first transistor was something only a mother could love; it is ugly and ungainly, but Bell Labs knew it was the secret to miniature, low-power electronics that would revolutionize the world. And they were right. The practical applications have been immense, but it all came out of the basic research that developed quantum mechanics in the 1920s. The researchers who invented

quantum mechanics never dreamed that a theory developed to explain the spectra of light from atoms would lead to the transistor and the laser.

How did LMB and Bell Labs remain at the pinnacle of science for a half a century? Was the magic in the water they drank? Or can we understand and replicate these institutions today? I have thought a lot about this over the past twenty years, and I have concluded that we *can* draw several lessons.

Lesson one. Great people try to hire people better than they are, people who have the potential to surpass them. They don't hire people to be assistants – they seek protégés. The very best people aren't insecure – or at least they are less insecure. They want the very best people around them. Second-tier people are more drawn to people who think and act like them. Radical thinkers carry more risk and are, by definition, not widely recognized. In short, A's hire A's, and B's hire C's. I see this pattern in industry, in government, and in academia.

Another common denominator was that LMB and Bell Labs had very flat management structures. In the research depart-

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ments of Bell Labs with which I was familiar, managers who oversaw up to several hundred research employees were expected to be engaged in active research with their own brains, and in the case of experimentalists, their own brains and *hands*.

Sydney Brenner, a Nobel laureate who worked at LMB for many years, said about the laboratory, “We attracted the best. Our job was to create people better than ourselves.” At LMB, especially in the early days, they felt a collective mission. When I

talked to Sydney of those early days, he told me, “*Everybody* worked in the lab. Flies, rats, physicists, chemists – were all going in the same direction.” Perhaps that was an exaggeration. Flies tend to be a bit more erratic. But the excitement of the research at LMB – the understanding of biology down to the molecular level as it was unfolding – was totally infectious.

Lesson two. After hiring the very best people, let them spread their wings and let them find their way. The management at Bell Labs supplied its scientists with funding, shielded them from extraneous bureaucracy, and urged them not to be satisfied by merely doing “good science.” When I started there, my department head told me to spend my first six months in the library and to talk to people before deciding what to do. A year later, during my first performance review, he chided me to be content with nothing less than starting a new field. I was a cheeky kid at that time and said, “I would love to start a new field. Can you give me a hint as to which field I should start?”

Lesson three. People stimulate each other; they get people to talk in informal

settings. When I became a department head at Bell Labs, my job was to help scientists in my group flourish. I would say, “Oh, you're working on this. You should talk to so-and-so over here. They may be able to help you. You should talk to them to find out what they're doing.” The Bell Labs culture promoted communication and communal brainstorming.

Most laboratories hold seminars where the scientists report on their work, but often they are attended only by the scien-

tists' own group or those in their immediate specialty. At LMB, Crick instituted an annual week-long set of seminars known as "Crick Week," which would be attended by *all* members of the laboratory.

At Bell Labs, lunch was the common scientific meeting ground. Even if you weren't hungry, you would go down at midday for an hour and sometimes longer. We would sit at big round tables with no borders that allowed "squeezing in." A common question was, "What are you up to?" In formal seminars, talks would seldom go more than fifteen minutes before someone would say, "I don't understand this. What are you talking about?" One outspoken department head was famous for regularly getting up and saying, "What the hell are you doing that kind of crap for?" The more civilized form of the question is, "What is the fundamental direction and importance of what you have done, and where do you want to go." In this way, the typical forty-five-minute seminar would stretch to an hour-and-a-half and often include some very blunt discussions.

It is important to get the right intellectual leaders to step forward to lead a team of researchers in a flat organization. The leaders should continue to be active researchers so that they remain solidly grounded.

Lesson four. The best science lab managers were some of the best scientists. Many of the best scientists avoid administrative roles for fear it would dilute their research efforts, but as a department head at Bell Labs, I could spend 80 percent of my time doing research in my own laboratory with my own hands. All department heads and division directors at Bell Labs were expected to carry on active research of the highest quality. Managers didn't go into management to retire from active research.

What was the attraction to becoming a manager at Bell Labs? As managers, we could mentor the best scientists and influence the direction of science. Hiring and funding decisions were made at the department head and director level, and upper management didn't demand extensive letters from outside experts to justify hiring. We were adequately funded and weren't allowed to seek any outside funding. Beyond a base level of funding, the department head was the first person who decided on additional support for significant equipment purchases; for greater additional resources, a director was consulted. There were no outside referees and decisions to proceed were often made after a single discussion.

Lesson five. Developing and applying new technology will maximize your chances of making a great discovery. I tell my students and postdocs that if they are the hundredth person to look under a rock with the same set of tools, they are probably not going to see anything new. If you're the first to look under the rock with a new set of

tools, you don't even have to be that smart to discover something new. At Bell Labs and LMB, there was a great appreciation for researchers who wanted to develop a new set of experimental tools.

While at Bell Labs, and earlier while I was a graduate student and postdoc at Berkeley, a large part of my efforts was spent improving or inventing new measurement tools. When I began to work on laser cooling and laser trapping of atoms at Bell Labs in the fall of 1983, the only application on my radar

screen was that the technology could be used to make a better atomic clock. After my group demonstrated the first "atomic fountain" at Stanford in 1987, it was a mere seven years before the atomic fountain configuration became the atomic clock time standard. Seven years is a very short time to go from discovery to practical implementation.

In 1989, I and one of my graduate students, Mark Kasevich, showed that wave interference properties of atoms could make exquisite measurements of acceleration and rotation. Mark is now a professor at Stanford and is developing ultra sensitive atom interferometers with applications from precision testers of general relativity to more precise inertial guidance systems. He is also designing a satellite atom interferometer that will measure tiny changes in the force of gravity due to changes in the local distribution of the mass of the Earth. The sensitivity of this satellite should allow us to measure changes in the thickness of glaciers with submillimeter accuracy and changes in the amount of water stored in underground aquifers. In 1985, I had no clue cold atoms could be used to monitor climate change or track the unsustainable use of our water resources.

At Bell Labs, Art Ashkin used the same "optical tweezers" laser trap to hold onto individual viruses or bacteria. When I arrived at Stanford, I asked, "If we can hold onto atoms and individual bacteria, can we use the same technology to hold onto a single molecule of DNA?" By 1990, we were able to attach a micron diameter plastic sphere to an individual DNA molecule. By decorating the molecule with organic dyes, we could see the molecule in an optical microscope. We positioned the laser focal spot with a joystick hooked up to an electronically controlled mirror. To my graduate students, the ability to manipulate and see a single molecule of DNA was like playing a video game. After a few days of fun, I went

Research is a humbling endeavor, and failure is much more common than success.

into the lab and said, “Guys, I know you’re having a lot of fun, but let’s do some science.” This initial work on single molecules is having a huge impact on biology research.

Recently, I have become active in battery research and have begun to work with Professor Yi Cui, a star in the Materials Science Department at Stanford. Using new nanotechnology structures, we may have a shot at quadrupling the energy density of batteries and of increasing their charging rate tenfold. If we can get the technology to work, it could change transportation energy. Imagine a \$25,000 car with a battery that weighs less than an internal combustion engine and a transmission that can go 200 miles on a five-minute charge and over 300 miles on a full charge. If we can get this process to work, that would be wonderful. If not, there are many other people working on higher energy density batteries, and I have faith a solution will come from some group within the next decade.

I want to conclude by stressing the value of getting the right intellectual leaders to step forward to lead a team of researchers in a flat organization. The leaders should continue to be active researchers so that they remain solidly grounded. Research is a humbling endeavor, and failure is much more common than success. As Winston Churchill said, “Success is going from failure to failure without losing enthusiasm.”

Discussion

Neal Lane

We have made the argument that investment in basic research is essential for the American Dream, for jobs, the economy, and all the rest of it. How do we respond to the people who say technology kills jobs? For example, they point to the jobs lost to information technology or to robotics. Is technology a job killer?

Norman Augustine

Technology does eliminate some jobs. We can all think of examples. But technology also creates jobs, and it creates better jobs and a better life for the people who have those jobs. Just this weekend I was looking at a letter Einstein wrote in which he addressed this same question. His response, which I’m paraphrasing, was that when one pursues science and technology, sometimes it produces negative outcomes. When we produce new human beings, sometimes the outcomes are negative. Does that mean we should quit reproducing?

Steven Chu

The United States doesn’t have a lock on technology, so if we don’t research, develop, and implement new technology, someone else will. The trick is to figure out how to manage the transition to new technology. And that’s a problem worthy of deep thinking. We have to ensure that technology creates new, higher-value jobs.

Question

How do you apply the experience you had in the golden days at Bell Labs to the current state of research?

Steven Chu

To start, you should allow people to fail. The ARPA-E premise is exactly that. But you should also teach people to fail quickly. To assess quickly whether an idea has a chance of working, you need to test the most crucial “go or no-go” questions as soon as possible. If things are not going to work, move on. Funding agencies need to have the courage to say, “We won’t hold it against you if you fail because you tried something daring.” In ARPA-E, we expected nine out of ten projects to fail. Once it is clear that the milestones are not being met, we didn’t keep funding the project.

Neal Lane

Norm, do you think industry is unwilling to take some of these risks?

Norman Augustine

I think industry is unable to do this. The market simply doesn’t tolerate it. I can suggest changes that could make it possible, but the main thing is that you have to give people a chance to fail and to learn from their failures. But when failures and successes take years of investment, there is little appetite among investors to provide funds.

Question

Why did Bell Labs fail, and how can we make the financials for this kind of lab work in the future?

Steven Chu

The most basic research areas that Bell Labs worked in began to disappear because the underlying company was no longer a government sanctioned monopoly. The corporate culture of AT&T – and later Lucent Technologies – was there but financial pressures didn't allow them to support it in the style of the days when I was there. If you want to start a new Bell Labs, it either has to be supported by a wealthy, stable company with a long-term view – or you need to start a foundation. I think you would need about five billion dollars to create an endowment that could support a new Bell Labs.

If an endowed research laboratory moves forward, the intellectual property generated would be part of the payment to keep it going. Because the basic research done at a Bell Labs 2.0 might not see practical applications for ten or twenty years, there needs to be stable funding at the level of a few hundred million dollars a year to attract a critical mass of the best scientists. It helps to be near a great research university and national laboratory so that scientists can share expensive critical infrastructure and have access to graduate students.

Norman Augustine

Something I have been promoting for probably twenty-five years, with my usual lack of success, is that we change the capital gains tax in this country so that the gain on an asset that's held for one day is taxed at a 99 percent rate and a gain on an asset that's held ten years is taxed at a 1 percent rate. One can then draw whatever line between those points one wishes to produce the tax revenues you desire. That would cause investors and CEOs to act very differently. You would suddenly find people willing to support operations such as Bell Labs.

Steven Chu

I was talking to the Rice faculty at lunchtime about the possibility of the re-emergence of great industrial labs. They felt that it was unlikely to happen because people in the financial community are not interested in five-year and ten-year investments. They are interested in one- to two-year investments that they can bundle, securitize, and sell, and they would lobby against changing the tax code to reward twenty-year investments over one- or two-year transactions. I agree with Norm, although I would make it twenty years instead of ten.

Question

I'm a really big fan of the flat structure you talked about. It's been shown to work. But how would a very hierarchical institution like the NIH shift from a top-down perspective to a flat culture? What policy changes are needed to encourage a Bell Labs structure in our universities and possibly in businesses?

Steven Chu

We designed ARPA-E with a very flat structure. The director of ARPA-E, Arun Majumdar, would brainstorm as a scientist with the program managers for hours. Occasionally I would be part of those conversations. I am less familiar with how the NIH runs its Institutes; so let me talk about the idea of the Energy Hubs, another program we started in the Department of Energy. The intent of the Energy Hubs was to put together a critical mass of scientists and engineers that would be directed by the local leadership, in the style of Bell Labs and the Manhattan Project. The intent was to avoid micro-management from Washington. In university funding, there is the problem of how to fund *genuine* teams of investigators. Funding agencies want to foster collaborative efforts,

but the culture of most university faculty is to divide the money among their own groups instead of working in truly intimate collaborations. If an extraordinary scientist were willing to step up and say, "I'll lead a team effort and take personal responsibility for its success," it would help.

Neal Lane

Norm, I have seen you testify many times where you get questions about the partnership between government and industry. Do we pick winners and losers?

Norman Augustine

To some degree the government does; but this is quite different from much maligned, centralized economic planning. I'm a business guy, so I'm not in favor of the government simply picking winners and losers. But when the government conducts open and transparent competitions among ideas and then has capable individuals make considered judgments of merit, that seems to me to be appropriate.

Neal Lane

Steve, what lessons were learned on Deep Horizon? That was an experience that came out of the blue. You didn't go to Washington to do that.

Steven Chu

When the big oil spill happened, I made a technical suggestion. The people at BP scoffed at it, but then they said, well, maybe it would work. So when the President heard about this, he said, "Chu, get down there and help them stop the leak."

So I picked a team of five people, called them up, and said, "I want you to join me and figure out how we can help them in

any way we can.” We started out thinking that most of our contributions would be in helping with diagnostics, but after a failed attempt to stop the leak in mid-May, I told Admiral Allen that we needed to be part of the approval process going forward.

Another member of my small group argued that it was risky to ask to be part of the approval process. That would mean that we were taking on responsibility. I said, “It’s OK. I don’t mind taking responsibility, but it will be a shared responsibility with BP.” I don’t think politicians are able or willing to assume technical responsibility. Over time the BP engineers began to trust us and really opened up. They saw that we weren’t looking to assign fault, and that we were focused on trying to help them stop the leak.

Being part of the decision-making process during a crisis like this cannot be done through a committee. If I had goofed, I might have gotten fired, but that’s okay. I would have gone back to a university. In the meantime I was willing to give the best recommendations possible. Those were nail-biting times. But the President backed me the whole time, and that was really important, because if I said, “Nope, we can’t do this until we know more about what’s going on,” BP couldn’t ignore me.

I was the first scientist to be a cabinet member in the history of the United States. When I was leaving, I said, “Mr. President, I really enjoyed working for you. You get a lot of credit for hiring me, a nonpolitician, to be a cabinet member. Do it again.” His inner circle was not enthusiastic about appointing another scientist. Perhaps they felt that scientists were less controllable, and they might blurt out the truth. The good news is that the President did it again.

Neal Lane

Steve, let me say how much the nation appreciates you taking time out of the lab to serve in the way that you did. I’m sure that when you were a young physicist looking at cold atoms in the laboratory, you weren’t thinking you would like to spend a chunk of your career this way. But we so appreciate that you did. And Norm, you have served this nation in so many ways, many of which we can’t even talk about. But thank you for that service. And thanks to both of you for taking time out of your calendar. We feel privileged to have had you here this evening. ■

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Discovering Handel's London through His Music

On May 11, 2015, Ellen T. Harris (President of the American Musicological Society and Class of 1949 Professor Emeritus in Music and Theater Arts at the Massachusetts Institute of Technology) spoke at the Academy about Handel's life and his inner circle of friends. Harris's slide presentation and discussion was followed by a performance by members of the Boston Early Music Festival Vocal and Chamber Ensembles. The program, which served as the Academy's 2021st Stated Meeting, included a welcome from Jonathan F. Fanton (President of the American Academy) and a remembrance of Academy members who died during the year read by Arthur M. Jaffe (Landon T. Clay Professor of Mathematics and Theoretical Science at Harvard University). The following is an edited transcript of Ellen Harris's unscripted talk.



Ellen T. Harris

Ellen T. Harris is President of the American Musicological Society and Class of 1949 Professor Emeritus in Music and Theater Arts at the Massachusetts Institute of Technology. She was elected a Fellow of the American Academy in 1998.

My talk tonight stems from my most recent book, *George Frideric Handel: A Life with Friends*, in which I try to understand Handel, the man. We tend to think of him as he is portrayed in Thomas Hudson's famous portrait (Figure 1), in which the rather portly Handel is wearing brocade, silk, ruffs and lace, and, most important, a big wig. In a literal sense, Handel was, in fact, a *bigwig*.

Unexpectedly, Handel's 1750 will was the best starting point I found for learning about the musician and the community of friends and intimates surrounding him. He left bequests to a number of friends, none of whom were known to Handel scholars. It seemed very strange to me that in the two hundred and fifty years since Handel's death not one researcher had investigated these individuals, who were referred to simply as the mysterious people appearing in Handel's will. I suspected that they could emerge as more fully realized figures.

