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The Comprehensive Nuclear-Test-Ban Treaty at 20

Lassina Zerbo, Rose E. Gottemoeller, Robert Rosner, and Siegfried Hecker



Public Research Universities: Serving the Public Interest in Michigan

Mark S. Schlissel, Mary Sue Coleman, Patrick Doyle, M. Roy Wilson, and Lou Anna K. Simon

ALSO: The Regulatory and Ethical Dimensions of Human Performance Enhancement
The Poetry of Walt Whitman and Allen Ginsberg
Managing the Benefits and Risks of Nuclear, Biological, and Information
Technologies
Russia Beyond Putin

Upcoming Events

SEPTEMBER 2016

14th

House of the Academy
Cambridge, MA

*Capturing Music:
The Technology of Medieval Sound*

Featuring: **Thomas Forrest Kelly** (Harvard University) and The Vocal Ensemble **Blue Heron**

18th

House of the Academy
Cambridge, MA

*Screening of "Command and Control,"
followed by a discussion with nuclear scholars*

A film about the accident at the Titan II missile complex in Damascus, Arkansas

OCTOBER 2016

7th–9th

Cambridge, MA

Induction Weekend

7th: *A Celebration of the Arts and Humanities*

Featuring: **Diane Ackerman**, **Eavan Boland**, **JoAnn Falletta**, **Terrance Hayes**, **Kim Kashkashian**, **Yusef Komunyakaa**, **Kongjian Yu**

8th: *Induction Ceremony*

9th: *Closing Program: Educating Students
Who Have Different Kinds of Minds*

Featuring: **Temple Grandin** (Colorado State University)

NOVEMBER 2016

10th

House of the Academy
Cambridge, MA

*The Future of Political Parties and
the Rise of Populism*

Featuring: **Jennifer Hochschild** (Harvard University), **Lawrence Bobo** (Harvard University), **Charles Stewart III** (Massachusetts Institute of Technology)

15th

Sanford Consortium
La Jolla, CA

Global Warming: Science and Policy

16th

Huang Engineering Center
Stanford University
Palo Alto, CA

New Dilemmas in Ethics, Technology, and War

18th

House of the Academy
Cambridge, MA

*Chamber Series in collaboration with the
Cantata Singers*

DECEMBER 2016

14th

House of the Academy
Cambridge, MA

Winter Concert

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

From the President



Jonathan F. Fanton

On October 8, 2016, 175 new Fellows and 37 new Foreign Honorary Members will be inducted into the American Academy. The Induction weekend is a wonderful occasion for Fellows and Foreign Honorary Members to meet one another, learn about the Academy's work, and formally celebrate their election to the Academy. All members are invited to attend the programs and to meet and welcome the 2016 class of new members. New and returning members find the experience to be both stimulating and inspiring.

The Induction weekend also provides us with an opportunity to reflect on the founding of the Academy in 1780. From the beginning our institution was more than a society to honor leading scholars and professionals. The Academy's charter, adopted on May 4, 1780, was clear "that the end and design of the institution is . . . to cultivate every art and science which may tend to advance the interest, honor, dignity, and happiness of a free, independent, and virtuous people."

John Adams, John Hancock, James Bowdoin, and other founders believed the new nation would need strong, independent, expert advice. A fundamental part of this call to service was the recognition of the important role that the arts, humanities, and sciences would play in allowing educated citizens to participate in an open democracy, to nurture a strong economy, and to build a fair and just community.

Today, this call continues and the tradition of members participating actively in the life of the Academy is flourishing. Members, supported by a talented and dedicated staff, take the lead on projects and publications. Fellows serve as guest editors of our quarterly journal *Dædalus*, and in the past year, eighteen members contributed essays to the journal. In the last three years, 230 members have participated in Academy projects and studies, such as The Commission on Language Learning, The Global Nuclear Future, The Commission on the Future of Undergraduate Education, The Lincoln Project: Excellence and Access in Public Higher Education, and New Models for U.S. Science & Technology Policy. And our new Exploratory Fund supports members who want to work together to pursue subjects or topics of common concern. We have ten Exploratory Fund initiatives, involving 55 members, which have recently been completed or are in the planning stages. Some of these projects are exploring the state of legal services for low-income Americans, the preservation of intellectual legacies, and the future of jazz in America.

Over the last 236 years, members have gathered together to discuss important issues facing the nation and the world. In the past year, the Academy expanded the number of meetings for members held across the country, which highlighted topics explored in our projects, studies, and publications. Several meetings focused on the Academy's recently launched Public Face of Science initiative, The Lincoln Project on Excellence and Access in Public Higher Education, and a forthcoming issue of *Dædalus* on *Russia Beyond Putin*. The Academy hosted 47 meetings in Cambridge and 44 meetings in 24 cities across the United States and abroad this past year. More than a thousand members participated in these meetings.

In addition, the Academy has formed regional program committees in several cities to bring local members together to advise on current Academy projects; to elevate the impact of Academy reports and publications; to explore topics of interest at the local or national level; and to provide opportunities for social and intellectual connection. The furthest along is the San Diego Program Committee, which has planned several events and receptions for local members on topics such as "Neuroscience and Architecture" and "At-Risk Global Heritage," with a meeting scheduled in November on "Climate Change Science and Policy."

FROM THE PRESIDENT

Discussions among members on important topics can now happen through the Academy's new on-line community, called Member Connection. For example, the Academy's new project on Understanding the New Nuclear Age is using the Member Connection platform to facilitate the work of the project. Through the platform, members of the project's working group are accessing, commenting, and discussing draft papers in advance of a meeting later this fall.

Looking ahead, in 2030 the Academy will celebrate its 250th anniversary. This milestone is an opportunity to reflect further on the nation that our founders imagined and ask, through an objective lens, how is "the democratic experiment" working? How can we continue to work together to make America the "city upon a hill" they sought, an example of a just and humane society with opportunity for all? We welcome your thoughts and suggestions of studies the Academy might undertake to assess the state of our democracy and to strengthen its ability to face the challenges of the future, in the spirit of our founders.

Let me conclude by returning to our founders' call to service. Election to the American Academy is not only an honor, but also an opportunity to work with other talented people who care about research, institutions, core values of fairness and opportunity, peaceful relations among nations, and building communities to help each of us fulfill our potential. With modest financial resources, the key to all that the Academy can accomplish is the leadership and engagement of its members. So we invite you to come forward with an idea you want to pursue through the Academy, to volunteer to lead a local program committee, to join a project, or to contribute to a publication. Let us work together to fulfill the vision of our founders. In their words: "It is the part of a patriot-philosopher to pursue every hint – to cultivate every enquiry, which may eventually tend to the security and welfare of his fellow citizens, the extension of their commerce, and the improvement of those arts, which adorn and embellish life."

A handwritten signature in black ink that reads "Jonathan F. Fanton". The signature is written in a cursive style with a large, stylized initial "J".

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The Academy convenes a discussion on the regulatory and ethical dimensions of artificially enhancing human cognition

For centuries humans have sought to enhance their natural appearance and abilities through medicine, surgery, exercise, and education. Today, performance enhancement is most often associated with drugs taken by athletes and college students to improve physical and mental performance. However there exists a vast portfolio of performance enhancement approaches, from pharmaceutical drugs to physical or cognitive training to prosthetic devices such as exoskeletons that augment the physical capabilities of military personnel. Recent technological advances have produced devices that directly affect and are integrated with brain function, offering the promise of brain-machine interfaces that might increase human capabilities or compensate for lost motor or cognitive function.

The rapid expansion of the human performance enhancement (HPE) field also raises new ethical dilemmas that must be addressed in order for society to integrate these approaches in a socially responsible manner. On January 21–22, 2016, the Academy convened a multidisciplinary group of scholars from medicine, neuroscience, ethics, law, and economics, along with experts from government agencies and the private sector, to discuss the current state of research and policy discourse on HPE. The discussion focused on the safety, regulation, and ethics of neuromodulation, a process that normalizes (modulates) brain function through the delivery of electrical stimulation or pharmaceutical agents to targeted sites of the body (see sidebar on page 5). Since several workshops over the years have already discussed the use of pharmaceutical agents in the form of nootropics or athletic enhancements, the January 2016 workshop focused on neuromodulation via electrical stimulation. This approach can be used either as a therapy for brain diseases or to augment normal cognitive function. Devices used to augment brain function are commonly referred to as cognitive enhancement devices (CEDs).

While the workshop was not intended to produce consensus recommendations on research projects, policy procedures, or ethical guidelines, the participants identified several topics that require further attention, including regulation by government agencies; safety, efficacy, and labor economics; and other societal implications such as justice, access, fairness, and coercion.

Clarifying the Regulatory Regime

A presentation by a panelist at the Academy workshop on her recent research¹ highlighted the lack of clarity regarding the regulatory framework for cognitive enhancement devices (CEDs) and the difficulty in determining which regulatory authority or authorities may



Workshop chair **Steven Hyman** (Broad Institute of MIT and Harvard; Harvard University)

be best suited to regulate these devices. Many CEDs are readily available to consumers in the form of unregulated “do-it-yourself” (DIY) products and direct-to-consumer (DTC) wearables that purport to enhance cognitive function. It is unclear whether CEDs should be considered medical (i.e., therapeutic) devices since they are marketed to augment healthy cognitive capacities, such as fine-tuning motor skills, changing mood, and improving concentration.

The Food and Drug Administration (FDA), which has primary legal authority to regulate medical devices under the Federal Food, Drug, and Cosmetic Act,² is currently considering whether and how CEDs should in fact be regulated as such. The FDA defines medical devices as any device that is “intended for use in the diagnosis of disease, or in the cure, mitigation, treatment, or prevention of dis-

1. Anna Wexler, “A Pragmatic Analysis of the Regulation of Consumer Transcranial Direct Current Stimulation (tDCS) Devices in the United States,” *Journal of Law and the Biosciences* 2 (3) (2015): 669–696.

2. Food and Drug Administration, Federal Food, Drug, and Cosmetic Act (FD&C Act), <http://www.fda.gov/regulatoryinformation/legislation/federalfooddrugandcosmeticactfdact/>.

ease . . . or to affect the structure or any function of the body, and which does not achieve any of its primary intended purposes through chemical [and metabolic activity].”³ The FDA has historically referred to advertising material and claims (therapeutic vs. enhancement) as evidence of intention. Since many CEDs are not explicitly intended for the diagnosis, cure, treatment, or prevention of disease, they do not come under FDA regulation. However, the FDA may still decide that, to the extent that they affect “the structure or any function of the body,” they should nevertheless be regulated as medical devices under this definition. Yet the effects of CEDs on brain structure and/or function can be difficult to establish with any degree of certainty (particularly given the lack of funding and studies of using these devices in healthy populations), leading to concern that manufacturers of CEDs would attempt to circumvent FDA regulation again by altering the descriptions of how their products work.

As suggested by the panelist during her presentation, in the event that the FDA decides that CEDs should not be regulated as medical devices, they could instead be subject to regulation by the Consumer Product Safety Commission (CPSC). The CPSC has the authority to develop certain safety standards for consumer products it deems to be potentially hazardous. A consumer product is defined as any product sold for use in or around the household, mainly for recreational rather than medical purposes. As previously mentioned, a given device can be regulated differently based on intended use claims. For example, a treadmill intended for medical or rehabilitation purposes is considered a medical device and thus is regulated by the FDA, but an identical product that is intended for home or recreational purposes is considered a consumer product and therefore regulated by the CPSC. While cognitive enhancement products could fit the latter intent, there is concern that the CPSC may not be prepared to appropriately regulate these devices, since it does not have the

Approaches to Human Cognitive Enhancement via Electrical Stimulation

Neuromodulation devices involving electrical stimulation, whether used for therapy or for enhancement, can be divided into two categories: invasive and noninvasive. Invasive technologies, for the purpose of the workshop discussion, require the physical implantation of devices into the brain. One example is deep brain stimulation (DBS), which requires the surgical implantation of an electrode into the brain to deliver electrical stimulation through specific regions of the brain for the treatment of neuropsychiatric disorders like depression and motor disorders such as Parkinson’s disease.