The will led me ultimately to six colleagues and acquaintances of Handel (some of whom are not actually named in the document). One of these was James Hunter, who received a bequest, a significant portion of which unfortunately remains unreadable despite the most advanced efforts to decipher it. Another was Joseph Goupy, one of Handel's colleagues who was best known as a painter of copies of artistic masterworks for the aristocracy. (First-rate painters who specialized in reproductions were very much in demand in the eighteenth century.) But Goupy had a huge falling-out with Handel and was not included in the will. Mary Delany, who has in recent years become well known for her flower mosaics, all of which are preserved at the British Museum, is another Handel colleague who fascinated me in the course of my research. Delany began making her mosaics at age seventy,

after Handel's death, and hoped to make one thousand; she ended up creating about 980. Other associates of Handel included Anne Donnellan, one of the legatees who lived nearby, and Elizabeth Mayne, who married the lord of the manor in Teffont Evias, near the city of Salisbury.

How did I find out about Handel's mysterious colleagues, and where did I go to retrieve information about them? I spent a lot of time in historical archives, looking through documents for evidence and



Figure 1: Thomas Hudson, *Portrait of George Frideric Handel, 1748-1749*. Image courtesy of the Staats- und Universitätsbibliothek Hamburg Carl von Ossietzky.

material about their personal lives. Their own handwritten wills are preserved in the United Kingdom's National Archives, based in Kew. The legal (Chancery) copies, which function like modern typed copies, can be purchased online, but in order to see the original handwriting, which can be very useful, it's necessary to go to the Archives.

Legal documents also reveal an enormous amount of information. Bills of complaint contain striking content, and depositions are especially interesting. Like captured speech, they are as close as we might get to the gossip of the time. In the course of a deposition, people tended to reveal an enormous amount of information in response to questioning (not all of it relevant to the case). All of that material was invaluable to my effort to learn about these characters in depth.

Bank of England documents, in particular, were essential to my work. Not only did I have Handel's records, but I also had the bank accounts of many of his friends. The Bank of England has preserved all of its documents back to its founding in 1694. Both my students and my colleagues sometimes ask me why I'm spending time with documents in the vaults of the Bank of England. For one, they're beautiful: these are stunning, handwritten documents of the time. There's a Dickensian feel to a lot of this research, though much of the material predates his novels by one hundred years. The image of Bob Cratchit of *A Christmas Carol* sitting on his clerk's stool and writing often came to mind. Second, if you want to know about someone, where better to look than in their financial records? I ask my students, if I had your credit card record and your bank accounts, what would I learn about you? They then understand!

I also spent a lot of time with fire insurance records. After the Great Fire in London in 1666, fire insurance became a coveted commodity. I consulted James Hunter's policy – created with the Hand-

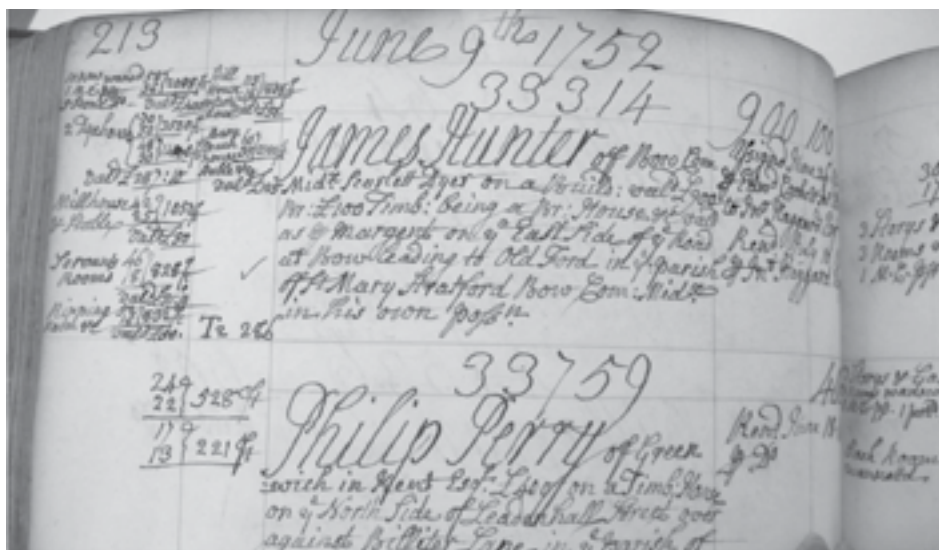


Figure 2: James Hunter's fire insurance policy, renewed in 1752 with the Hand-in-Hand Fire and Life Insurance Society. Image courtesy of London Metropolitan Archives, London.

in-Hand Fire and Life Insurance Society – on his dye house in Old Ford (Figure 2). I learned a great deal from reading in the margins. Hunter owned not just a single house, but a business with many buildings: dye houses, still houses, carriages and servants' rooms, which, taken together, constituted a factory. I could glean, then, that Hunter was not himself up to his elbows dyeing linen in vats, but instead delegated work to his company's workers. Fire insurance records can tell you other essential information about these residences, such as which rooms have wainscoting or how many chimneys a house had (an important piece of information for fire insurance). After examining Hunter's insurance record, I was able to create a fairly accurate facsimile of what Hunter's dye house would have looked like.

Finally, I relied on art auction catalogs, some of which featured beautifully handwritten records about buyers and prices. Unknown to many, Handel had a significant art collection that included "a large landscape and figure" by Rembrandt. Handel's

name is written in the catalog in red, indicating he was the purchaser. The authenticity of the "Rembrandt" cannot be confirmed. All of Handel's paintings were auctioned after his death, and we do not yet have enough information to trace his collection.

Combing through these records, catalogs, and bank documents, I got the sense that Handel and his friends formed a distinct neighborhood. All of these people lived in very close proximity to one another. In 1723, Handel moved to 25 Brook Street, close to Bond Street, Tiburn Road (now Oxford Street), and Grosvenor Square (where the American Embassy stands today). For some time in the late twentieth century, there was a chance that Handel's house would be torn down, but in 2001, it opened as the London Handel House Museum. (Much effort went into preserving this house as a museum. Operations began on the upper three floors, thanks to a "peppercorn rent," before the museum raised enough funds to buy the ground floor.)

The map of the neighborhood around St. George Hanover Square (Figure 3) gives an approximation of where Handel's

friends lived. They moved around a great deal. In the small area of this map, Delany had two different residences; Donnellan had four; Goupy had three; and Palmer had two, including a big double house on Curzon Street. Handel is the one stationary figure. Once he moved into the house on Brook Street, he remained there for the rest of his life, dying there in 1759. In contrast, Goupy first took leased residence on Bond Street, but as he rose in station, he moved to a much better address on Savile Row. When he began working for Frederick, Prince of Wales, he moved to a beautiful house at 97 Park Lane, just down the street from Handel.

Through the surviving documents, I found, not surprisingly, that playing music was one of the main activities that Handel's

inner circle enjoyed. Elizabeth Mayne (Elizabeth Batt before she married) was a harpsichordist, noted for her playing. I tracked down her early keyboard book from 1704 in the British Library, and in it, I found a lot of fascinating music from the time, such as incidental music by Purcell adapted for keyboard and excerpts from English opera. Batt's name is carefully written out in gothic letters on the cover of the book. She began using it when she was nine.

Mary Delany, who much of her life lived right up the road from Handel on Brook Street, was, like Elizabeth Mayne, also a fine harpsichordist. She studied Handel's keyboard pieces and suites. Delany hosted many music parties, often attended by Donnellan, also a friend of hers, and sometimes by Handel. In one of her letters about these

events, she describes Handel attending and how he was in a good mood, which suggests to me that he wasn't always in one. She relates that Handel performed with one of his featured prima donnas, but stayed until the early hours of the morning accompanying all the ladies in attendance.

Handel's friend Anne Donnellan was widely known as a singer. There are letters from Delany about excursions on the Thames River, during which other boats crowded around to hear Donnellan's voice. In another story, it was suggested that Lord Burlington would fly to her feet if ever he heard her sing "Verdi prati" from Handel's *Alcina*.

In Figure 4 we see Donnellan stand in the middle of a particularly revealing Hogarth painting of the Wesley family, ancestors of the Duke of Wellington. The young girl is a dancer, and the older daughter is a keyboard player. The father holds a violin in his lap. The mother is giving the beat. They are poised to begin, and looking at Mrs. Wesley. Donnellan's house at the base of Berkeley Square on Charles Street has survived. (There's a pub just one door down, which was also in existence at the time, and I do like to speculate on whether Anne Donnellan or Handel ate there.)

Probing the lives of Handel's friends has helped round out certain difficult periods in Handel's life. For instance, at the very end of his life, Handel began losing his sight; by 1754, he was completely blind. This loss ended his compositional work, but not his ability to perform music on the keyboard. His friends continued to ask him to play instruments in their homes, and he continued playing up until his death in 1759. For instance, Delany reports in a letter how in late 1755 Anne Donnellan had him try out her new Jacob Kirkman harpsichord at her house on Charles Street at the base of Berkeley Square, which still survives. In a combination of historical and financial sleuthing, I found Donnellan's financial records at

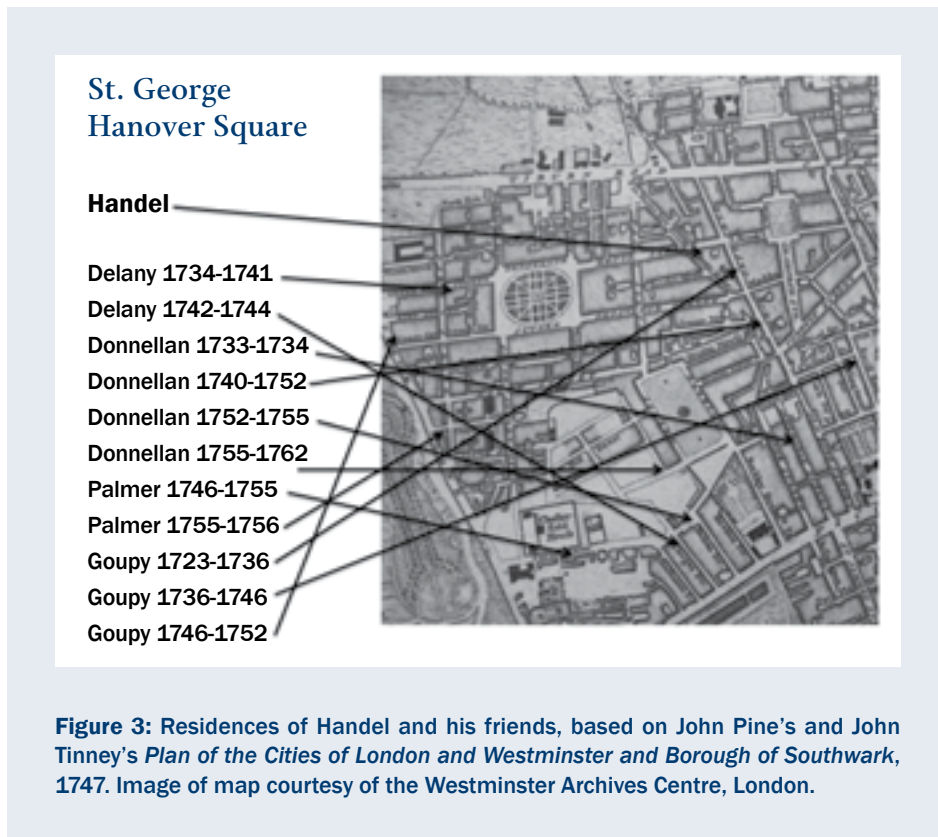


Figure 3: Residences of Handel and his friends, based on John Pine's and John Tinney's *Plan of the Cities of London and Westminster and Borough of Southwark*, 1747. Image of map courtesy of the Westminster Archives Centre, London.

Goslings Bank, a private bank that many women used for the convenience of having a financial advisor. And within those records I found the record of her purchase of the harpsichord from Jacob Kirkman for nine pounds and nine shillings in January 1756. This is a wonderful example of how documents can come together to support one another.

When Handel first arrived in London, late in 1710, before he had his own house and had built all of these friendships in the neighborhood, he sometimes performed at public concerts held by Thomas Britton. Britton was a dealer in small coal, or charcoal, who is described as walking through the streets of London, in a blue smock with a sack of small coal upon his back, crying out his wares on the two notes that formed an octave. Above his shop, he had a music room where he held concerts. Many foreigners came to these concerts to get a sense of the cultural scene in London. I'm certain that Handel was one of the foreigners attracted to this scene.

I like to imagine that at Britton's concerts Handel played his *Trio Sonata in F*, one of only two trio sonatas that Handel is known to have composed before he came to London. This trio was written for two violins, cello, and harpsichord, and it is a sassy little piece. It would have introduced Handel to his London audiences in a wonderful way.

Listening to the trio, you get the sense of a children's game, of playing: notes that are approaching, then running away; or are more like objects, tossed back and forth. What is astonishing about this trio is that once begun, Handel doesn't continue along with this playful progression; he moves away from it, and slides into an unexpected chromatic passage before returning to the chase. As soon as this return accelerates up to full speed, Handel suddenly cuts it off as if with a guillotine. There's a long silence before the piece picks up again with a new chromatic passage and moves to a close.



Figure 4: William Hogarth, *The Wesley Family (with Anne Donnellan)*, 1731. Wellington Collection; Stratfield Saye Preservation Trust. Image courtesy of Stratfield Saye Preservation Trust.

One imagines this composition might have shocked the English auditors, who learned quickly that Handel's music was not well-behaved. With a piece like this trio sonata, the young Handel would have introduced himself as an innovative, risk-taking composer. His music might not be shocking to us now, since we have learned to relish the striking juxtapositions and silences he built into his scores. But if you were hearing Handel's music for the first time, and his early work at that, it would have likely signaled to you that he was a figure well worth paying attention to. You would never be lulled into an expectation of what would come next.

Besides being neighbors, playing music with one another, and visiting each other's houses, Handel's friends had another point in common: none of them had conventional marriages. Handel never married; neither did Goupy, nor Donnellan. The other

friends had marriages that were forced on them, or they made "clandestine marriages" where the couples effectively eloped without any provision from their families and were then largely ostracized for doing so.

Elizabeth Mayne was the exception, as the only friend who had anything resembling a conventional marriage, negotiated by the participating families through a marriage contract that outlined a proper exchange of status and money. At this time, marriages more resembled mergers and acquisitions than a love match. Despite the conventional preparations, however, Elizabeth Mayne's husband, it turns out, had murdered a woman in Essex some years earlier. There is certainly something unconventional about that. One of the delights of my research was that the Mayne family didn't know this fact and they eagerly asked for all the documents. So my research has

revealed that having a murder in your family three hundred years ago turns out to be an exciting event – at least it seemed to be in this case.

Some of the other friends had much more difficult marriages. For instance, Elizabeth Palmer married Ralph Palmer, who was related, along with his family, to the aristocratic Verney family by marriage. Elizabeth, whose maiden name was Peacock, was the child of servants, and this fact did not sit well with the Verneys. Lord Verney, in particular, was extremely unhappy about the marriage, and all sorts of legal documents were taken out to separate Elizabeth Peacock from any portion of the Palmer inheritance.

In another case, we have James Hunter, the scarlet dyer. He was the third son of a family of Huguenot traders, though he did not expect to get very far from that position. His oldest brother was sent to Aleppo to work for the Levant Company as an apprentice, but as the third son, James was

not given a comparable opportunity. So, he decided to take things into his own hands, and on December 17, 1728, at the age of seventeen, he set about marrying. To avoid asking permission or having the banns announced for three weeks before the marriage, Hunter acquired a marriage license from the Bishop of London, in which he falsely declared he and his bride-to-be were both twenty-one years old. After their wedding in Somerset Chapel, they were largely separated from family and left to manage on their own. Hunter tried to make a living as a trader in the city, but ran into financial difficulties. He was sued by the Bank of England, and, ultimately, was declared bankrupt, a privilege allowed only to international traders in order to help them get back on their feet. Other defaulters were declared insolvent and sent to debtor's prison.

Among Handel's friends who married, Mary Delany offers, in some ways, the saddest case (Figure 5). At the age of seventeen, she was forced to marry a man who was her uncle's political crony. He brought a certain kind of stature to the family, along with votes in Parliament. Mary hated him. She wrote a great deal about her feelings, mentioning, vividly, that on her wedding day, *never was woe dressed out in gayer colors*. As she was led to the altar, she wished from her soul she had been led, as Iphigenia was, to be sacrificed. Mary's marriage lasted until her husband died, seven years later. As a young widow, she moved to Brook Street, only a few blocks from Handel. At the age of forty-four, she married Patrick Delany, the love of her life, though her family disapproved and thus withheld inheritances and family gifts from her.