Noninvasive technologies, by contrast, do not require surgical implantation but rely instead on external stimulation delivered to the brain from an instrument placed on or around the head. Examples include transcranial direct current stimulation (tDCS), which uses a pair of electrodes affixed to the head to run a current to superficial layers of the brain, and transcranial magnetic stimulation (TMS), which uses a magnetic coil held above the head to stimulate superficial layers of the brain. Because they bypass the risks associated with surgical implantation such as biological rejection, noninvasive devices may be less likely to be perceived as dangerous. Given their ease of use and ease of construction (particularly in the case of tDCS), noninvasive devices are more prevalent outside of the clinical setting and are often subject to direct-to-consumer (DTC) marketing.

It is important to note that many scholars in the HPE field consider the distinction between “invasive” and “noninvasive” to be problematic. For example, the current induced by TMS and tDCS, not unlike an invasive DBS, can have downstream effects in areas beyond the brain, such as in the spine and musculature. Additionally, the use of noninvasive devices can produce internal and external side effects, including headaches, seizures, and scalp burns. More study is needed to determine whether invasive and noninvasive devices should be considered (due to similar safety risk profiles and cognitive/bodily effects) in parallel when developing ethical, regulatory, and medical guidelines.

FDA’s expertise or resources and is generally perceived to be weaker in terms of enforcement.

Several workshop participants also expressed concern that CPSC regulations focus on the nature of the device itself rather than patterns of use. For example, a product might be safe for adults but not for children, or for use for 15 minutes rather than two to three hours per day. Regulating CEDs based on the end use or the end user would also make it easier for companies to market medical devices in cases where nontherapeutic uses are not approved.

3. Food and Drug Administration, “What is a Medical Device?” <http://www.fda.gov/AboutFDA/Transparency/Basics/ucm211822.htm>.

Recent technological advances have produced devices that directly affect and are integrated with brain function, offering the promise of brain-machine interfaces that might increase human capabilities or compensate for lost motor or cognitive function.

The Federal Trade Commission (FTC) can also play a role in regulating CEDs by highlighting unfair or deceptive business practices. The FTC has filed complaints against companies that have made unsubstantiated cognitive enhancement claims, such as in the case of the brain training product *Jungle Rangers*.⁴ More recently, the FTC entered into a settlement with Lumos Labs, makers of the brain training game *Lumosity*, for purporting medical benefits.⁵ Yet several workshop participants expressed concerns that the FTC may not have ready access to the necessary scientific expertise to make such determinations.

State authorities may also regulate CEDs. For example, in May 2013 the California Department of Public Health shut down the company tDCS Home Device Kit for violating California's Sherman Food, Drug, and Cosmetic Law by selling a misbranded and unapproved medical device.⁶

Monitoring Safety, Efficacy, and Privacy

To date, there are little data on the long-term effectiveness of CEDs. The limited availability of large-scale, longitudinal data makes it difficult if not impossible to determine the true safety and efficacy of the devices currently on the market. Furthermore, studies that show little to no benefit of a particular product often do not get published. To address these problems, one workshop participant suggested the creation of a database that would allow researchers to register, submit, and analyze data on the efficacy of CEDs, similar to the ClinicalTrials.gov website, established by the National Insti-

4. Federal Trade Commission, "Makers of *Jungle Rangers* Computer Game for Kids Settle FTC Charges that They Deceived Consumers with Baseless 'Brain Training' Claims," January 20, 2015, <https://www.ftc.gov/news-events/press-releases/2015/01/makers-jungle-rangers-computer-game-kids-settle-ftc-charges-they>.

5. Federal Trade Commission, "Lumosity to Pay \$2 Million to Settle FTC Deceptive Advertising Charges for its 'Brain Training' Program," January 5, 2016, <https://www.ftc.gov/news-events/press-releases/2016/01/lumosity-pay-2-million-settle-ftc-deceptive-advertising-charges>.

6. California Health and Safety code, division 104, part 5, Sherman Food, Drug, and Cosmetic Law, effective January 1, 2008, <https://www.cdph.ca.gov/services/Documents/fdb%20Sher%20Law.pdf>. California Department of Public Health, "CDPH Warns Consumers not to use tDCS Home Device Kit," <https://www.cdph.ca.gov/Pages/NR13-029.aspx>.

tutes of Health to provide "a registry and results database of publicly and privately supported clinical studies of human participants conducted around the world."⁷ Evaluating the safety and efficacy of CEDs would also be greatly facilitated by additional fundamental neuroscience research into how brain function is affected by electrical and magnetic stimulation, particularly in healthy populations.

The development of appropriate safety standards will also require much more post-clinical and post-market surveillance to document the side effects of CED use. For example, devices that improve cognitive ability in one area could have negative effects on other cognitive functions.⁸ These side effects may not necessarily be reversible and could impact an individual's identity, particularly if traits such as personality or memory are altered. The availability of post-market surveillance data would help regulators and the medical community to determine the level of compensation in function that is considered safe and appropriate for a given technology or device.

Who Should Benefit?