Looking closely at the marriages of Handel's friends might give us some insight into what Handel observed around him and drew inspiration from. Marriage played an enormously important role in all of the operas he wrote. In conventional narratives, true love faces obstacles, but ultimately prevails in

marriage. Two of Handel's operas from the early 1720s, *Radamisto* and *Rodelinda*, revolve around marital relationships. In *Radamisto*, the title character and his wife Zenobia are in danger of being taken prisoner. Zenobia pleads with Radamisto to kill her rather than allow her to be taken captive, but he can't bring himself to comply. In desperation, she leaps off a cliff.

Like Hamlet, Radamisto can never quite decide what is the right thing to do. After Zenobia's desperate action, he stands paralyzed and sings the aria, "Ombra cara," calling out to her, *Oh, beautiful shade*. Rest happily, he continues; after I take revenge, I will fly to you. Some interpreters of *Radamisto* deem this aria an inappropriate response: Radamisto should either feel more agitated or sing a heartfelt lament. However, I think the aria captures exactly the right tone. Radamisto is stunned, and the aria depicts that perfectly.

As Radamisto sings long, sustained lines with little melodic movement, the orchestra depicts his submerged emotions in twisted, contrapuntal and chromatic lines that wash over the listener in a flood of sound. That is, the passionate depth of the aria emerges not from the voice, but from the melodies of the orchestra, from which Radamisto is wholly cut off. The power of the scene is derived in part from an unyielding divide between the stark vocal line and the orchestra's roiling emotion.

Generally, when Handel composed operas about true love, or about companionate marriage, he was writing about something that was desired, but did not often exist, in contemporary culture. Elizabeth Robinson Montagu remarked that talking about marriage based on love was a fitter conversation for an imaginary Utopia than the current state of Great Britain. Given her own experiences, Handel's friend Mary Delany felt strongly that marriage should be based on choice. "I have no notion of love and a knap-



Figure 5: A miniature portrait of Mary Delany, one of four portraits in a friendship box, by Christian Friedrich Zincke, c. 1740. Image courtesy of the National Portrait Gallery, London.

sack, but I cannot think riches the only thing that ought to be considered in matrimony," she is quoted as saying.

Unlike Handel's earlier operas based more on Montagu's Utopian dreams, *Imeneo* and *Deidamia*, the last two operas Handel wrote, are about couples not finding the love they desire. They are the only two of Handel's operas in which the cultural period is accurately represented, and the listener gains a good sense of what marriage was like in the eighteenth century. Women could be forced to relinquish a love relationship, forced to marry, or both. Handel's last two operas represent the first and only time this theme is touched upon in his work.

In *Deidamia*, Achilles dresses up as a woman to avoid being shipped off to the Trojan War. Ulysses arrives with a large platter of jewels, a sword, and a helmet. He asks the lovely women gathered to pick something they would like. Achilles is outed when he chooses the masculine tools of war. When he leaves to join his comrades, Deidamia is left desolate.

She turns on Ulysses, and reproachfully cries, "You have made me unhappy, and you're proud of that?" There is no orchestral introduction; the aria just begins with the voice floating in space. The orchestra responds with a plaintive echo, one octave below what Deidamia has sung. It is as if she is singing into a void. Deidamia receives very little in return from the orchestra or Ulysses; and she certainly doesn't get back Achilles. She then pronounces vengeance on Ulysses: may he face storms; may they sink his ships; may he never get what he desires; may he never return to his homeland. Unlike Radamisto, Deidamia is deeply engaged and emotionally connected to the scene as her emotions shuttle back and forth.

For people who know Baroque opera and know the structure of da capo arias, returning to the beginning is the norm. But that return, to the head of the piece, doesn't hap-

pen in Deidamia's aria. Deidamia expresses her unhappiness, followed by an explicit desire for vengeance. Though her "I am very unhappy" followed by her subsequent "I'm very vengeful" *sounds* as if it should develop into a da capo, something the text seems explicitly to allow, Handel's setting, with its continuing vacillation, gives the clear sense

When Handel composed operas about true love, or about companionate marriage, he was writing about something that was desired, but did not often exist, in contemporary culture.

that her emotional instability will continue. There is none of the closure found in a traditional da capo aria.

Another vital cultural issue of Handel's time found in his operas and later oratorios is illness, which, of course, played a large role in eighteenth-century culture, as it did in the stories of many of Handel's friends. The two most common causes of death listed in the bills of mortality from this period were convulsions and fever. Hallucinations that attended fever were a particular concern as doctors needed to determine whether these were fever-induced or if the patient was, in fact, mentally ill. When Handel began in 1738 to have a number of what were called paralytic attacks, some of the people around him worried about his mental stability, which was, however, never in serious doubt. In contrast, we have the medical records of a "mad doctor" consulted by Joseph Goupy for a person in his household who had to be confined.

Perhaps drawing from personal experience, Handel wrote a number of important scenes of madness: in his opera *Orlando*, in the oratorio *Saul*, and in the oratorio *Hercules*. In *Admeto* (1727), Handel depicts the hallucinations of physical illness. The story is well

known. The dying King Admetus can only be saved if someone else will die in his stead. None of the citizens of the kingdom, or any of his servants, are willing to make this sacrifice, so it falls to his wife, Alcestes. The opera begins with a depiction of the dying Admetus, and instead of employing a conventional overture, Handel begins the opera with the

curtain rising on action. We see Admetus in his bedroom, joined by hallucinatory figures dancing around him. The orchestra replicates his convulsions and fever with pairs of jerky, loud notes followed by a weak falling back in four descending notes.

In the next movement, Admetus begs his hallucinations to go away, and Handel carefully adds directions in the score to make sure the emotional (and physical) vacillations in the text are properly depicted (Figure 6). *Admeto* begins *con stupore*, shifts into *adagio, e piano* (slow and soft), then *furioso*, then *adagio* again, and so on. The scene is full of agitation, and the tone full of instability, until Admetus, totally exhausted, pleads, in a very quiet, hymn-like aria, let me die. Just close my eyes, and let me die.

The final theme in Handel's works that I'll address tonight is religion, a subject of paramount importance in Great Britain at this time. Handel's penultimate oratorio, *Theodora*, is a story about the Christian martyr, Theodora. Theodora and Didymus, a former soldier who had secretly converted to Christianity, are both sentenced to death, sacrificed as Christians before the Roman authorities. In their final duet together, they sing of the "Streams of Pleasure ever flow-



Figure 6: The pages of the dramatic recitative of Handel's *Admeto* (1728), which features Admeto singing, "Orride larve"! From G.F. Handel's *Werke: Ausgabe der Deutschen Handel-Gesellschaft*, ed. Friedrich Chrysander. Images courtesy of the author.

ing" that await them when they are "from Life's dull Labours free." Earlier in the oratorio, Theodora has already said goodbye to this "fond, flattering world."

The next year, when composing his last oratorio, *Jephtha*, Handel began to experience the symptoms that resulted in his blindness. While working on the final chorus at the end of Part II, "How dark, O Lord, are thy decrees," he wrote in the margin: *I was unable to continue my left eye was too weak*. He was forced to stop composing for about month. When he returned to work, he was able to complete this chorus, which ends with the words, "What God ordains, is right." Later, he changed these words to "Whatever is, is right," taken from Alexander Pope's "An Essay on Man." Every time this phrase is sung, it is pounded out in a different key: first in C, then in F, next

in E-flat, as if "any" key is harmonically "right." I find it enormously moving that Handel, as he was losing his sight, set this phrase from Pope to the tune of "Fond, flatt'ring world, adieu."

As we reviewed these personal stories of Handel and his friends, we explored four aspects of their world, all of which ultimately played a central role in Handel's music: how these friends made music with one another; found (or failed to find) fulfillment in marriage; fell ill; and exercised their religion. Learning about Handel's friends helped me to see a reflection of their lives in Handel's music. Further, it gave me a picture of the Handel they might have known. He visited his neighbor's houses, trying out their harpsichords. He stayed up late at parties, accompanying at the keyboard for all of the women in attendance who sang. And

from 1738 on, his music takes on a very personal sense of expression as he dealt increasingly with physical illness and blindness. All of these sensations, memories, and feelings resonate in his music, and we can still feel them today. Through his music, we are welcomed into Handel's world. ■

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Forty Years of Evolution in the Galápagos Finches: An Interview with Peter and B. Rosemary Grant

On March 5, 2015, Peter Grant (Class of 1877 Professor of Zoology, Emeritus at Princeton University) and B. Rosemary Grant (Emeritus Professor and Senior Research Biologist in the Department of Ecology and Evolutionary Biology at Princeton University) presented their research studying evolutionary processes in the Galápagos finches. Jonathan F. Fanton (President of the American Academy) opened the program, which served as the Academy's 2019th Stated Meeting, remarking: "For forty years, Peter and Rosemary Grant have examined the beauty and wonder of change over time, and their research has been seminal in numerous fields of study, including evolution, ecology, and population biology. Moreover, their work continues to inspire new generations of young researchers who seek to understand what Darwin once called 'the mystery of mysteries.'" Jonathan B. Losos (Monique and Philip Lehner Professor for the Study of Latin America, Professor of Organismic and Evolutionary Biology, and Curator in Herpetology at the Museum of Comparative Zoology at Harvard University) introduced the speakers.

The program was live streamed to Fellows and guests gathered in New York City and Chicago. Jonathan Weiner (Maxwell M. Geffen Professor of Medical and Scientific Journalism at Columbia University Graduate School of Journalism) led a discussion in New York City and Trevor Price (Professor of Biology in the Department of Ecology and Evolution at the University of Chicago) led a discussion in Chicago following the video presentation.

After the meeting, Zackory Burns (Hellman Fellow in Science and Technology Policy at the American Academy; ethologist) interviewed Peter and B. Rosemary Grant. The following is an edited transcript of their exchange.

Zackory Burns

What inspired you to pursue your research in evolution?

Peter and B. Rosemary Grant

Our initial sources of inspiration were early experiences of a diversity of animals, plants, and fossils in our respective childhoods, followed by learning about genetics at school and university. Studying birds and mice, we always asked *why* as well as *how* questions. We also found certain seminal papers and books to be inspirational; they opened our



B. Rosemary Grant (Princeton University) and Peter Grant (Princeton University), speaking at the Academy's 2019th Stated Meeting.

eyes to what could be discovered through the combination of ecological field studies and genetic analyses. Our immersion in Mendelian genetics, ecological genetics, quantitative genetics, and, finally, molecular genetics opened doors to the direct study of evolutionary processes in contemporary time.

Zackory Burns

What are three takeaway messages from your joint research over the past four decades?

Peter and B. Rosemary Grant

The first lesson is to pick a biological system that is particularly suitable for the scientific question to be addressed. One of our initial questions was why some populations are extremely variable, while other populations of the same species, in the same or similar environments, are not. As it turns out, Darwin's finches are close to being an ideal system for answering this question.

The second message we would share is that when a single approach to a complex problem is clearly insufficient, it is critical to try out a variety of approaches. For instance, the question of variation, mentioned above, demands a broad approach because it encompasses elements of adult morphology, development, ecology, behavior, quantitative genetics, and molecular genetics.

The third takeaway message from our research is that long-term studies of ecology and the evolution of organisms living in their natural environment have immense value. Such studies are certainly not the only way to investigate natural biological phenomena, but they are a powerful way to establish the link between evolution observed in our lives and past evolution inferred from research.

Zackory Burns

In layperson's terms, could you describe your most recent discovery as published in *Nature* 518 (February 2015): the evolution of Darwin's finches and their beaks, revealed by genome sequencing?

Peter and B. Rosemary Grant

The history of a group of organisms like Darwin's finches on the Galápagos lies coded in their genomes: the totality of genetic factors that govern how they develop and how they function. Through partial genetic analyses, we had previously obtained glimpses of that history. But now, by sequencing the genomes of all of the species, we could create as full a record of their history as we shall ever have in the absence of fossils. This record tells us who is related to who. It indicates when the process of species multiplication began in the Galápagos. It tells us, to our surprise, that species have probably been hybridizing throughout the history of the whole group for perhaps as long as one million years.

Further, it has helped us to understand the evolution of beaks, the trait that so impressed Charles Darwin on his epic 1835 visit to the islands. The record has revealed one of the genes that is important in regulating beak shape development. Species differ in beak size and proportions; some beaks are elongated, while others are blunt. We discovered that species with pointed beaks had one particular variant of a gene called *ALX1*, and species with blunt beaks had another variant of that gene. (Interestingly, the same gene is expressed early in human development, and mutations in the gene cause defects in the development of the human face, including cleft palate.)

Zackory Burns

You were able to observe the creation of a new species of Darwin's finch. Why is this significant?

Peter and B. Rosemary Grant

The world has, literally, millions of species of animals, plants, fungi, and microorganisms. Many biologists would like to know how and why they evolved in the way that they did. Charles Darwin's central question – how do new species form – is still with us today, because we don't observe the process from start to finish. The standard explanation is that speciation begins with a population splitting into two. In the Galápagos, it is easy to envisage this happening through colonization of a new island by a few birds, followed by the establishment of a second population: two populations formed from one. The two populations then evolve in different directions, each adapting to its own environment. They become so different that later, when they encounter each other through dispersal of some birds from one island to another, members of the two populations either do not interbreed, or do so rarely.

By carefully following the lifetime fates of measured finches, we discovered an interesting twist to the standard speciation theory: rare hybridization between two species can lead to the evolution of a third. This happens under special circumstances: the genetic and morphological variation of the hybridizing species increases, producing novel genetic combinations and phenotypes. We witnessed this on Daphne Major Island, following the arrival of a hybrid finch. Thus our findings put the spotlight on two inter-related processes that are usually considered to be antagonistic – divergence during speciation is counteracted by hybridization – but can in fact be synergistic.

Zackory Burns

What are the major insights of your book *40 Years of Evolution: Darwin's Finches on Daphne Major Island* (2014) that you hope readers will take with them?

Peter and B. Rosemary Grant

There are three key points a reader of *40 Years of Evolution* might take away. The first is that the physical world is dynamic and ever-changing, albeit slowly, and so are many of the organisms that inhabit it. The second: a surprising amount of new discoveries can be made by studying known and identifiable organisms, year by year, throughout their lives. The third point is that it really helps to think laterally, and not exclusively within the confines of a predetermined research program. This is needed in order to take advantage of the unexpected, as Alexander Fleming did with his discovery of antibiotics, and Conrad Waddington did in his discovery of heat shock proteins. In our case, lateral thinking led us to discover a new finch lineage.

In a similar vein, we are impressed by the potential evolutionary importance of two

improbable events occurring close together. In our example, the evolution of a new lineage followed from a hybrid's colonization of Daphne in 1981, and from the exceptional ecological circumstances created by the colonization of a different species during the most intense and prolonged El Niño event of the last four hundred years.

Zackory Burns

Are there any questions left about Darwin's finches to be answered or further research to be explored?

Peter and B. Rosemary Grant

Forty years of research has taught us a lot, but there are many questions left unanswered, and our ignorance remains profound.

Broadly, we cannot yet be sure if there is something special about the finches as a group that explains why more than a dozen species evolved over a period of one to two million years. (In contrast, only four mockingbird species, at most, evolved in roughly the same amount of time, or longer.) We are uncertain about the identity of the finch's ancestral species, and about what it looked like. We still only have a hazy understanding of the early stages of the diversification of the finches, after the archipelago was first colonized, and before the colonizing population split into two.

Specifically, though we do know where all finch species are located, we don't know their evolutionary dynamics, except on Daphne Major Island. We also don't know the extent to which our findings on that small island can be generalized to other species, or to other islands. We do not understand why the two lineages of warbler finches (*olivacea* and *fusca*), the oldest species, never occur on the same island, or whether they would interbreed if they came

into contact. We know very little about some of the species in Galápagos, such as highland populations of the sharp-beaked ground finch and the vegetarian finch. And we cannot be sure whether their origin preceded, or followed, the arrival of key elements of their current diets. We have a poor understanding of the single species of finch on Cocos Island. The list goes on and on. With new techniques becoming available in the future, it should be possible to answer several of these questions.

Zackory Burns

What advice would you give to the next generation of evolutionary biologists?

Peter and B. Rosemary Grant

As techniques for probing the cellular and molecular world of living creatures continue to be developed at an extraordinary rate, it is very tempting to probe deeper and deeper into the submicroscopic world. The rate of return there is extremely high.

However, for anyone wishing to follow in anything like our footsteps, we would encourage giving equal attention to organisms living in their natural environment, be it sea, freshwater, land, or air. There is some urgency to do this. Natural environments are being depleted and despoiled at an increasing rate; thus, it is increasingly difficult to gain access to natural environments.