Technological advances in HPE can open up new professions to persons with disabilities, only 16 percent of whom participate in the U.S. workforce.⁹ An extreme example cited by one workshop participant was a tetraplegic woman who, in a laboratory setting, was able to control a fighter jet simulator through the use of a brain-controlled prosthetic. Performance enhancement technologies could also, according to one participant, substantially shift the landscape of the workforce by raising the bar for employee performance. One potential concern is perceived or enacted coercion wherein employees feel forced to undergo enhancements in order to be successful and competitive in their careers.

7. ClinicalTrials.gov: A Service of the U.S. National Institutes of Health, <https://clinicaltrials.gov/>.

8. Teresa Luculano and Roi C. Kadosh, "The Mental Cost of Cognitive Enhancement," *Journal of Neuroscience* 33 (2013): 4482, 4486.

9. American Institutes for Research, *One Size Does Not Fit All: A New Look at the Labor Force Participation of People with Disabilities* (2015), <http://www.air.org/sites/default/files/downloads/report/Labor-Force-Participation-People-with-Disabilities-Yin-Sept-2015.pdf>.

An additional concern is that the development and sale of cognitive enhancement devices may exacerbate social inequality, as the most potent and effective enhancements are likely to be prohibitively expensive to all but the most wealthy. This would result in a radical exacerbation of a division between the “haves” and “have nots.” As one participant noted, “People with disposable income are ready and willing to facilitate an enhancement marketplace.” Access would then be deeply reliant on price subsidization, as private companies that have made large investments in HPE technologies seek to recoup their development costs quickly in order to survive in this competitive new market.

CEDs are increasingly recognized as having potential benefits for elderly populations. For example, neuroenhancement devices and neurocontrolled prosthetics could increase quality of life while reducing health care costs by delaying or even avoiding the need to move a patient to an assisted living facility, or perhaps more importantly facilitating independence of those with disabilities. Recognizing both the potential benefits and the concomitant ethical issues, the President’s Council of Advisors on Science and Technology (PCAST) recently advocated for the development of a national research agenda on the issue of cognitive training for the elderly.¹⁰

At the other end of the age spectrum is the need to establish guidelines for the use of cognitive enhancement devices by children. The potential market for such uses is suggested by the popularity of instructional approaches such as preparatory classes for the Scholastic Aptitude Test and other entrance exams. But the devel-

Performance enhancement technologies could substantially shift the landscape of the workforce by raising the bar for employee performance.

opment of CEDs for children would pose an entirely new set of scientific and ethical questions. How much permission should parents be granted, for example, in allowing (or requiring) their children to attend tDCS sessions? Do enhancement interventions imposed by parents close off options for children when they are older? Will the

The development and sale of cognitive enhancement devices may exacerbate social inequality, as the most potent and effective enhancements are likely to be prohibitively expensive to all but the most wealthy.

outcomes of such treatments be permanent, or will they be reversed as the child ages? And the primary question is how such devices and their use in the enhancement context impact the developing brain. More studies are needed on these and many other questions.

Lastly, when DIY brain stimulation devices first emerged in the mid-2000s, many neuroethicists and media observers predicted the immediate and widespread adoption of such devices throughout society. Contrary to those expectations, DIY enhancement devices have remained confined to a small subculture. Nevertheless, it will be important to analyze how extensive the informal economy of off-label experimentation and use will become in the future, especially if the regulatory regime remains unclear.

Conclusion: The Future of Enhancement

As one workshop participant observed, “the great thing about this meeting, as opposed to the last ten years of enhancement meetings, is that we are getting to real world, actionable issues.” Although workshop attendees agreed that the technology has not advanced as rapidly as predicted a decade ago, that fact should not deter scholars and policy-makers from investing in research in this field. Just a year prior to the Academy workshop, gene therapy was largely seen as being medically and commercially infeasible, yet since that time rapid scientific advances have resulted in five public companies initiating clinical trials on gene therapies for human brain disease.

The workshop did not fully address issues such as the privacy and security of implanted neurostimulation devices, however several critical questions were raised. Who should be ultimately responsible for communications to and from the brain via such devices? Is content in the brain hackable? If so, how much would an individual “own” his or her identity? Are there areas of the brain with which one should not interfere?

10. PCAST, *Report to the President: Independence, Technology, and Connection in Older Age* (March 2016), https://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_independence_tech_aging_report_final_o.pdf.

Suggestions for Future Work

Throughout the Academy workshop, participants suggested opportunities for new scholarship and robust policy discussions on the regulatory, safety, economic, and societal issues surrounding human performance enhancement. Several of these opportunities are described below. Advancing these objectives will require the cooperation of government agencies, companies, university researchers, and medical institutions and practitioners.

- More frequent roundtable discussions with U.S. regulatory agencies, industries, and scientists are needed to develop:
 1. a thorough understanding of the technical fundamentals of the effects of CEDs on brain function;
 2. near-term policy actions to provide a more transparent regulatory landscape and determine the authorities responsible for enforcing regulation and surveillance of CEDs;
 3. separate regulatory policies for devices intended for enhancement and treatment
- Comparisons of regulatory policies with those of international regulatory authorities could also aid in developing a clearer regulatory framework for CEDs in the United States.
- Concerned organizations could consider creating an independent body to evaluate the safety and efficacy data on consumer products and implement a database of these results to establish baseline standards for each individual CED.
- Better estimates of the number of innovators, consumers, and DIY users who are developing and using CEDs will be essential for understanding the market potential for these products as well as their potential for unsafe use.
- Studies on the current and future demand-side of the enhancement market are necessary to predict its impact on the social and labor economics of the United States.
- Additional research on invasive forms of modulation is required to compare their effectiveness to noninvasive approaches. The paucity of information is due to limitations of the technology discussed earlier in this report.
- Topics such as genome editing as a foreseeable enhancement tool, autonomy in choice of use, the impact of cognitive training games, and issues with security and privacy regarding the brain-machine interface represent opportunities to bring together government agencies, companies, and academic researchers at future roundtable discussions.