That said, we live in exciting times, with unprecedented opportunities to combine investigations into the evolution of organisms past and present, at all scales, from the community of genes, to the community of species. ■



To view or listen to the presentations, visit <https://www.amacad.org/evolution>.

Teaching and the Digital Humanities

On April 2, 2015, at Emory University in Atlanta, Georgia, William G. Thomas III (Angle Chair in the Humanities and Professor of History, University of Nebraska–Lincoln), Anne Cong-Huyen (Digital Scholar, Whittier College), Angel David Nieves (Associate Professor of Africana Studies, Hamilton College), and Jessica Marie Johnson (Assistant Professor of History, Michigan State University) engaged in a panel discussion on pedagogy in undergraduate digital humanities classrooms. The discussion, which was presented in collaboration with Emory University, was moderated by Erika Farr (Head of Digital Archives, Manuscript, Archives, and Rare Book Library [MARBL], Emory University). Stephen G. Nichols (James M. Beall Professor Emeritus of French and Humanities, Johns Hopkins University) and G. Wayne Clough (former Secretary, Smithsonian Institution; President Emeritus, Georgia Institute of Technology) provided national perspectives as respondents to the panel. Jonathan F. Fanton (President, American Academy) and James W. Wagner (President, Emory University) provided opening and closing remarks. The following is an edited transcript of the discussion.



William G. Thomas III

William G. Thomas III is the Angle Chair in the Humanities and Professor of History at the University of Nebraska–Lincoln.

The ways in which we teach and learn will change with the increased use of digital technologies in our classrooms, in our labs, and especially in the humanities. All of us on this panel have experimented in our courses with widely varying approaches to digital pedagogy, encompassing a very broad range of activities: teaching students

Central to the future of the humanities and, indeed, to the future of the liberal arts and sciences is developing students as producers in the digital medium, rather than only as consumers of digital content.

to interact with large data sets, teaching students to navigate and manipulate information repositories, and teaching students to use digital tools to ask new questions in the humanities, to name a few. We can imagine students in courses doing rapid prototyping of scholarship in the digital medium, investigating digital culture and society, and using social media to engage with new audiences. Digital pedagogy does not necessarily occur because a course is online: much online teaching is quite traditional in its pedagogical approach and uses standard lecture formats and memorization as modes of instruction. The irony is that online teaching needs the most help in engaging critical digital pedagogy, especially in the humanities.

Jesse Stommel, a blogger, humanities scholar, and perceptive critic of media, has called critical digital pedagogy a practice that “demands that open and networked educational environments must not be merely repositories of content. They must be

platforms for engaging students and teachers as full agents of their own learning.”

One aspect of digital pedagogy that will be central to the future of the humanities and, indeed, to the future of the liberal arts and sciences is developing students as producers in the digital medium, rather than only as consumers of digital content. To be producers in the digital medium, students need first and foremost an understanding of how the medium operates, what it does and does not afford. Digital narratives scholar Janet Murray’s work in this area on the “affordances,” as she calls them, of the digital medium is inspiring. In fact, I use her “affordance grid” of four characteristics as a beginning point, an essential guide to enable students to think critically about the nature of the digital medium: it is *procedural*, *spatial*, *encyclopedic*, and *participatory*.

Murray’s first book on narrative in cyberspace, *Hamlet on the Holodeck* (1998), provided much of the foundation for my initial engagement with teaching students to be

producers in the digital medium. Here are three brief examples from my teaching in which students are engaged as producers working in a critical fashion with and in the digital medium.

In academic year 1997–1998, historian and now-president of the University of Richmond Ed Ayers and I received a Teaching with Technology fellowship at the University of Virginia’s Teaching Resource Center to develop further the Valley of the Shadow project, which was a large-scale, collaborative research initiative for many years at the University of Virginia.

Ed and I taught a series of digital history seminars to explore what historical scholarship and scholarly communication would look like and what it could do in cyberspace. We literally asked our students what history might look like in the digital medium, what affordances historians should pay attention to, exploit, or design around. Students worked for a semester in teams of four on interpretive projects that would be added to the Valley of the Shadow project as stand-alone websites, and at the end of the semester, they gave a public demonstration to an open audience at the University of Virginia. One outcome was that – before blogs, before wikis, before Google – students were sharing and publishing their work online, and the public nature of the presentation altered the terms of their engagement with their work significantly. This experience highlighted what I expect will be a major theme of this panel: our students need to be working in the open web rather than in contained content- or learning-management systems, such as Blackboard.

One team produced a project on the U.S. Colored Troops that was the most scholarly, definitive, and well-designed site on the subject for about five years. This was an undergraduate project that received considerable traffic and email correspondence beyond the semester of the course, and the

student team continued to manage and cultivate the site years after the course ended. The sixteen-week course became a kind of transitional, porous engagement in which students long after remained responsible for and committed to an ongoing interactive engagement in the digital medium.

The second example is a project created at the University of Nebraska called the History Harvest. The main aim of this project is to engage students in making history by working directly on the creation of digital resources that document the history of their community. It’s an experiential course in which students organize and manage a public, digital, community “history harvest.” Students invite local people to share their historical artifacts and their stories for inclusion in a unique digital archive. In this way, students create the possibility and digital space for a more diverse, inclusive, and democratic narrative of American history.

These resources build upon themselves and have been made available for further teaching, use, and research. Schools around the United States – in Texas, Florida, Virginia, Indiana, and Minnesota – are developing courses modeled after History Harvest. Students see their work as public, community-oriented, and part of a larger ongoing endeavor. Students in the History Harvest become producers in the digital medium, rather than consumers of digital content.

A third example: an NEH-funded research collaborative between the University of Nebraska and the University of Maryland focused on slavery and freedom in early Washington, D.C., using original files of D.C. circuit court cases, including hundreds of petitions for freedom by enslaved people between 1800 and 1862. As with the Valley project, students are making generative contributions to the project. In this work, students have also made invaluable contributions by marking up and encoding parts of the project. They are contributing to the

research and writing of Wikipedia entries about important petitions for freedom that are virtually unknown to the wider public.

One final point in closing: several historians who attended presentations of the slavery and freedom project at the American Historical Association convention have asked to participate in it. This has laid the foundation for cross-institutional collaboration that will allow students as well as faculty at other institutions to participate in this major research initiative.

And this sort of cross-institutional collaboration based in digital pedagogy offers an exciting model of generative digital research to which undergraduate students make a significant contribution. The questions students begin asking about encoding are really about typology: what do you do with a residence that is unclear, or a relationship that exists but is not clearly stated? These are very helpful sorts of questions to prompt students’ historical thinking.

We have opportunities to reimagine our teaching and learning in the digital medium. So, my message today is to encourage student work in the open web, to encourage critical digital pedagogy, and to engage students as producers in the digital medium.



Anne Cong-Huyen

Anne Cong-Huyen is the Digital Scholar at Whittier College.

I am the co-coordinator of the Digital Liberal Arts Center at Whittier College, a small, private liberal arts college in the Quaker tradition (now secular). We have about 1,700 undergraduate students, and 60 percent of our enrollees are students of color. We are a Title V Hispanic-Serving Institution, and many of our students are first generation and working class. Our program answers one of the criticisms of the digital humanities: that too many programs and centers are located in large research institutions.

We call ourselves the Digital Liberal Arts Center – not a digital humanities center – and, in an effort to make ourselves as inclusive as possible given the collaboration and porousness within our curriculum, I am working with faculty members from the natural and social sciences, mathematics, fine arts, and theater (disciplines that might be siloed at larger institutions) to bring the ethos of the digital humanities into classrooms across our campus. That means we

Through the digital humanities, we are trying to bring experimentation, play, openness, collaboration, and diversity in form to classes in all different disciplines.

are trying to bring experimentation, play, openness, collaboration, and diversity in form to classes in all different disciplines.

Now, entering the second year of a generous Mellon grant, we have a broad definition of what it means to be digital and technological (for example, recognizing pens and pencils as tools). Our goals are to increase student engagement, to produce more public-facing work, and to show responsibility to the community in the Quaker tradition. We want our students to take ownership of their work and pride in what they have accomplished – things we sometimes don't see them doing when they turn in traditional papers to their faculty members.

We've been offering small grants to faculty to entice them to come out and join us. We are working with faculty one-on-one to think of ways that they can transform their classes to be more digitally inclined or to include digital assignments and activities. So we're exploring ways that we can help faculty to design digital assignments: from small infographics that students can make public and publish on the web, to larger semester-long projects such as digital sustainability plans. This is happening in ethnic and gender studies, environmental sciences, and mathematics courses – none of which have the words *digital humanities* in the course title. (This is my first year on the job so we're learning a lot!) We are doing much of this on a very small scale. As a small school with very limited resources, we have become a teaching resource center. It's not about trying to get our colleagues to jump on the digital humanities bandwagon, so much as finding innovative ways for us to become

better teachers. What we have emphasized, rather than simply using new digital tools, is the importance of good rigorous teaching, of digital literacy, and of interrogating our relationships with the digital.

Before I started at Whittier, I taught at much larger public institutions – UCLA and UCSB – and I would like to share a project that students of mine built there. One thing that was vitally important with our demographic of students was that we wanted them to become engaged digital citizens. Many were already consuming digital media, but we wanted them to be producing it, to be working in digital platforms very critically and also to be aware of the communities in which they live and work. To this end, my former students at UCLA, in a course about the racialization of Los Angeles, created a digital book in the Scalar publishing platform.

As part of this project, students learned about the history and politics of publishing. I asked them to think about what it means to produce a digital book that anyone can access. An important detail about building digital assignments is that you want to scaffold larger projects with smaller assignments so that students learn the technical skills in small stages while they are also developing their critical analysis, research, and writing skills. These students, for example, were asked to go into different ethnic enclaves in Los Angeles and produce urban ethnographies of those communities: they took public transportation to get there, spent time in the space, and then documented their experiences to produce a digital book (<http://scalar.usc.edu/works/ethnic-los-angeles/>

index). Many students at UCLA spend most of their time on the West Side and don't travel too far outside of Westwood, so this was an important experience for them. This was an opportunity for them to counter and rewrite a representation of a city that they thought they were already familiar with. It was proof that undergraduate students can do high-level, original scholarly research if we provide them with innovative, interdisciplinary digital methodologies and analytic frameworks.



Angel David Nieves

Angel David Nieves is Associate Professor of Africana Studies at Hamilton College.

When we first began teaching our introduction to digital humanities in the fall of 2012, we had only nine students in the classroom. In the third year of teaching the course, we now have twenty-nine students working to develop a series of collaborative, scalable projects. This effort not only demands mastery of the classic research paper's primary and secondary sources, archival research, and formatting, including footnotes and bibliography; but as a digital humanities exercise, it also incorporates other forms of critical media including music, video, still image, and graphic design. For example, an English class examining aspects of the twentieth-century novel can go beyond lecture or even Socratic dialogue and now do something much more complex, creating not just a research paper that appears online, but a research "paper" in a platform like Scalar that can move into understanding a novel's translations, its film adaptation, a video interview with the novel's author, fragments from the film adapta-

tion's score, or textual analysis; and it can introduce other lecturers to provide insight into extradisciplinary research through the use of blogs, wikis, Skype, and Twitter.

In a 2012 article in *Digital Humanities Quarterly* entitled "Envisioning the Digital Humanities," information technology and humanities scholar Patrik Svensson details the ways in which digital humanities have often become a kind of laboratory for thinking through the current state of pedagogy and the future of the humanities as a whole. Svensson draws some important parallels in the growth of digital humanities with the establishment of Asian American studies in the 1980s. The core values of "a predominantly textual orientation and a focus on technology as tool embedded in the digital humanities," have in many ways relegated digital humanities to two centers at most research institutions: the English and history departments. For scholars like me who have leveraged the expertise and political capital of their peers to build a home for digital humanities, it's also very clear that in order to remain at the cutting edge of the field, we must situate ourselves also in the interdisciplinary fields of Africana studies, women's and gender studies, as well as American studies. I can already see parallels between what Svensson has argued in his piece with the radical transformations that many of us helped to bring about in academia in the 1980s and 1990s, and even well before that. The margins – area studies, identity studies, interdisciplinary studies – have become more central to standard practice with the advent of the digital humanities.

I am currently codirecting an Andrew W. Mellon Foundation-funded initiative to jump start the digital humanities at Hamilton College. We have also received support from the Office of Digital Humanities at the NEH to institutionalize digital scholarship, research, and teaching at Hamilton.

The Digital Humanities Initiative (DHI) is a research and teaching collaboration in which new media and computing technologies are used to promote humanities-based research, scholarship, and teaching, including curriculum development across the liberal arts. My partnership with Janet Simons from Library and Information Technology Services (LITS) was the first between a

faculty member and an administrator to cut across multiple units: namely, ITS, the dean of faculty, and the library. We work to unite faculty research goals with technology and library science resources to build upon Hamilton's significant strength in teaching and research. We also work to emphasize the interdisciplinary nature of humanities research, incorporating undergraduate students as scholarly partners in significant original research projects.

We are developing a platform through which we can embed primary archival materials in a 3D world to recreate scenes from the apartheid era so that students can engage with lost or hidden history that tourism in South Africa has since displaced.

ity for digital collections whose scalability and extreme flexibility in the manner in which objects can be accessed in the long term has helped define industry best practices. Our collections software also offers flexibility for the creation and maintenance of the relationships between objects and across digital collections. Metadata schemas for digital collections are developed in

collaboration with faculty research directors and students to promote the richest possible exploration and discovery for digital scholarship. We're all getting our hands dirty with metadata, and we love it. None of these multiyear collaborations would have been possible without two of our core curricular efforts: first, the creation of an undergraduate minor in cinema and media studies; and second, through our comprehensive undergraduate research program entitled "CLASS," the effort to remove the confines of the semester schedule to promote students' deep understanding of digital humanities research within a specific field over the long term. In these experiences, students and the faculty advisor become part of a collaborative working team of experts in the DHI. CLASS provides students with training in digital literacies through intensive research and scholarship coupled with unique internship experiences. In the summer between sophomore and junior years, CLASS offers undergraduate students an intensive professional development experience and provides a comprehensive overview of work in their

respective fields. Assistance with job placement in a professional field based on their CLASS internship is an important feature of their final year at Hamilton.

My own work in South Africa has largely looked at the ways in which we might begin to engage with 3D historical reconstructions and has promoted efforts to reclaim social justice narratives of the apartheid era. This effort would not have been possible had it not been for the work that we have been doing with students to visualize and create 3D environments and models. We are developing a platform through which we can embed primary archival materials in a 3D world to recreate scenes from the apartheid era so that students can engage with lost or hidden history that tourism in South Africa has since displaced. Through the DHI, the prospect of twenty-first century interdisciplinarity may well be made real, and the promise of a "new renaissance scholar" with mastery in many disciplines may become increasingly commonplace.



Jessica Marie Johnson

Jessica Marie Johnson is Assistant Professor in the Department of History at Michigan State University.

I teach African American history at Michigan State University, a research institution with a digital humanities center and laboratory. Digital humanities, digital tools, and working in digital, radical, or new media is significantly reshaping how faculty engage with students, just as the technology is reshaping how students engage with faculty. Whether asking undergraduates to work with online databases and materials (similar to Emory's Transatlantic Slave Trade Database), to blog their reflections on and analyses of primary source texts, or to participate in conversations online via Twitter, Facebook, or a range of other social media platforms, faculty and teachers everywhere have a new range of tools for exposing students to new material and introducing them to new ways of thinking about the world. As a historian both of New Orleans and of slavery and the African diaspora, I am especially interested in ways digital tools encourage students to

There is a fundamental difference in how students approach their research via the written page and how they present their research via screen and code.

see the past from a nonlinear perspective. I encourage students to see the past from the perspectives of slaves, and I've found there is a fundamental difference in how students approach their research via the written page and how they present their research via screen and code.

Let me explain: As opposed to a lecture that encourages students to digest and evaluate information presented to them, digital tools can provide students with a cornucopia of informational choices. Students may find themselves exploring an assigned website and researching a digital exhibit, or they may find themselves having discussions about the class with me or with other students on Facebook. As a teacher, I have less control over what they encounter than I ever did before because of the depth and breadth of information available online and the kind of conversations that are already happening there. I may send them down any number of research paths, but these are not definitive, linear journeys. Students can take control of the research process for themselves and ask interesting new questions that we would not have imagined before.