Following the workshop, conversations with several participants demonstrated continued interest in discussions on CEDs as well as the following two activities that would advance the field:

1. Roundtables with scholars, regulators, and ethicists as well as current and potential users of DIY CEDs to break down communication barriers and work together to clarify regulations and safety measures for these devices.
2. Consideration of the possible long-term scenarios that could optimally and thoughtfully deepen long-term developments on issues like autonomy, agency, and identity in the context of neuromodulation and highlight consequences for the individual, institution, and society.

Both activities would foster deep partnerships among government, non-government, and academic organizations that could significantly advance our understanding of the ethical, technical, and social dimensions of current and future approaches to enhancing human capabilities. ■

The January 2016 Academy workshop on Human Performance Enhancement was supported by a generous gift from the Richard Lounsbury Foundation.

Troubled Times for Humanities in Higher Education

The humanities face a variety of challenges in higher education, as reflected both in declining numbers of college majors and in openings for new faculty, according to recent findings from the Humanities Indicators.

Dozens of commentators have cited the number of college degrees in the humanities in recent years as a key metric for the health of the field, and the latest trends can only add to their worries. The number of new bachelor's degrees in the humanities fell 7.1 percent from 2012 to 2014 (<http://bit.ly/HIBAs>). The decline was particularly notable among the largest humanities disciplines (languages and literatures, history, and philosophy), which fell to their lowest recorded share among new bachelor's degrees (6.1 percent) in 2014 (in data that extend back to 1948).

The number of master's degrees awarded in the humanities from 2012 to 2014 also fell by more than 7 percent (<http://bit.ly/HIAdvancedD>). Here again, as a share of all degrees conferred at this level, the humanities disciplines fell to a historic low (3.1 percent) in 2014.

One potential bright spot in the most recent data was the continued increase in the number of associate's degrees requiring substantial training in the humanities. The number of such degrees rose to 347,735 in 2014 – nearly double the number of bachelor's degrees in the humanities (<http://bit.ly/HIAssocD>) conferred in 2014.

The number of doctoral degrees conferred in the humanities in recent years has been steady or rising slightly, but that might be seen as

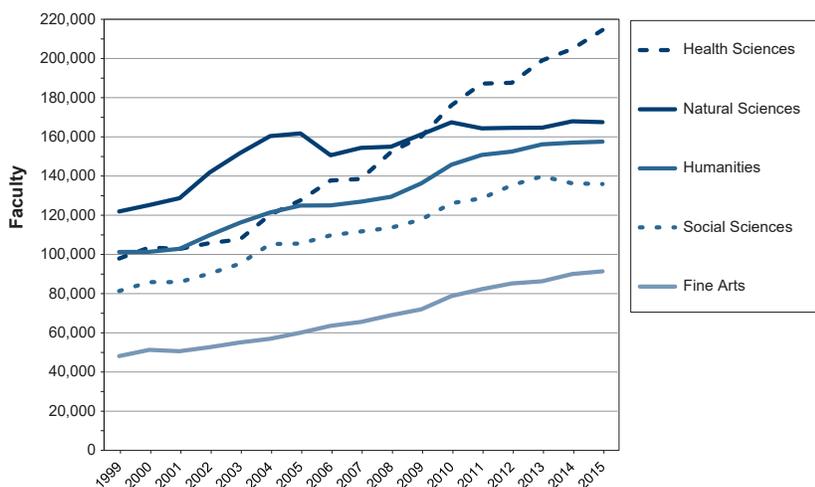
worrisome news, depending on one's view of job prospects in academia. A new survey of primarily academic jobs advertised through the major humanities disciplinary societies found openings down more than 30 percent in every discipline from pre-recession levels (<http://bit.ly/HumJobs16>). In 2015, available openings fell in every discipline.

While the number of job advertisements has been falling, the number of humanities faculty employed in the nation's colleges (both two- and four-year) and universities expanded slightly in recent years. From 2013 to 2015, almost every humanities discipline experienced some growth in its number of faculty members. However, the trend marks a substantial diminution in growth rates seen through the 2000s, and is a striking contrast to the continued increase in the number of faculty members in health science fields.

While the trends in college majors and faculty hiring may be worrisome, other recent updates at the Indicators offer some positive news about the field. As of 2013, the number of new academic publications released in the humanities rose to the highest level in at least five years (<http://bit.ly/HIACadPubs>), and research funding support for the humanities was 75 percent higher in 2014 than in 2005 (the first year in which reliable data of this kind were collected; <http://bit.ly/HIRschSupp>).

While higher education remains a core area of interest for the Humanities Indicators, the project takes a holistic approach to the field. Other recent updates have ranged from reading skills and practices in schools and in the general public to visits to art museums and historic sites. For more information about the Humanities Indicators, please visit <http://humanitiesindicators.org> or sign up for email updates at <http://bit.ly/IndicatorsUpdates>. ■

Numbers of Postsecondary Faculty Teaching in Selected Academic Fields



Source and details at <http://humanitiesindicators.org>.



New *Dædalus* issue studies Political Leadership

The collection offers insight into the character and quality of effective political leadership.

“The yearning for a strong individual leader who will dominate all and sundry is the pursuit of a false god,” argues Archie Brown (University of Oxford), guest editor of the Summer 2016 issue of *Dædalus* “On Political Leadership.” Since no leader in a democracy was ever elected because he or she was believed to have a monopoly of wisdom, it defies both common sense and democratic values for other members of the leadership team to subordinate their independent judgment to the perceived preferences of the top leader. As Brown writes in his essay, “Against the *Führerprinzip*: For Collective Leadership,” “Wise decisions are less likely to be forthcoming when one person can predetermine the outcome of a meeting or foreclose the discussion by pulling rank.” Yet, notwithstanding ghastly experience with overweening leaders in many different countries, the craving for a “strong leader” still persists, and is a major factor in the 2016 U.S. presidential election.

These and other issues concerning the character and quality of political authority are explored by the multinational and multidisciplinary group of authors convened in the latest issue of *Dædalus*.

In his introduction to the issue, Archie Brown highlights the major questions the contributors will explore: What is effective political leadership? Do we need “strong” individual leadership, or do we need to be protected from it? And what forms of leadership have best promoted democratic values: in the United States, in post-Soviet Eurasia, and following the Arab Spring?

In “Leadership, Equality & Democracy,” Nanerl O. Keohane (Princeton University) notes that though democracy is rooted in the idea of political equality, wealth inevitably makes some citizens “more equal” than others. She argues that profound and worsening socioeconomic inequalities, as found in the United States, pose a fundamental threat to democratic governance. Further, she maintains that only passionate and pragmatic leadership – found with presidents and heads of government but also with congressional committees, local politics, and education – can overcome the dangers of a polity in which the power of money so exceeds the will of the people as effectively to veto social change.

In “Rethinking the Psychology of Leadership: From Personal Identity to Social Identity,” S. Alexander Haslam (University of Queensland) and Stephen D. Reicher (University of St. Andrews) describe effective leadership as the capacity to mobilize a mass constituency to bring about shared goals. But the same qualities that make one leader effective may render another useless. Using a social identity approach, Haslam and Reicher explore leadership as an influence process built on an internalized sense of group membership shared between leaders and followers. Successful leaders not only



President Barack Obama meets with other government leaders during the G8 Summit at Camp David, May 19, 2012 (Photograph by Chief Official White House Photographer Pete Souza).

represent and mirror their followers, but actively create, advance, and embed this identity in pursuit of their goals.

In “Presidential Leadership & the Separation of Powers,” Eric A. Posner (University of Chicago) argues that the U.S. presidents judged the “greatest” leaders by historians and pundits are also the most heavily criticized by legal scholars. These presidents overcame the barriers erected by Madison’s separation of powers and breached the constitutional norms they swore to uphold. But what then stops presidents from abusing their powers? Posner points to the multifaceted nature of presidential leadership: the president is at once leader of the country, a party, and the executive branch. The conflicts between these interests constrain his or her power.

In “Women & Legislative Leadership in the U.S. Congress: Representing Women’s Interests in Partisan Times,” Michele L. Swers (Georgetown University) directs her attention to the notable underrepresentation of women in American political institutions. Swers also highlights the policies espoused by women legislators: Do women legislators tend to prioritize different causes than do their male colleagues? And at a time when the partisan divide in Congress has grown wider and more acrimonious, do the approaches of female politicians present opportunities for consensus-building?

Robert Elgie (Dublin City University), in “Varieties of Presidentialism & of Leadership Outcomes,” reflects on the relationship between institutional power and political leadership and wonders about the effects of presidential institutions on political, economic, and social outcomes. He examines the protracted debate among political scientists about whether a parliamentary or presidential system is more conducive to the transition to democracy, and argues that any approach to studying institutional power must account for the quality and style of specific political leaderships and the interactions between institutions, leaders, and contexts.

Eugene Huskey (Stetson University), in “Authoritarian Leadership in the Post-Communist World,” explores the origins and development of personalistic rule in the successor states to the Soviet Union. Several of these states have seen the emergence of monstrous cults of personality; in a number of cases, their presidents wield even more individual power than that of party leaders in the post-Stalin Soviet era.

In “Leadership – It’s a *System*, Not a Person!” Barbara Kellerman (Harvard Kennedy School) is skeptical of the very notion that individual leaders are overwhelmingly important. Highlighting the absurdity of what she calls the “leadership industry,” Kellerman suggests that “we do not have much better an idea of how to grow good leaders, or of how to stop or at least slow bad leaders, than we did one hundred or even one thousand years ago.”

Alfred Stepan (Columbia University), in “Multiple but Complementary, Not Conflictual, Leaderships: The Tunisian Democratic Transition in Comparative Perspective,” points out that while democracy has spectacularly failed to take root in Egypt, Syria, and Libya, an impressive but still fragile democracy has emerged in post-Arab Spring Tunisia. He observes a commonality with the transitions that produced effective democratic leadership in Indonesia, Spain, and Chile; like those nations, Tunisia has had a multiplicity of cooperating leaders, rather than a single “strong leader” or multiple conflictual leaderships.

In the issue’s concluding essay, “In Favor of ‘Leader Proofing,’” Anthony King (University of Essex) notes the model of Swiss success in arguing that the best-governed liberal democracies have actually obviated the need for strong leaders, who are by definition high-risk individuals likely to do more harm than good. He acknowledges that while there may be crises necessitating the acquisition and wielding of power by a single leader, there is much to be said for a liberal democracy’s “political culture and institutions having built into them a fair amount of ‘leader proofing.’”

Academy members may access an electronic copy of this *Dædalus* issue by logging into the Academy’s website. For more information about *Dædalus* or to order copies of “On Political Leadership,” please visit <http://www.amacad.org/daedalus>. ■

Morton L. Mandel Public Lecture

Creation and Destruction: Managing the Benefits and Risks of Nuclear, Biological, and Information Technologies

On May 10, 2016, the Academy hosted a meeting at the University of Chicago on the benefits and risks of nuclear, biological, and information technologies. The speakers included **Robert Rosner** (William E. Wrather Distinguished Service Professor in the departments of Astronomy & Astrophysics and Physics, as well as in the Enrico Fermi Institute and the Harris School of Public Policy Studies at the University of Chicago), **James M. Acton** (Co-Director of the Nuclear Policy Program and Senior Associate at the Carnegie Endowment for International Peace), **Elisa D. Harris** (Nonresident Senior Research Scholar at the Center for International and Security Studies at Maryland), and **Herbert Lin** (Senior Research Scholar for Cyber Policy and Security at the Center for International Security and Cooperation at Stanford University). The program, the Morton L. Mandel Public Lecture, served as the Academy's 2038th Stated Meeting and included a welcome from **Robert J. Zimmer** (President of the University of Chicago) and **Jonathan F. Fanton** (President of the American Academy). The following is an edited transcript of the discussion.