The interface itself—a website, a database, the computer itself—raises questions for all ranges of history, whether the topic is slavery or histories of race, gender, sexuality. American studies, ethnic studies, African studies, and women's studies programs can have a special role to play for digital humanities projects. Digital histories of slavery—indeed, all histories of slavery—have been haunted by a struggle over the role slavery should play in how we understand society; it is a tension that is felt in different ways through all places touched by the Atlantic

slave trade. It often comes down to a contest between those struggling to center histories of bondage in national narratives and narratives of international injustice and those who disagree that slavery played a pivotal role in shaping the world that we know.

For example, using Tumblr—which is a bit like a cross between Twitter and Facebook—students can have conversations with each other they might not have had with a professor. And they can have conversations with the screen that they might not have had with me. They can also meet and interact with social media users in the real world, which can make the material being discussed much more real for them.

One of the challenges that I find when using digital humanities or social media in the classroom is an assumption that students (and faculty) are well versed in technology, when that is often not the case. Students have ranges of skills that vary depending on the kind of institution where they study and the topics they choose to study. Many faculty members assume that students want to learn with technology when they often do not. And sometimes students do not want to critically engage with academic issues on Facebook or Twitter or Tumblr; for some students, those sites represent their leisure time, and they would prefer not to blur the boundaries of work and play.

But other students—many of whom are themselves training to become teachers—are particularly interested in how digital tools work. About twenty students in the College of Education at Michigan State who also participate in the History of Education program took a course I designed for their research methods and skills requirement: in

it they learned how to approach, for example, a history of slavery through new (digital and social) media. I created a Tumblr site for their discussions where they could follow along with each other and reply and talk to each other online. They could then bring these experiences with them to class and experiment with how to introduce these online concepts and methods into elementary and high school classrooms. Further, social media sites frequently serve as gateways to more specifically purpose-driven digital tools: for example, my class's interaction Tumblr encouraged one student to create a WordPress site. The student, Kristen Roberts, used a digital archive of Missouri Supreme Court records between 1830 and 1860 to document cases of resistance by enslaved women and then built a timeline of the cases using a digital tool called TimeMapper. In other words, learning how to use digital media can become an exercise that moves a student across platforms like Tumblr to WordPress to TimeMapper – to still greater digital skills and deeper historical understanding.



Stephen G. Nichols

Stephen G. Nichols is the James M. Beall Professor Emeritus of French and Humanities at Johns Hopkins University. He was elected a Fellow of the American Academy in 2013.

The digital humanities are patently exciting to those who are involved with them. What I see as a problem is how many of our colleagues are *not* involved in them, how many do not even begin to understand why they should be involved with them. And it is not necessarily that they think they have to have some degree from MIT in order to get involved, but they think it will be too much work given the kind of preparation they do for their teaching and their research: they have a lot of deadlines, so why add to the list? But at the same time, they frequently justify their resistance by arguing, “The digital humanities do not get students involved – it is all too passive.”

This panel, however, has shown that we, in fact, seek student producers, not consumers, of digital materials. And we can make use of digital resources to enable students to become producers: that is the nature of engagement. As others have mentioned,

We are used to nonlinearity in our lives, in our books and film, and in our social media, but we have not introduced this to our teaching. How do we capture the attention of contemporary students as they sit in the classroom tweeting?

through digital resources students could become involved in a historical set of issues in a nonlinear way. We tend to want to present narratives from the beginning with a middle and end – a very good Aristotelian narrative. But as we now know from our reading of contemporary fiction, the notion of a neat narrative that begins and develops and then ends satisfactorily has gone by the wayside. We are used to nonlinearity in our lives, in our books and film, and in our social media, but we have not introduced this to our teaching. How do we capture the attention of contemporary students as they sit in the classroom tweeting?

Further, faculty frequently express concern over how they ought to approach the traditional issue of credentialing – how to judge academic nonlinearity expressed through digital media? Faculty have not yet sensed the seismic shift that has already taken place in the evaluation of the work of digital humanists.



G. Wayne Clough

G. Wayne Clough is former Secretary of the Smithsonian Institution and President Emeritus of the Georgia Institute of Technology. He was elected a Fellow of the American Academy in 2010.

I am a passionate supporter of access to higher education and to learning resources, and this applies to resources whether they are found on a university campus, in an archive, in a library, or in a museum. Their assets should be available so all people can benefit, but we live in a time when access is at risk of being diminished because of rising costs and inadequate attention to reaching underserved audiences. This is of concern for reasons related to equality but also to our democratic process that requires an informed electorate. Fortunately, digital technology is a tool that will allow us redress the issues we face.

When I brought the concept of digital learning and digitization to the Smithsonian, I hit a wall fairly quickly with some who thought I was merely talking about people having unlimited access to the collections and using them for purposes that might be seen as frivolous. Personally, I

Despite all of the interesting possibilities, it appears that digital technology has not yet penetrated very far into the traditional classroom. If we are to influence the market, it is critical that we offer resources and support to faculty who want to change.

don't think there is anything wrong with people having a bit of fun, but our curators questioned how rigor and informed investigation – which Stephen made an excellent point about – would be built into the use of digital resources. There is no question that if we want to optimize the value in using digital resources we need to build a context for them beyond simple images on a page. There has to be a structure that allows for discovery and growth if we are to make optimal use of the digital technologies that are pervading our lives.

Will spoke about encouraging critical thinking, something our students today too often lack. This has to be part and parcel of the basis for the use of the new approaches to learning. This speaks to a role for mentors and teachers who will always be needed, even in the digital world. Angel used the words *sustainability* and *can-do attitudes*. I think those are very much on target: if you are going to get into the digital enterprise, you cannot think of this as a one-time or short-term initiative. These tools are here to stay and will only become more important to the future. We have to build a framework that will allow us to take advantage of social and historical currency. Current events – for example, natural disasters such as Hurricane Sandy and Hurricane Katrina – can help connect what is happening today with the relevant historical precedent and help expand the depth of the process of discovery.

Anne talked about how digital technology is going to reshape pedagogical

approaches. I like that phrase. Too often, in an attempt to get attention, the word associated with changes related to use of digital technology is *transformative*. This word is overused and exaggerates what can and will be done. But *reshape* – a better and more accurate word – goes much further in thinking about encouraging engagement. There is an opportunity here for institutions not only to improve learning for traditional students but also to engage close-in groups like alumni, as well as to reach a wide array of nontraditional learners. In the case of museums, only 15 percent of people who are called minorities go to museums – so what is the future of museums with demographic change? Digital approaches that could complement traditional exhibitions can be designed to reach groups who might not consider coming in person.

I get the opportunity to lecture at a number of universities, and I often request a separate meeting with students with no faculty present. One of the questions I ask them is how much technology they are using in their classrooms. I am surprised by how often they say that while there is a lot of talk about technology, there is very little real action. Despite all of the interesting possibilities, it appears that digital technology has not yet penetrated very far into the traditional classroom. Will talked about the growing importance of teaching and learning resource centers: I fully agree. If we are to really penetrate the market, it is critical that we offer resources and support to faculty who want to change.

To return to the point that Stephen made about the humanities leading in the use of digital learning technologies, I agree this is the case. The humanities present a clearer picture for the average person of how digital technology serves the purpose of research and encourages engagement than does astrophysics, say, in utilizing digital technology to explain the discovery of the latest exoplanet. It is easier for most people to achieve understanding through history and shared human experiences, as provided by the humanities, than it is through examples in the sciences or in engineering.

I would also like to mention my belief that the growing use of digital technologies will break down the long-standing barriers that have been built up between learning institutions. Here I am referring to universities, museums, libraries, and archives. Just because resources of such institutions are typically housed in different buildings and are separated by different cultures, this does not mean it has to remain this way in the future. Once digital resources are housed in the cloud, users will not care too much about the source.

In using digital technologies, the future will belong to those who see the value in collaboration. When I first came to the Smithsonian, I found there was a lack of collaboration not only within the institution itself but also between the Smithsonian and other institutions and universities. We set out with a new strategic plan to change this and have made considerable progress. I am convinced that the national resources found at places like the Smithsonian, the Library of Congress, and the National Archives can be of great value for the types of projects discussed in this forum – but only if we create the collaboratives needed for it to happen.

In envisioning the possibilities, there is one reality check needed. One of the challenges to progress is the scale of the job to digitize the assets of the nation's great

national institutions. When I first arrived at the Smithsonian, I was told the collections held some 138 million objects and specimens. That is a lot, but when I spoke with David Ferriero at the National Archives, he told me they had ten billion items. Amazing! To tackle digitizing such large collections, it requires a multipronged approach, using both internal resources and external third party contractors. Constrained federal budgets do not help, but we realize the work must be done regardless. Fortunately, new technologies are speeding up the process; but it will take time, especially to do it right.

Complicating the task is the need for not just a high-resolution digital image, but also its metadata that provides context and allows for a search to locate it. At the Smithsonian, we created a transcription center that allows volunteers to work with us in putting metadata against our objects; and when you have 66,000 bumblebees, 450,000 works of art, and 650,000 baseball cards, you need help. The transcription center concept has proven invaluable in speeding up public access to the Smithsonian collections.

One final note on collaboration: the Smithsonian has established private funding for the creation of an endowment for internships and postdocs supporting young people who can help us in our efforts to create access to our digital resources and to help us learn how better to build our growing partnerships with universities. We recognize that while we have a huge opportunity, we also face a great challenge and will not succeed without casting the largest net possible. We look forward to working with our partners to making the most of what is to come.



James W. Wagner

James W. Wagner is President of Emory University. He was elected a Fellow of the American Academy in 2009.

The digital humanities seem wonderfully powerful for harvesting information and data about art and literature and doing analyses of those. But from the beginning of the panel, Will posed the challenge of how we can better develop digital content producers, rather than content consumers. Where does the state of the art need to advance to achieve this? And does the goal present some particular challenges, or even risks? So please consider the following two questions.

First, the state of the art seems to be most well positioned to transmit information at highly rapid rates – so is there a risk that the pace of information flow could outstrip our ability to convey and appreciate the art of the humanities? None of us read Shakespeare to follow the plot line, and yet, if I am going to contribute snippets and bytes and join the conversation at the speed required

Is there a risk that the pace of information flow could outstrip our ability to convey and appreciate the art of the humanities? How can we ensure that art is not sacrificed for pace?

of me, how can I ensure that art is not sacrificed for pace?

Second, do we have any concerns about integrity of data? It is frightening that we can launch an avalanche of conversation that gets started by an initial snowball of flawed data. The propensity for that is much higher when we can interact and react so quickly, and we see some of this danger in the role of this technology in news reporting.

The real question, then, is about the composition, contribution, and production of the data. Are there some things we need to pay attention to with current technology (art communication and information integrity, as particular examples) and other things you wish future technology could help us address?

Discussion

William G. Thomas III

Those are truly excellent questions. I would observe that in the field of history, we do not have many examples of compositional, interpretive scholarship in the digital space – examples that are available for peer review and understood widely in the profession as the pinnacle of art, of that achievement of the historian as a storyteller and as a weaver of evidence into a fabric of the past.

If there is something that is unfulfilled in the digital moment, I think you have put your finger on it: the energy has been centered on the building of tools and in the collection and digitization of material. I have tried to build some examples of interpretive work that attempt a representation of the past. We are now at a point of trying to figure out what digital historical scholarship looks like and how it can be evaluated and rated for quality and rigor as well. I agree that we are in a moment when we need to pay attention to these qualities, and I wish that the disciplines would think more carefully about these questions. The American Historical Association has put together a committee, which Ed Ayers is chairing, to look at what digital scholarship is. What does interpretive historical work created at the highest level look like? We are going to have more clarity about what that might be and what we can agree upon in the coming years.

There has been a delay because the disciplines haven't figured this out, and tenure and promotion committees haven't figured this out. It is a very risky operation for young faculty to step forward and create something that they are calling interpretive and "compositional" – as you have put it – digital scholarship. I love that word for this. There are few models of that sort of digital scholarship. Evaluation and definition is a very important next step.

Anne Cong-Huyen

Quite a few scholars in the digital humanities and the information sciences, people like David Kim, Fiona Barnett, and Johanna Drucker, have addressed the problematics of data: how it is not neutral, how we always have to be questioning and thinking critically about where the information is coming from, who is capturing the data, who is publishing the data, and where it is being published. The humanities are of great importance to our ability to address and read data critically. We are really good at addressing questions of contradiction and recuperating the obscure things that are highlighted in dense data sets.

Collaboration is also important in addressing these concerns. Recently I was at a hackathon on police brutality that UCLA's Information Science graduate students had

Many of our colleagues are sitting idly on the bench until they see how the digital art tackles the problem of evaluation. Evaluation runs counter to what we might call the metaphysics of the digital world: speed, size, and everything related to accessing content instantly.

put together. They brought together information that was released by the LAPD, but also by the *Los Angeles Times* Homicide Desk, and data compiled by community organizations. They filled gaps found in existing government and local databases through community involvement in mining and analyzing social media data related to these incidents. They made use of social media information operating in concert with publicly available government and local databases to create a clearer representation of the lived realities of communities experiencing police brutality in the United

States. That is just one example of how we can critically look at the avalanche of information.

Stephen G. Nichols

Many of our colleagues are sitting idly on the bench until they see how the digital art tackles the problem of evaluation. Evaluation runs counter to what we might call the metaphysics of the digital world: speed, size, and everything related to accessing content instantly. Evaluation, on the other hand, is quite the opposite: it is putting the brakes on, it is analyzing, and it is sifting through fine details.

Crowdsourcing has been a major topic of interest and concern for academics, and scholarly journals and research projects are only beginning to approach it. Crowdsourcing is closely linked to that other C-word, collaboration. It involves taking seriously

what anybody who wants to weigh in says. To evaluate an academic article, in the old days, we used to have two people read it. But that was a disaster: one reader would like it, the other would hate it. So we added a third reader, but by then you find yourself involved with the politics of the thing. But having one hundred people or fifty people weigh in on an article creates something more resembling democracy.

I was on the committee for scholarly editions for the Modern Language Association (MLA) when we tried to encourage digital

editions. Briefly, in analog editions – the way that they used to be done – you would have the text, you would have the variants, and the edition would gain a stamp of approval. Digital editions involve much more input, and we sought to give those editions an MLA seal of approval that would help with credentialing the young scholars who were doing this. We managed to modify the traditional means of evaluation, to find people who were willing to look at these digital editions, to review them as scholarship, but all on a digital platform. We modified crowdsourcing so that the “crowd,” which includes maybe five or ten people, comprises experts in the field, and they could look at different aspects of the edition.

But that is the elephant in the room: the whole notion of evaluation. We have to deal with it now, before it becomes an impossibility in the near future.

G. Wayne Clough

We are creating one exabyte – one quintillion bits of information – every week. And what we see in this digital world is a tendency for it to expand, as opposed to converge. And university faculty prefer things to converge. If you are talking about a subject in the digital world, somebody can use Google and say, “I don't think you've got it right,” or “here's something else I've always wondered about,” and the discussion diverges. There is a diffuseness sometimes around topics when you do digital learning that you do not see when you have only a captive audience and your lecture notes. I don't think we understand yet how that works, and I think it is a very good question.

Jessica Marie Johnson

Platforms like Blackboard and other closed learning management systems do not interface very well with outside platforms. They

also do not interface well with social media or even WordPress. There are technical reasons for that, but it comes down in some ways to what Bill said earlier: there is a difference between digital pedagogy and online teaching. Blackboard gives us a space in which we can post information and share it more readily. We can put PDFs up for class consumption; we can have a message board, but I think that is probably the closest that we get to the kind of improvisational and conversational environment that you have with social media.

Blackboard or other learning management systems represent a closed system, one that still replicates the space of the classroom as a cloistered space. Working with a closed community can be really productive. I have a Tumblr that I run for a black studies class that is password protected. It is meant to be a safe space that can still take advantage of Tumblr's technology and interface, which I find really useful and aesthetically pleasing for students.

But posting in Blackboard is not the same thing as thinking through in a really rigorous and critical way what social media, Tumblr, Twitter – what online engagement on a twenty-four-hour basis in an expanding information environment – does for teaching, does for your interactions with students and interactions with your research and with other faculty.

Perhaps Blackboard is a gateway for faculty to enter into a world of thinking about social and visual media. In the conversation we are having about students as producers and consumers, I think that with social media as pedagogy, students are both consuming and producing. We may charge students with finding ways to produce, but they are also consuming all the time. For example, if I am talking about slavery, they are already talking about the film *12 Years a Slave*. If the topic is New Orleans, they already may be having a conversation about Hurricane Katrina. Social media does

require us as teachers to do an extra jump beyond what Blackboard or any learning management system can provide into what works for us in engaging students and taking seriously the ways they are already engaging the world and doing intellectual work.

Angel David Nieves

The changes that we are seeing in the humanities can be further advanced simply by acknowledging the ways in which top-tier humanities presses have adopted new publishing platforms online. NYU, Harvard, and MIT Press, among others, have adopted these platforms, basically announcing that the heartbeat of the monograph is slowing down. We need to think differently not only about the ways in which our scholarship is produced, but also how it is disseminated. A push and pull from different factions is allowing some of the bleeding-edge, cutting-edge movements to grow, but it is largely unnoticed. I have long wondered why it is that these particular presses, despite their stature, have not had their work acknowledged as cutting-edge. We have talked about evaluation for a long time, but why are we still having those conversations? And why are we talking about older platforms when we have Scalar and numerous advanced platforms on the horizon? There is huge resistance on the part of humanities faculty to understand the silofication of their disciplines. As Kathleen Fitzpatrick has said, we have planned our obsolescence in so many ways, and we have got to find a way out of this.

James W. Wagner

Thank you for those presentations and responses. I was really struck by the fact that for all of you, the teaching and the thinking and the collaboration now taking place are exciting and innovative, but the actual

technologies that you are employing are not state-of-the-art, cutting-edge technologies. Which is not a criticism; I think that this is the kind of work that we are doing in Domain of One's Own here at Emory. The technology has reached the point now where you do not have to be a tech person to publish and otherwise create content online.

But I am wondering whether that presents its own challenges. Perhaps digital pedagogy is not taken as seriously as some of the other kinds of digital humanities work that is going on – perhaps it has not penetrated deeper into the teaching profession exactly because we are always interested in the technology that is on the bleeding edge and that pushes the state of the art. Perhaps this work is ignored because it has actually been going on for a long time. The assessment of multimodal writing now has a long history; digital dissertations have been written now for the past twenty years; and digital tenure portfolios are not so novel anymore. But maybe some digital tools are not spreading just because they are not brand new. If the ideas and the collaborative potential are interesting, we need to get people to take the work seriously, even if it is no longer technologically innovative. Perhaps in the presence of never-ending change we need patience to let our innovative use of maturing technologies determine the state of the art, helping to ensure that digital technologies enhance what we do in creating and communicating the humanities. ■

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On Legal Services for the Poor

John G. Levi

Forty-five years ago, I spent my very first summer as a Harvard law student working at the Mandel Legal Aid Clinic in Chicago handling various housing and consumer civil legal aid matters for low-income persons. In my early years as an associate at the Chicago office of the Sidley Austin law firm, where I have been fortunate to practice my entire career, I volunteered once a month at a civil legal aid clinic on the near Northwest Side of Chicago helping to handle whatever came through the door.

A few years later, as a board member of a children's care agency, I participated in a court-watching program at the Juvenile Courts of Cook County. This led me to be appointed to the Citizens Committee on the Juvenile Court of Cook County and other related boards. At the same time, I became a founding member of the Advisory Board for Northwestern Law School's Center on Wrongful Convictions.

In these not-for-profit and pro bono endeavors, it became increasingly clear to me that low-income Americans have significant difficulty navigating our country's legal system on their own, and that this is a gravely serious issue facing our country. So when Barack Obama became President of the United States and asked me to chair pro bono the Board of the Legal Services Corporation (LSC)—the country's single largest funder of civil legal aid for low-income Americans, providing federal grants to 134 nonprofit legal aid programs in every state—I jumped at the chance to serve.

Congress created the Legal Services Corporation in 1974 to help “provide equal access to the system of justice in our nation” and to “provide high quality legal assistance to those who would be otherwise unable to afford adequate legal counsel.” This mission—and, in my view, there is none more important in American law—attracted me to LSC and has sustained me throughout my tenure as board chair.

LSC is charged with honoring and protecting a core American value: equal access to justice. Core values cannot be taken for granted. As my father, Edward Levi, a former President of the American Academy of Arts and Sciences, reminded us nearly forty years ago in his farewell address as the Seventy-First Attorney General of the United States, the values on which the country is founded “can never be won for all time—they must always be won anew.”

Winning anew equal access to justice is the vital work of the eleven-member, presidentially appointed LSC Board of Directors, which has been my great privilege to lead since 2010. But from the beginning, our LSC board faced pressing challenges. LSC needed a new president, and after a national search, appointed Jim Sandman, former managing partner of Arnold & Porter LLP. LSC also needed

a new strategic plan, adopting one in 2012 after a year-long planning process, laying out three foundational goals: maximize the availability, quality, and effectiveness of civil legal services that its grantees provide; become a leading voice for civil legal services for poor Americans; and achieve the highest standards of fiscal responsibility both for itself and its grantees.

We also wanted to make sure that LSC reached the gold standard in grants management and oversight; thus, we formed a blue ribbon task force that issued a 2011 report outlining steps to ensure that LSC reaches this goal.¹ This restructuring has enabled LSC to confront more effectively the enduring challenge to us and the legal aid community: namely, limited resources to address the vast and growing national need.

In 1976—our first year of full congressional funding—when 12 percent of the U.S. population was eligible for LSC-funded legal assistance, the fledgling LSC was allocated (in inflation-adjusted terms) more than \$468 million. Three years later, Congress increased funding to an all-time high of what today would be more than \$880 million.

I wish I could say we were anywhere near that level of funding now, but despite our best efforts, the FY2015 allocation of \$375 million is less than half of that peak, and is only \$10 million more than the previous year. Even ten years ago, LSC's actual funding was \$400 million.

Since 1969, when LSC funding began to decline, the population eligible for LSC-funded assistance has grown to an all-time high. Nearly one in three Americans—96 million people—qualified for LSC-funded services at some time during 2013, the most recent year for which U.S. Census Bureau data are available. According to the data:

- 63.6 million people—one in five Americans—had annual incomes below the threshold for LSC-funded legal assistance of 125 percent of the federal poverty line (\$14,363 for an individual and \$29,438 for a family of four).

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1. Legal Services Corporation, *Fiscal Oversight Task Force Report to the Board of Directors* (Washington, D.C.: Legal Services Corporation, 2011), <http://www.lsc.gov/sites/default/files/LSC/pdfs/FiscalOversightTaskForceFINALReport.PDF>.

- Another 32.4 million people had incomes below the 125-percent level for at least two consecutive months during the year.

To stretch limited resources, LSC has encouraged the expansion of pro bono services from the private bar. In August 2011 at Harvard Law School, LSC convened a national Pro Bono Task Force of more than sixty leaders of the legal community, and later that year released its report and recommendations on how to increase the number of lawyers willing to do pro bono work and how to better match the available talent pool with the large unmet need.² With help from others in the profession such as the American Bar Association (ABA), Access to Justice (ATJ) Commissions, and local bars, LSC has implemented many of the recommendations detailed in the report. One of those recommendations, the creation of a Pro Bono Innovation Fund to award competitive grants supporting innovative pro bono projects throughout the country, was funded by Congress for FY2014, and was increased to \$4 million in FY2015.

Developing new technology and better uses of existing technology is another way to stretch limited resources, and LSC continues to be a leader in this effort through its extraordinary Technology Initiative Grants (TIG) program, which this year celebrates its fifteenth anniversary. Through this program, LSC has funded 525 tech projects with a total of more than \$40 million. In its FY2015 budget, Congress increased funding for the TIG program by \$550,000 to \$4 million.

TIG funding supports a broad range of technologies to make the delivery of legal services in the United States more efficient and effective. For example, with our partners, the TIG Program has built a network of websites that delivers a wealth of legal information, self-help videos, and automated forms to assist low-income individuals with their legal needs from coast to coast. Further, TIG funding has supported the creation of a national veterans' legal assistance website (statesidelegal.org) and new, user-friendly tools designed for women veterans in need of legal help. LSC's second technology summit, held in 2012 – 2013, also produced a ground-breaking blueprint for using innovative technology to improve the delivery of legal services.³

Raising public awareness is crucial to the success of LSC's mission. In response, LSC's board has convened distinguished judicial and expert panels at every one of its national quarterly meetings and

2. Legal Services Corporation, *Report of the Pro Bono Task Force* (Washington, D.C.: Legal Services Corporation, 2012), http://www.lsc.gov/sites/default/files/LSC/lscgov4/PBTF_%20Report_FINAL.pdf.

3. Legal Services Corporation, *Report of the Summit on the Use of Technology to Expand Access to Justice* (Washington, D.C.: Legal Services Corporation, 2013), http://www.lsc.gov/sites/lsc.gov/files/LSC_Tech%20Summit%20Report_2013.pdf.

annually at the White House to help call attention to the crisis in civil legal aid and LSC's and its grantees' roles in addressing it. Of the many problems discussed, the challenges presented by the millions of *pro se* litigants ("in one's own behalf"; litigants who represent themselves) in our state courts were among the most distressing.

In September 2015, LSC convened a comprehensive three-day conference in Washington, D.C., to commemorate the nonprofit corporation's fortieth anniversary. More than one hundred distinguished panelists and speakers from the legal community, law schools, the judiciary, government, and the private sector, together with nearly all of the executive directors and many board chairs of LSC's 134 grantees across the country, took part in wide ranging discussions about the crisis in civil legal aid in America.

Across the spectrum, there was agreement about the importance of equal justice and its role in American self-understanding. As Hillary Clinton, LSC's second board chair, stated:

Guaranteeing legal services for all Americans makes us a better country and a fairer country. It helps by empowering people to solve those problems and it helps to level the playing field. It is not just a fair shot at the justice system, but it is a fair shot at the American dream.

Justice Antonin Scalia sounded a similar theme:

The American ideal is not for some justice. It is, as the pledge of allegiance says, "Liberty and justice for all"; or as the Supreme Court pediment has it, "equal justice." I've always thought that's somewhat redundant. Can there be justice if it is not equal? Can there be a just society when some do not have justice? Equality – equal treatment – is perhaps the most fundamental element of justice.

The Justice also reminded us of Hamilton and Madison's stirring words in Federalist No. 51:

Justice is the end of government. It is the end of civil society. It ever has been and ever will be pursued until it is obtained or until liberty be lost in the pursuit.

As LSC board chair, it is my professional responsibility to do everything I can to honor and preserve this ideal. As an American, it is my – as it is all of our – civic duty to make sure that the justice system we leave to future generations of Americans remains true to our country's founding values.

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Causes of Campus Calm: Scaling China's Ivory Tower

Elizabeth J. Perry

In the more than twenty-five years since the momentous student-led Tiananmen uprising of 1989, university campuses in the People's Republic of China (PRC) have been notably tranquil. The situation is particularly striking in light of the veritable explosion of popular protest found among virtually all other sectors of post-Tiananmen Chinese society. Land conflicts by rural villagers, labor disputes by urban workers, environmental protests by a rising middle class – to name only some of the most prominent varieties of popular resistance – contribute to an impressive level of contention in contemporary China. Yet, in the midst of this widespread social ferment, college students and their professors have remained conspicuously compliant. The only significant student participation in protest activity has taken the form of regime-sponsored nationalistic demonstrations against Japanese claims to the Senkaku/Diaoyu Islands. Such acquiescence cannot be attributed to any inherent passivity on the part of Chinese academics. Prior to Tiananmen, every generation of twentieth-century Chinese intellectuals engaged in consequential political protest. Moreover, the recent “sunflower movement” in Taiwan and the “occupy central” demonstrations in Hong Kong indicate the continuing capacity of university students in other parts of Greater China to mobilize large-scale political protests in direct opposition to PRC policies.

My current research seeks to explain the means by which the Chinese Communist party-state maintains campus calm, despite the many unpopular and potentially unsettling higher education reforms – from the introduction of student tuition fees to the imposition of faculty publication requirements – that the Ministry of Education has implemented in recent years. The party-state's methods of control are multifaceted and dynamic, continually evolving to reflect the latest developments in international pedagogy and information technology. These techniques include mental health screening and military training, as well as formal and informal instruction in political ideology, moral values, and Chinese history and culture. Dissemination of officially approved messages is not confined to the classroom: social media are used extensively (and often unobtrusively) as a means to communicate the party line.

A dense network of “guidance counselors” (*fudaoyuan*) – trained personnel tasked with keeping close tabs on their student charges to ensure that their beliefs and behaviors do not violate approved boundaries – forms a mainstay of the control regimen at PRC universities. Typically advanced graduate students and young instructors in their late twenties or early thirties, the counselors

(assisted by student informants) report to the deputy party secretaries responsible for student work at all levels of the university structure. The guidance counselors also help mobilize students to participate in various “voluntary associations,” often under the direct or indirect auspices of the Communist Party or Youth League, which deliver a range of social services, including eldercare for senior citizens and education for migrant children. The result of this associational activism is to relieve the state of some of its onerous welfare burden while at the same time providing an outlet for student engagement that is supportive, rather than subversive, of the political system.

Ironically, among the most powerful weapons in the PRC's arsenal of control mechanisms is the promotion of a battery of assessment measures – by no means unique to China – that are internationally recognized as standard metrics for any globally competitive system of higher education. At the core of these evaluation procedures is a fixation with *scaling*, or quantifiable ratings of “quality,” that pervade (and pervert) both official and unofficial criteria of scholarly excellence. A driving motivation behind China's contemporary higher education reforms, first unveiled in 1998, has been the effort to catapult the country's leading universities into the upper echelons of “world-class universities,” as reflected in the *Times Higher Education*, *Shanghai Jiaotong*, *QS*, and other rankings of top research universities in the world. The PRC has pumped enormous amounts of funding into this endeavor via centrally mandated programs such as Project 211 (initiated in 1995) and Project 985 (1998). To protect its generous financial investment, the state has also imposed an elaborate system of evaluation and compensation – consciously tailored to the benchmarks of the world univer-

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sity rankings – that serves to structure and constrain the activities and attitudes of Chinese academics.

Bibliometrics – the counting of articles published in SCI (Scientific Citation Index) and SSCI (Social Science Citation Index) journals – has become the gold standard for measuring China's progress in scaling the ivory tower. As a component of this strategic ascent, armies of postdoctoral fellows have been hired by all of China's major universities. These young scholars (often with considerable overseas research and study experience) have no teaching duties and are employed on short-term contracts, renewable upon producing a specified quota of SCI or SSCI journal articles. Faculty members are also rewarded with generous bonuses for publishing in these designated outlets. The result is an academy more preoccupied with fulfilling "productivity" targets than with political criticism.

In determining the global rankings of universities, the number and size of research grants is, of course, another important criterion: world-class universities are supposed to have world-class funding. China's Communist Party games the system of grantsmanship so that it functions simultaneously to improve the global rankings of Chinese universities and to inhibit the independence of researchers. The party, through its propaganda departments at both central and provincial levels, exercises considerable control over university research by setting priorities for large-scale grants. In the social sciences and humanities, the propaganda departments' influence can be seen in the extraordinary number of major grants earmarked for the study of General Secretary Xi Jinping's "China Dream," for example. There is both tremendous pressure on faculty to apply for these lucrative and prestigious grants and severe discrimination against those who are unwilling or unable to garner them. Such funding affects not only faculty salaries and promotions, but also university standings.

The party-state's generous funding of higher education, propelled in large part by the prospect of rising rapidly in the global rankings, is surely a key reason for the notable quiescence of the Chinese academy. It is sometimes suggested that Chinese universities can never become "world class" as long as Communist Party committees remain in charge; but that depends on how we define a world-class university. If research universities are measured by the quantities of publications they produce or the sizes of the research grants they secure, then the party's ability to channel vast amounts of state resources toward such outcomes is a decided advantage.

But China's skillful scaling of the ivory tower is important not only in helping to explain an otherwise puzzling absence of campus protest in the PRC. Inasmuch as American universities are also engaged in the frenetic global competition to attain or retain

"world-class" status, not to mention their interest in attracting tuition dollars from China, the Chinese approach to higher education competition implicates us all.

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Philologia Rediviva?

Sheldon Pollock

Mesopotamian scholars began writing commentaries on Babylonian and Assyrian texts as early as 800 B.C. Some four centuries later, scholars in India brought systematic order to the language and discourse of the (by then very ancient) Vedas, while those in Alexandria for the first time became aware of variation in the Homeric poems and the need to address it through textual criticism. In the seventh century, Arab scholars were confronted with the problem of clarifying the language of a new revelation, the Qur'an. Across the early modern world, the problem of textual understanding became acute: scholars in fifteenth-century Italy realized that language is historical and that texts in newer languages that pretended to be old (like the *Donation of Constantine*) were forgeries; a little later, scholars in Timbuktu and neighboring regions invented ways to adapt the Arabic script for writing West African languages; those in late seventeenth-century China were convinced they had lost the empire to barbarians because they no longer understood their classics, and developed "evidential research studies" in response; and scholars in eighteenth-century Japan believed that if they could learn how to read their most ancient texts (like the *Kojiki*), they could therein find an original Japan, one that had existed long before the influence of Chinese culture.