The biggest opportunity we have for improvements in the regulation of dual-use nuclear technology, and it is a limited opportunity, is with the domestic decision-making processes used to answer questions about whether to develop and deploy new nuclear technologies.

– James M. Acton



Robert Rosner

Robert Rosner is the William E. Wrather Distinguished Service Professor in the departments of Astronomy & Astrophysics and Physics, as well as in the Enrico Fermi Institute and the Harris School of Public Policy Studies at the University of Chicago. He serves as Cochair of the Academy's Global Nuclear Future Initiative. He was elected to the American Academy of Arts and Sciences in 2001.

Modern concerns about dual-use technologies emerged in concert with fears about the proliferation of nuclear weapons. The history of dual-use technologies, however, long predates the Cold War and the modern era. For example, the chemical advances underlying the use of fireworks in Imperial China were adapted in the tenth century A.D. to produce fire arrows for use in battle. Arguments about dual-use go back literally millennia.

What has changed is not the balance of dual-use technologies but the ability of modern weaponry to kill and damage human society on vast scales. This dynamic is probably best captured by J. Robert Oppenheimer's sobering allusion to the two-thou-

What have we learned about the potential for dual-use technology control from the decades-long efforts to restrict the spread of technology related to nuclear and biological weapons and, more recently, cyber weapons?

sand-year-old *Bhagavad Gita*, "I am become Death, the destroyer of worlds."

These words came to mind when Oppenheimer described the Trinity nuclear explosion. That was the point when the physicists involved in the Manhattan Project realized they had unleashed something unique in the history of humankind; namely, the ability to wipe human life off the face of the earth.

What we are faced with today is weaponry that is appropriately referred to as "weapons of mass destruction." When we talk about dual-use concerns, we are really worried about such weapons. So, what can we say today about the management of the risks inherent in dealing with such weaponry? And the technologies that have contributed to their existence?

In response to such questions, the American Academy's Global Nuclear Future Initiative, which I direct alongside Steven Miller at Harvard and senior advisor Scott Sagan at Stanford, has been taking a comprehensive look at the range of current efforts to constrain dual-use technologies; that is, efforts to create dual-use governance structures with a particular focus on their effectiveness in controlling the spread of technologies that have both beneficial and harmful consequences.

We began with a series of small workshops in 2012 that sought to explore the critical issues surrounding dual-use technologies. These workshops led to a larger meeting held at Stanford University in January 2013, which helped us to narrow our focus. We decided to organize our strategic

approach around governance: What have we learned about the potential for dual-use technology control from the decades-long efforts to restrict the spread of technology related to nuclear and biological weapons and, more recently, cyber weapons? We were fortunate to enlist Elisa Harris, one of our speakers this evening, to organize a meeting, held last year in Chicago, that focused on these questions and to address the issue of biological technology herself, and to convince James Acton and Herbert Lin, who will also be speaking this evening, to offer their views on the governance issues in the nuclear and information technology domains, respectively.

Our three speakers tonight have written chapters in the recently published volume *Governance of Dual-Use Technologies: Theory and Practice*. All three are clearly well versed in the issues that we are going to discuss this evening.



James M. Acton

James M. Acton is Co-Director of the Nuclear Policy Program and a Senior Associate at the Carnegie Endowment for International Peace.

About 150 meters from us is the site of CP-1, the world's first nuclear reactor, a part of the Manhattan Project. This is a reminder that nuclear technology is not civilian technology that happens to have a military purpose; it is military technology that happens to have a civilian purpose.

In 2007, the British political scientist William Walker wrote about how the exceptional nature of nuclear weapons calls for an exceptional kind of cooperative politics. Nuclear technology really does provide the paradigm example of how cooperative governance efforts can have considerable success in restraining the potentially harmful side of dual-use technology.

The system for regulating nuclear technology divides into two largely separate systems. One is the nuclear security architecture, devoted to preventing nonstate actors from acquiring nuclear materials. That is the less developed system; it is a patch-

Countries developing new technologies should have in place some kind of domestic nonproliferation risk assessment.

work largely made up of non-legally binding agreements with no verification.

The second system, and the focus of my remarks, is the nonproliferation side, the system designed to stop the further spread of nuclear weapons to states. This is an almost universal, legally binding, verified regime.

Often when people think about the nonproliferation regime, they think of one or two elements, or perhaps both elements at once. The first element comprises the international oversight mechanisms used to deter or detect proliferation. Safeguards implemented by the International Atomic Energy Agency are the most well-known elements of that regime, but not the only ones.

The second element comprises strategic trade controls, the circumstances under which states agree to trade in potentially sensitive nuclear technology. These controls are based on both domestic laws and international coordination.

Although imperfect, the two layers have been remarkably effective over the course of the nuclear age. That effectiveness has largely been facilitated by the specific characteristics of nuclear technology, which stand in contrast to biological and cyber technology.

First, with nuclear technology we are worried about only a few materials: primarily, highly enriched uranium and plutonium, and under most circumstances those materials are conserved. (There is an asterisk here, but I won't bore you with it!) This permits relatively easy oversight, in contrast to biological organisms, which have the annoying habit of reproducing; and in contrast to cyber, which doesn't really deal with materials at all.

Second, governments today remain central to nuclear technology. Without govern-

ment involvement, there would be no nuclear technology. This is very much in contrast to bio and cyber, and it allows for a focus on the actions of states and governments.

Third, nuclear technology has spread to a surprisingly limited degree, especially relative to bio and cyber, making strategic trade controls relatively effective.