These scholars were all philologists: contributors to the discipline of making sense of texts – all texts, whether oral, written, printed, or electronic, whether literary, religious, or legal, those of mass culture no less than those of elite culture. If philosophy is thought critically reflecting on itself, philology is the critical self-reflection of language. If mathematics is the language of the book of nature, philology is the language of the book of human being. And under this description – and not its older and narrower definitions (grammar or textual criticism or corpus linguistics) – philology has been as ubiquitous a discipline in time and space as either philosophy or mathematics. Human history from Mesopotamia to Japan for almost three millennia is evidence enough. Philology once defined education itself: every educated person learned languages and texts, and how to interpret them.

Today, however, philology is confronted with two closely related threats. First, almost everywhere in the world, the field is vulnerable in the academy; to some observers, philology's very survival now hangs in the balance. Second, philology has no secure disciplinary geography in today's university, nor has it ever – in my sense of the term – held one in the era of the modern university. The solution to

the existential threat may, to some degree at least, be dependent on the solution to the institutional one.

Charting the global endangerment of philology is complicated. In the United States, the American Academy's own Humanities Indicators project offers a starting point, though philology itself has not been studied (note that it is not even identified as a humanistic field), and extrapolating information about it from the Indicators is difficult. Generally speaking, the last forty years have seen a startling decline in the growth of humanities faculty in general, with the number of full-time positions nearly cut in half over the period. The Indicators reveal that the percentage of doctoral degrees that were awarded in the humanities fell to its lowest level in 2007 (5.6 percent) before recovering slightly (to 6.2 percent) in 2013. Further, the share of degrees in languages and literatures other than English (including classics) ranged from a mere 1.2 percent to 1.7 percent in the past two decades. This general trend was corroborated by a February 2015 report of the Modern Language Association describing steep, even drastic (as in the case of ancient Greek), declines in foreign language studies.

What all this suggests, in a word, is that the population of academic professionals in the United States responsible for preserving, understanding, and transmitting a large segment of historical culture – for making sense of the vast world of texts – is hardly more than a rounding error in academic demography. This population stands in inverse proportion to the size, and significance, of its object of study.

The situation outside the United States is considerably worse, though hard data are still more difficult to get. In Europe, while esteem for philology may remain high, anecdotal evidence points to a serious diminution of professorial positions. Consider the fact that as of 2012 – for the first time since 1821, when Franz Bopp was

Sheldon Pollock, a Fellow of the American Academy since 2014, is the Arvind Raghunathan Professor of Sanskrit and South Asian Studies. He is the author of The Language of the Gods in the World of Men: Sanskrit, Culture, and Power in Premodern India (2006) and more recently Kritische Philologie: Essays zu Literatur, Sprache und Macht in Indien und Europa (2015) and Reader on Rasa: Classical Indian Aesthetics (forthcoming 2016). He is General Editor of the Murty Classical Library of India (Harvard University Press).

appointed professor and introduced, according to Michel Foucault, the science of philology itself – Sanskrit is no longer taught in a university in Berlin. And in India, the world’s greatest philological laboratory (to which I have devoted myself for over forty years) seems almost on the verge of shutting down. It is now conceivable that within a few generations, the number of people able to make sense of texts in many of India’s almost two dozen premodern languages – which together constitute the world’s longest continuous multilingual textual history – will have approached a statistical zero.

In short, we may well be standing on the verge of a historic event: the inauguration of a world without philology for the first time in three thousand years.

In response to these developments, but at the same time recognizing the opportunities that challenges offer, scholars across the globe have begun to take action. Five years ago in Berlin, a number of young scholars from across the geographical and historical spectrum initiated a project, called *Zukunftsphilologie* (“future philology”), aimed at rejuvenating the field with new research programs, postdoctoral fellowships, and workshops held in the Arab world, Africa, and South Asia. In 2008, a conference organized by scholars at the Institute for History and Philology at Academia Sinica (Taipei) gave rise to *World Philology* (Harvard University Press, 2015), the first book to chart the global history of the field. Fellowship programs, such as “The Learned Practices of Canonical Texts” at the Max Plank Institute (founded by Academy Fellow Anthony Grafton), have been initiated; conferences have been held and scheduled for the future, including “The Languages of the Past and the Future of Ancient Studies” at the University of Pennsylvania this October; influential new books have been published, including *Philology: The Forgotten Origins of the Modern Humanities* (Princeton University Press, 2014) by James Turner; and new journals – such as *Philological Encounters* and *Philology: An International Journal on the Evolution of Languages, Cultures and Texts* – have been founded while older journals – such as *Geschichte der Germanistik* – have been updated to account for recent global developments. Further, Harvard University Press has inaugurated several notable multilingual book series, including the I Tatti Renaissance Library (Latin; 2001), the Dumbarton Oaks Medieval Library (Byzantine Greek, Medieval Latin, and Old English; 2010), and the Murty Classical Library of India (at present, fourteen different languages in nine different scripts, 2014). New York University Press, meanwhile, launched the Clay Sanskrit Library (2005) and the Library of Arabic Literature (2012). There is now even talk at the international level of forming a World Philology Association.

If such efforts are to be sustained, philologists must develop a new disciplinary formation, with a new intellectual core. For as

defined here, philology, unlike philosophy and mathematics, has never had a disciplinary home in which its real capacities could develop. If it did achieve some measure of institutional dominance in the nineteenth-century European university, this was because of the veneration then paid to the study of the classics. Philology’s fall from grace in the course of the twentieth century was caused in part by the classics’ loss of centrality, but even more from the proliferation of philology’s subfields, such as linguistics and comparative literature, and, more recently, by the transformation of language and literature departments into area studies. In fact, philology today is not defined as a unified discipline, but is divided by and confined to geopolitical units, whether national traditions in the West (such as English, French, and German) or regional traditions in the non-West (such as those in South Asia, East Asia, and the Middle East). These are admittedly important conditions of understanding – texts exist in social and political contexts, after all – but they need to be complemented by a structure that acknowledges what unifies philologists, encourages comparison and synthesis of diverse traditions and their interpretive multiplicity, and fosters larger generalization from particular cases. It is through the disciplinization of philology that its real intellectual contribution – as the basic science of the humanities – can be realized.

How broad this science is, both within the academy and outside, is easily demonstrated. Textual interpretation – the core of philological theory and method – is central not just to literary and religious studies but to history and law (philology being like mathematics in the vast dissemination of its techniques, but unlike mathematics in its lack of a disciplinary home). Beyond the academy, philology – though one that does not know its name – continues to broadly influence the public domain. It is ironic to observe, given the decline I have charted, how significant are the philological energies across the Internet on sites like “Rap Genius” (<http://rap.genius.com>), a self-described “crowd-sourced (and artist/producer-sourced) annotation of rap lyrics/beats, from ‘Rapper’s Delight’ to ‘To Pimp A Butterfly.’” Users, including original creators, provide annotation to the often complex lyrics of songs, as well as intertextual linkages and contextual material. The purpose of Rap Genius, originally named Rap Exegesis, is precisely to make sense of texts. It has recently been branching out to include other musical forms, as well as law, history, and more; it is, in fact, now simply named “Genius.” The site seeks to “annotate the world,” “to help us all realize the richness and depth in every line of text.” This is pure philology in terms of practice, albeit practice that as yet has little awareness of its history, theory, or method. Providing that context, and formalizing the discipline, is the role of the university;

and today's academy must also recognize and channel the energies of these popular philological enterprises.

Columbia University hopes to help in this effort via a new program in World Philology. We are starting small, with just two new courses (one undergraduate and one graduate) to be offered in the academic year 2016 – 2017 and a lecture series that will bring many of the most thoughtful historians, theoreticians, and practitioners of philology to campus. At the same time, new teaching materials will be developed that will eventually produce one or more *Readers in World Philology*, showcasing by way of annotated translations of primary texts – online and crowd-sourced, in fact, though also peer-reviewed – the key contributions to the discipline from around the world and through time.

Our goal is not only to enable students to gain a historical and theoretical grasp of textual understanding – to understand why Supreme Court Justice Scalia is wrong to assert, about the text called the U.S. Constitution, that “words mean what they mean,” and “their meaning doesn't change” – but also to see the remarkable continuities in global philology, and, equally important, the differences, sometimes startling differences, in what it has meant for people to make sense of texts. We also want to show them how philology can be more than an academic discipline; indeed, it can be a way of living. You are how you read, and learning to read better – with greater precision, self-awareness, and, above all, respect for the diversity of textual truth in a world ever more unified and ever more in need of unity – means, potentially, learning to be better.

My colleagues and I are aware that far-reaching social and technological developments may be working to the disadvantage of philology, and even to the disadvantage of the very literacy philology rests upon. But every society will continue to have texts of some sort, and the need to make sense of them is assured. Philology's defenders may not be certain they can secure its future, but they know they must do everything possible to prevent its demise.

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Author's Note: This essay draws on a number of my earlier publications, including “Future Philology? The Fate of a Soft Science in a Hard World,” *Critical Inquiry* 35 (4) (2009): 931 – 961; “Crisis in the Classics,” *Social Research* 78 (1) (2011): 21 – 48; “Philology in Three Dimensions,” *postmedieval* 5 (4) (2014): 398 – 413; “Liberating Philology,” *Verge* 1 (2014): 16 – 21; and “Introduction,” in *World Philology*, ed., Sheldon Pollock, Benjamin Elman, and Kevin Chang (Cambridge, Mass.: Harvard University Press, 2015), 1 – 24.

Shinto Festivals and Bricolage

Helen Hardacre

My glasses have crosshairs, like a camera. In the horizontal plane, I see the flow of history and a changing society. In the vertical, I see the shifting tide of religious tradition. At the intersection lies my subject: Japanese religions and society. As a graduate student, my syllabi were top-heavy with Wittgenstein, so I am under no illusion that my vision is anything but partial and fragmentary. We also read mountains of Lévi-Strauss, and the bricoleur is still with me (I don't mind how bowdlerized the idea has become). I see bricoleurs at work fashioning a way of life out of a powerful experience, or struggling to wring a message from a founder's revelations that will speak to contemporary problems. Brick by brick, people labor to grasp their religious heritage and forge tools from it to deal with life's dilemmas. Religion is about this kind of labor: people sensing discord, feeling the way forward, building something by trial and error, and working to align it with contemporary issues. To study religion in this way requires enduring relationships that enable me to see how things will turn out. An example may clarify.

I have been working on Shinto shrine festivals since the late 1990s, especially the Darkness Festival (*Kurayami Matsuri*) of the Ōkunitama Shrine in Fuchū City in Western Tokyo Prefecture. During the early modern era, it was the best-endowed shrine in the province. More recently, urban sprawl has turned Fuchū into a suburb of Tokyo, and most current residents migrated to Fuchū after 1945; thus, newcomers now far outnumber the shrine's old-time supporters.

The Darkness Festival is a protean spectacle, a complex of ceremonies and displays unfolding annually from April 30 to May 6. The festival begins on a boat in Tokyo Bay, from which participants draw seawater; it continues with the polishing of mirrors symbolizing the *Kami* (deities) of the shrine, a procession of gaily caparisoned horses making symbolic offerings to the imperial court, more horses galloping through a tree-lined arcade in town at night, and many other displays of music, dance, and feats of strength. It culminates in a great procession on May 5.

The festival's purpose is to effect the rebirth of the *Kami*. The *Kami* are carried in darkness (to look upon them would be blinding) in eight palanquins called *mikoshi*, in a procession involving hundreds of bearers and attendants, back to the *tabisho*. Marking where the *Kami* first manifested, the *tabisho* is a large, fenced, vermilion enclosure at a crossroads several hundred meters from the shrine's

main gate. Dozens of men pull huge drums, each large enough for several people to stand on, to clear the way for the *mikoshi*. The *mikoshi* each weigh more than one ton, and are carried on long poles atop the bearers' shoulders. Each bearer thinks the direction he or she is facing is "front," so the *mikoshi* whirls in the shrine yard in repeated assaults on the narrow gate through which it must pass to join the procession. Drums await the *mikoshi* on the other side, calling them with incessant booms. The erotic symbolism is liberally fuelled with alcohol, heat, noise, and the bearers' calls of *Hoissa! Hoissa!*

Under fresh-cut bamboo canopies in the *tabisho*, the *Kami* receive elaborate offerings of food, music, and prayers of praise. Remaining in this parturition pavilion until morning, they emerge reborn. Their joyous human "children" convey them back to the shrine, where they are solemnly installed to bless and protect Fuchū for another year.

Before the town's suburbanization, no one publicly disputed the all-night carousing, cross-dressing, brawls, and transgressive sexual encounters that assisted the rebirth of the *Kami*. But contemporary Japan more conservatively prioritizes school and the workweek, and has limited patience for rowdy shrine festivals and the attendant disruption (especially on a school night). After a string of complaints, the local PTA forced the shrine to adopt a daytime festival schedule in 1962.

The daytime schedule eviscerated the festival's rationale and made nonsense of its copious use of distinctively shaped decorative lanterns. The costumes and ritual gear, lovingly preserved across generations, presumed a nighttime format; yet they could hardly be abandoned, even if their use made no sense in daylight. Enter the shrine's high priest Sawatari Masamori, who was appointed in 1999. Determined to restore darkness to the festival, he worked to establish for himself a position of respect and trust in Fuchū, allying with the mayor and other city officials, and

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A mikoshi in the Darkness Festival.

eventually rising to head the local PTA. By 2002, he had secured the town's agreement to restore the traditional nighttime format.

Head priest Sawatari's bricolage utilized the connections and alliances he fostered to insert the shrine into civic life. As a Shinto priest, it was axiomatic to him that the rebirth of the Kami requires darkness, shadow, and mystery. But he also recognized that in the twenty-seven year interval between the institution of a daytime format and his appointment, a generation had grown up thinking that it was normal that the Darkness Festival be conducted in daylight. How to explain the change without undermining that generation's love for the festival as they knew it? How to persuade Fuchū's police and fire departments that residents would be safe with a return to darkness? How to convince the city office that Fuchū's reputation would not be damaged by injuries, deaths, or more-minor mischief at the festival? How to gather allies from disparate groups without disrupting the shrine's flow of support? How to raise a new generation of festival participants from across town?

I cannot know every detail of Sawatari's labor, but I can see the results. (Granted, the festival was easier to see and photograph during my first few visits, when it was still being conducted in day-

time.) The shrine's numerous support groups today incorporate a spectrum of attitudes, as do allied civic groups like the chamber of commerce, which benefits from the success of the festival. Many Fuchū residents have participated in the Darkness Festival for decades, far longer than the head priest. But the restored Darkness Festival under Sawatari has become an official "face" of Fuchū, proudly advertised on the town's website.¹ In an era when many shrines are going under for lack of support, head priest Sawatari has reinstated Shinto at the center of a community. I have been lucky to be there to follow the revival.² ■

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1. See <https://www.city.fuchu.tokyo.jp/bunka/ibento/kurashi/kurayamimaturi.html>.

2. I was also lucky to receive a Guggenheim Fellowship for this research, as well as support from the Edwin O. Reischauer Institute of Japanese Studies and the Asia Center at Harvard University.

As of press time, several Fellows of the Academy, listed below, had been nominated or appointed to key positions in the Obama administration:

Akhil Amar (Yale University) was nominated as a member of the National Council on the Humanities.

Elizabeth H. Blackburn (University of California, San Francisco) was appointed a member of the President's Committee on the National Medal of Science.

Edward Felten (Princeton University) was named Deputy Chief Technology Officer in the White House Office of Science and Technology Policy.

Timothy J. Ley (Washington University School of Medicine) was appointed to the National Cancer Advisory Board.

Rebecca Richards-Kortum (Rice University) was appointed a member of the President's Committee on the National Medal of Science.

Andrew Viterbi (The Viterbi Group) was appointed a member of the President's Committee on the National Medal of Science.

Select Prizes and Awards to Members

El Anatsui (Nsukka, Nigeria) received the Golden Lion Award for Lifetime Achievement, awarded by the Venice Biennale.

Bonnie Bassler (Princeton University) received the 2015 Shaw Prize in Life Science and Medicine. She shares the prize with **E. Peter Greenberg** (University of Washington).

Adelaide Cromwell (Boston University) received a 2015 Massachusetts Historical Commission Historic Preservation Award.

Mahlon DeLong (Emory University School of Medicine) is the recipient of the 2015 Taubman Prize for Excellence in Translational Medical Science.

Harold Demsetz (University of California, Los Angeles) received the Elinor Ostrom Lifetime Achievement Award from the International Society of New Institutional Economics.

Michael Gellert (Windcrest Partners) received a 2015 Harvard Medal from the Harvard Alumni Association.

E. Peter Greenberg (University of Washington) received the 2015 Shaw Prize in Life Science and Medicine. He shares the prize with **Bonnie Bassler** (Princeton University).

Stephen C. Harrison (Harvard Medical School) received the 2015 Welch Award in Chemistry from the Welch Foundation.

Henryk Iwaniec (Rutgers University) received the 2015 Shaw Prize in Mathematical Sciences. He shares the prize with Gerd Faltings (Max Planck Institute for Mathematics, Germany).

Tyler Jacks (Massachusetts Institute of Technology) received the James R. Killian Jr. Faculty Achievement Award from MIT.

Daniel Kahneman (Princeton University) and **Anne Treisman** (Princeton University) were honored with a gift to Princeton University to establish the Kahneman and Treisman Center for Behavioral Science and Public Policy at Princeton.

Hiroo Kanamori (California Institute of Technology) is the recipient of the Marcus Milling Legendary Geoscientist Medal, given by the American Geosciences Institute.

Thomas W. Lentz Jr. (Harvard University) received a 2015 Harvard Medal from the Harvard Alumni Association.

Douglas N.C. Lin (University of California, Santa Cruz) is the 2015 recipient of the Catherine Wolfe Bruce Gold Medal, given by the Astronomical Society of the Pacific.

Robert L. Nussbaum (University of California, San Francisco) received the 2015 Award for Excellence in Human Genetics Education. He shares the award with **Huntington Willard** (Marine Biological Laboratory) and **Roderick R. McInnes** (McGill University).

Roberta Cooper Ramo (Modrall Sperl) received the inaugural Award for Professional Excellence from the Harvard Law School Center on the Legal Profession. She also received the ABA Medal from the American Bar Association.

Robert D. Reischauer (Urban Institute) received a 2015 Harvard Medal from the Harvard Alumni Association.

Mark J. Roe (Harvard Law School) received the 2015 Allen & Overy Working Paper Prize from the European Corporate Governance Institute.

Helmut Schwarz (Technische Universität Berlin; Alexander von Humboldt Foundation) received the ENI Foundation Award for 2015 for New Frontiers of Hydrocarbon Research.

Laurence Senelick (Tufts University) has been named a Fellow of the Center for Advanced Studies, Ludwig-Maximilians-Universität München, Germany.

Diana Wall (Colorado State University) has been awarded the Ulysses Medal from the University College of Dublin.

Christopher Wheeldon (London, United Kingdom) received the 2015 Tony Award for Best Choreography for *An American in Paris*.

Huntington Willard (Marine Biological Laboratory) received the 2015 Award for Excellence in Human Genetics Education. He shares the award with **Robert L. Nussbaum** (University of California, San Francisco) and **Roderick R. McInnes** (McGill University).

Chi-huey Wong (Scripps Research Institute; Academia Sinica) is the recipient of the 2015 Robert Robinson Award for Contributions to the Advancement of Organic Chemistry, given by the Royal Society of Chemistry.

New Appointments

Mary Beckerle (University of Utah) has been appointed to the Board of Directors of Johnson & Johnson.

William J. Burns (Carnegie Endowment for International Peace) has been appointed Senior Advisor to Blackstone.

Jonathan Epstein (University of Pennsylvania, Perelman School of Medicine) has been named Executive Vice Dean and Chief Scientific Officer for Penn Medicine.

Paula T. Hammond (Massachusetts Institute of Technology) has been named the head of the Department of Chemical Engineering at the Massachusetts Institute of Technology.

Charles O. Holliday, Jr. (Bank of America) has been appointed Chairman of Royal Dutch Shell plc.

Talmadge E. King, Jr. (University of California, San Francisco School of Medicine) has been appointed Dean of the School of Medicine and Vice Chancellor for Medical Affairs at the University of California, San Francisco.

Robert Kirshner (The Gordon and Betty Moore Foundation) has been named Chief Program Officer for Science at the Gordon and Betty Moore Foundation.

Reynold Levy (Lincoln Center for the Performing Arts) has been elected to the Board of Directors of the National Book Foundation.

Jane McAuliffe (Library of Congress) has been named Director of National and International Outreach at the Library of Congress.

Maurice Obstfeld (University of California, Berkeley) has been appointed as the economic counselor and director of the International Monetary Fund's Research Department.

Ariel Pakes (Harvard University) has been appointed Senior Advisor to Cornerstone Research.

Henri Termeer (Genzyme) has been named a key advisor to Sarepta Therapeutics Inc.

Luis A. Ubiñas (New York, New York) has been appointed President of the Board of Trustees of the Pan American Development Foundation.

Select Publications

Poetry

John Ashbery (Bard College). *Breezeway*. Ecco, May 2015

Nonfiction

Peter Ackroyd (London, United Kingdom). *Wilkie Collins: A Brief Life*. Doubleday/Talese, October 2015

George A. Akerlof (Georgetown University) and **Robert J. Shiller** (Yale University). *Phishing for Phools: The Economics of Manipulation and Deception*. Princeton University Press, September 2015

Guido Calabresi (United States Court of Appeals for the Second Circuit). *The Future of Law and Economics: Essays in Reform and Recollection*. Yale University Press, January 2016

Jonathan Culler (Cornell University). *Theory of the Lyric*. Harvard University Press, June 2015

Leo Damrosch (Harvard University). *Eternity's Sunrise: The Imaginative World of William Blake*. Yale University Press, October 2015

Stanley Fish (Florida International University). *Think Again: Contrarian Reflections on Life, Culture, Politics, Religion, Law, and Education*. Princeton University Press, November 2015

Sheila Fitzpatrick (University of Sydney). *On Stalin's Team: The Years of Living Dangerously in Soviet Politics*. Princeton University Press, October 2015

Nancy Foner (City University of New York, Hunter College and The Graduate Center) and **Richard Alba** (City University of New York, The Graduate Center). *Strangers No More: Immigration and the Challenges of Integration in North America and Western Europe*. Princeton University Press, May 2015

Harry G. Frankfurt (Princeton University). *On Inequality*. Princeton University Press, October 2015

Robert J. Gordon (Northwestern University). *The Rise and Fall of American Growth: The U.S. Standard of Living since the Civil War*. Princeton University Press, January 2016

Jürgen Kocka (Humboldt-Universität zu Berlin). *Capitalism: A Short History*. Princeton University Press, October 2015

Thomas W. Laqueur (University of California, Berkeley). *The Work of the Dead: A Cultural History of Mortal Remains*. Princeton University Press, October 2015

Joseph LeDoux (New York University). *Anxious: Using the Brain to Understand and Treat Fear and Anxiety*. Viking, July 2015

Neil Levine (Harvard University). *The Urbanism of Frank Lloyd Wright*. Princeton University Press, November 2015

Sanford Levinson (University of Texas at Austin). *An Argument Open to All: Reading "The Federalist" in the 21st Century*. Yale University Press, November 2015

Helen V. Milner (Princeton University) and **Dustin Tingley** (Harvard University). *Sailing the Water's Edge: The Domestic Politics of American Foreign Policy*. Princeton University Press, October 2015

Richard E. Nisbett (University of Michigan). *Mindware: Tools for Smart Thinking*. Farrar, Straus and Giroux, August 2015

Gordon Orians (University of Washington). *Snakes, Sunrises, and Shakespeare: How Evolution Shapes Our Loves and Fears*. University of Chicago Press, April 2015

Francine Prose (New York, New York). *Peggy Guggenheim: The Shock of the Modern*. Yale University Press, September 2015

Matt Ridley (Newcastle, United Kingdom). *The Evolution of Everything: How New Ideas Emerge*. Harper, November 2015

Robert J. Shiller (Yale University) and **George A. Akerlof** (Georgetown University). *Phishing for Phools: The Economics of Manipulation and Deception*. Princeton University Press, September 2015

Frank Wilczek (Massachusetts Institute of Technology). *A Beautiful Question: Finding Nature's Deep Design*. Penguin Press, July 2015

Robert Wuthnow (Princeton University). *In the Blood: Understanding America's Farm Families*. Princeton University Press, September 2015

Ruth Bernard Yeazell (Yale University). *Picture Titles: How and Why Western Paintings Acquired Their Names*. Princeton University Press, October 2015

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. ■

In Memoriam: John David Steinbruner (1941–2015)

Elected to the Academy in 1992



It is with profound sadness that I note that John Steinbruner, a longtime member of the Academy and cochair of the Academy's Committee on International and Security Studies since 2000, died of cancer in Washington, D.C., on April 16, 2015. He is survived by his wife Cris Gobin, his sons David and Greg, and his stepdaughter Gretchen.

John Steinbruner's remarkable life was full of remarkable achievements. He was an intellectual giant from the earliest age, publishing a path-breaking book about the psychology of decision-making – *The Cybernetic Theory of Decision* – not long after completing his doctorate at MIT. He became an Assistant Professor of Government at Harvard in 1969, served as Associate Professor of Public Policy at the John F. Kennedy School of Government at Harvard from 1973 to 1976, and then was granted tenure at Yale and was an Associate Professor in the School of Organization and Management and in the Department of Political Science. He left that position in 1978 to become the Director of the Foreign Policy Studies Program at the Brookings Institution – all before he turned 40. From 1996 until his death, he was Professor of Public Policy at the School of Public Policy at the University of Maryland and Director of the Center for International and Security Studies at Maryland.

He was a brilliant scholar and widely published author, whose multidisciplinary expertise spanned from climate change to biological weapons to civil discord and nuclear operations. He served on influential advisory committees, including the Pentagon's Defense Policy Board, and guided innumerable studies for the National Academy of Sciences, the intelligence community, and other government agencies. He inspired two individuals who each went on to become the Secretary of Defense of the United States, and who joined him in articulating innovative precepts for post-Cold War security that became the underpinning for decades of U.S.-Russian nuclear cooperation. And he was a highly successful institution builder, widely respected by foundation leaders for his intellectual clarity and near-prophetic understanding of twenty-first-century global security trends.

John was a deeply private man who led a hugely public life. Even people who thought they knew him well have expressed astonishment at the range and diversity of individuals who considered him their intellectual and spiritual anchor. His friends were many and varied – a Supreme Court justice, a Benedictine abbot, prominent Russian scientists, a group of Catholic Bishops (twelve of whom travelled to Qom under his guidance in 2014 to talk to Iranian clerics about nuclear security), and many dozens of senior policy-makers from around the world. But his circle somehow always included younger people just starting their careers, whom he took under his wing and mentored generously. Those of us who were lucky enough to fall into his orbit will always feel an incalculable debt, not just for his help in transforming our inchoate ideas into refined research concepts (and then tactfully pretending that this was what we had always meant to say – he was famous for that) but for instilling a sense of values and higher purpose that we might never have had the courage to espouse without his encouragement. John's success granted him access to the highest levels of academia and policy-making but for him this was never the goal. He genuinely believed in the perfectibility of human beings – and of society – if only given the right tools and opportunity.

John had known for a decade that he had an incurable disease. He endured repeated episodes of experimental treatments that sometimes required long periods of hospitalization, each time returning to his many professional responsibilities as if he had just been on vacation. When asked how he was doing, he would respond that his tennis game was slightly off or that his hair (which, to the consternation of his grey-haired sons, always came back black) was growing too slowly. As was true in all areas of his extraordinary life, John

managed to achieve near bionic status with his doctors – always engaged and informed, determined to beat the odds (which he had analyzed carefully), and working hard to reassure the medical staff that their efforts were not in vain.

It would not surprise anyone who knew John that he spent many hours of his final days calling students and close colleagues – including Academy President Jonathan Fanton – to express regret about the circumstances that would prevent him from fulfilling his commitments. As the news of John’s illness spread across Washington, D.C., and beyond, the reaction it provoked was unusual for the world of power and policy. It is, perhaps, best described as love. John’s far-reaching and stellar intellectual legacy and his unflinching efforts to advance transformational concepts of global security will surely endure; but it will be more than equaled by the bedrock of loyalty and affection he inspired in so many – an all too rare and precious gift. ■

Janne E. Nolan
*Research Professor, Elliott School of International Affairs,
George Washington University*

Remembrance

*It is with sadness that the Academy notes the passing of the following Members.**

Meyer Howard Abrams – April 21, 2015; elected in 1963
John Wesley Baldwin – February 8, 2015; elected in 1992
Joseph Frederick Bunnett – May 22, 2015; elected in 1959
Chris Burden – May 10, 2015; elected in 2014
Marilyn Speers Butler – March 11, 2014; elected in 1998
John S. Carroll – June 14, 2015; elected in 2003
William Owen Chadwick – July 17, 2015; elected in 1977
Mark Correa – June 16, 2015; elected in 1993
Martha Ann Derthick – January 12, 2015; elected in 1982
E. L. Doctorow – July 21, 2015; elected in 1991
Russell J. Donnelly – June 13, 2015; elected in 2001
Allison J. Doupe – October 24, 2014; elected in 2008
George W. Downs – January 21, 2015; elected in 2014
Maurice Duverger – December 16, 2014; elected in 1962
James Alan Fay – June 2, 2015; elected in 1962
David B. Frohnmayer – March 9, 2015; elected in 2002
Peter Jack Gay – May 12, 2015; elected in 1967
John H. Gibbons – July 17, 2015; elected in 2005
Gunter Grass – April 13, 2015; elected in 1970
Albert Henry Halsey – October 14, 2014; elected in 1988
Benjamin Harshav – April 23, 2015; elected in 1995
Theodore Martin Hesburgh – February 26, 2015;
elected in 1960
Louis Norberg Howard – June 28, 2015; elected in 1965
Donald Raymond Keough – February 24, 2015; elected in 2002
B. B. King – May 14, 2015; elected in 2008
Robert Paul Kraft – May 26, 2015; elected in 1974
Stephen Martin Krane – January 19, 2015; elected in 1983
Benjamin Lax – April 21, 2015; elected in 1962
Norman B. Leventhal – April 5, 2015; elected in 2007
Philip Levine – February 14, 2015; elected in 2002
Henry Linschitz – November 24, 2014; elected in 1967

John Leask Lumley – May 30, 2015; elected in 1975
Mary Frances Lyon – December 25, 2014; elected in 1980
Albert Harry Maysles – March 5, 2015; elected in 2013
Daniel J. Meltzer – May 24, 2015; elected in 2004
Yoichiro Nambu – July 5, 2015; elected in 1973
John Forbes Nash, Jr. – May 23, 2015; elected in 1995
Norman H. Nie – April 2, 2015; elected in 2009
Richard John O'Connell – April 2, 2015; elected in 2007
James Olney – February 4, 2015; elected in 2001
Jack Walter Peltason – March 21, 2015; elected in 1981
Andrew Porter – April 2, 2015; elected in 1985
Karl Harry Pribram – January 19, 2015; elected in 1956
David Malcolm Raup – July 9, 2015; elected in 1996
Alexander Rich – April 27, 2015; elected in 1960
Rutherford David Rogers – February 17, 2015; elected in 1976
Irwin Allan Rose – June 2, 2015; elected in 1977
James F. Rothenberg – July 21, 2015; elected in 2015
James Salter – June 19, 2015; elected in 2009
Gunter Alexander Schuller – June 21, 2015; elected in 1967
Richard Burton Setlow – April 6, 2015; elected in 1975
Janet Taylor Spence – March 16, 2015; elected in 1984
John Bruton Stanbury – July 6, 2015; elected in 1965
Daniel Steinberg – March 14, 2015; elected in 1986
John David Steinbruner – April 16, 2015; elected in 1992
Malcolm Woodrow Pershing Strandberg – May 3, 2015;
elected in 1957
Gordon Tullock – November 4, 2014; elected in 1978
Ralph Herbert Turner – April 5, 2014; elected in 1984
Mark I. Vishik – June 23, 2012; elected in 1990
Anthony C. Yu – May 12, 2015; elected in 2000
Vladimir Petrovich Zinchenko – February 6, 2013;
elected in 1989

**Notice received from February 13, 2015, to July 27, 2015*

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PHOTO CREDITS

David Ditzler Photography	page 5
Michael Stravato	pages 10, 12, 16
Martha Stewart	page 22
Gail Oskin	page 29
Office of University Communications, University of Nebraska-Lincoln	page 32
Emory University Photography	pages 34, 35, 37, 38, 40

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