Unfortunately, the stresses on this regime, already huge, are growing. Some of those stresses are technical. Some of the new nuclear technologies – and even some not so new nuclear technologies, such as gas centrifuge enrichment plants – present huge detection challenges. Patterns of trade are becoming much harder to monitor because they are increasingly complex.

These technical challenges might have solutions but for the fact that the politics surrounding the regime have become increasingly frozen and acrimonious. States lack the political willingness to enhance the regime.

Perhaps most serious is the lack of political willingness to do something when misbehavior is actually detected. In my chapter for the Academy's new report on dual-use technologies, I discuss in some detail why this acrimonious politics has arisen.

Suffice to say that in spite of the Iran deal, which I think is one of the few bright spots on the horizon, I am not terribly sanguine about the long-term future of the nonproliferation regime. Change is likely to be both difficult and incremental. Probably the biggest opportunity we have for improvements in the regulation of dual-use nuclear technology, and it is a limited opportunity, is with the domestic decision-making processes used to answer questions about whether to develop and deploy new nuclear technologies.

Let me give you an example that I think illustrates the lacuna in this system at the moment. Back in 2009, General Electric Hitachi submitted a license application to the Nuclear Regulatory Commission in the United States to build a new laser enrichment facility. Assessing whether this was a net positive or a net negative was a genuinely difficult decision, I believe.

From the principle of encouraging free enterprise and private companies making profits, it was potentially a good thing. At the same time, the technology posed potential proliferation risks. If the United States were to commercialize this technology, what is the likelihood it would spread to other countries?

The fact that one country has commercialized the technology means that, even if proprietary details of the technology do not leak out, other countries might be inspired to try to recreate it for themselves. That is a demonstration effect. And the process would be speeded up if proprietary details leaked.

Second, what would be the consequences of the spread of this technology? How detectable would small laser enrichment plants be? How easy would they be to safeguard by the International Atomic Energy Agency?

I don't know the answers to those questions. In fact, I don't think one *can* know the answers to those questions without classified information. GE Hitachi's application required a genuinely difficult cost-benefit analysis. But the remarkable thing is that no attempt was made anywhere within the U.S. government to actually do that cost-benefit analysis.

The Nuclear Regulatory Commission (NRC) interpreted its role as being merely to test GE Hitachi's ability to handle classified information appropriately. The executive branch and Congress decided that their role was to leave everything up to the NRC.

So, in the end, the NRC licensed this facility without any kind of discussion about the potential proliferation costs or benefits.

Now, as it happens, the plant will almost certainly not be built for commercial reasons. GE Hitachi appears to think it won't be commercially viable.

What this points to is a principle that could, in a highly imperfect yet promising way, enhance the nonproliferation regime: countries developing new technologies should have in place some kind of domestic nonproliferation risk assessment.

We have plenty of historical precedents for this in the area of nuclear technology. In the mid-1970s the United States imposed a domestic moratorium on funding for reprocessing (the extraction of plutonium from reactors). Everybody always attributes that to the administration of Jimmy Carter, but the Ford administration was actually the first to implement the moratorium. The Carter administration made it permanent, a decision

The goal is not to find an excuse not to do nuclear research. The goal is to find a coherent, systematic process for weighing the benefits and risks of such research.

that was not purely to do with nonproliferation, although nonproliferation was a factor.

In 1977, the UK government launched a judicial inquiry into the construction of a large plutonium separation plant. That inquiry did consider nonproliferation issues. More recently, the George H. W. Bush administration, in an ambitious plan called the Global Nuclear Energy Partnership, which was intended to develop and commercialize various kinds of new technology, ordered a nonproliferation impact assessment that was published in draft form (but not in final form, because the administration didn't like what it had to say).

In addition to historical precedents for a nonproliferation impact assessment, other

areas of nuclear regulation also offer precedents. A basic principle of nuclear safety is that facilities and activities that give rise to radiation risks must yield an overall benefit. Within the European Union that has translated into a formal, legally binding requirement for member-states to ensure that all new classes and types of practice resulting in exposure to ionizing radiation are justified – in terms of their economic, social, or other benefits relative to the potential harm to health – in advance of being adopted.

If you replace the word *health* with *proliferation*, you get a nice summary of the kinds of issues a proliferation impact assessment would address.

Finally, precedents can be drawn from other technologies. Searching for new forms of enrichment technology is in some ways analogous to “gain of function” stud-

ies in the biological realm. Biotechnology has an emerging process for determining whether these studies – in which scientists give microorganisms increased destructive capability, with the goal of learning how to cure disease – have net benefits.

The process might be imperfect, even flawed in many ways, but it is a process, and the fact that it is in place stands in stark contrast to nuclear technology. The goal is not to find an excuse not to do nuclear research. The goal is to find a coherent, systematic process for weighing the benefits and risks of such research.



Elisa D. Harris

Elisa D. Harris is a Nonresident Senior Research Scholar at the Center for International and Security Studies at Maryland.

The history of efforts to prevent dual-use materials, equipment, and knowledge from resulting in destructive consequences involves many different governance efforts at multiple levels – international, national, local, and even individual. The measures that have been adopted over the last half-century have taken many forms. In some cases, as with treaties and national law, they have been legally binding, but they have also taken the form of guidelines and standards, even of codes of conduct for scientists.

In the brief time that I have, I am not going to try to talk about all of the governance measures. Instead, I want to leave you with five takeaways and then close with some policy recommendations for addressing what I consider to be the biggest weakness in the governance regime for biological technology.

My first takeaway is that biological technology can cause harm either as a result of deliberate malfeasance or because of inad-

The challenge in the biological area is both to prevent dual-use technology from being used intentionally for hostile purposes and to prevent unintended harm.

vertence. Pathogens that are used to develop vaccines can escape from the laboratory and cause disease. Equipment used to study the underlying biological properties of pathogens can be used to make pathogens more transmissible and more lethal. Knowledge gained from research about extinct pathogens, such as the 1918 pandemic virus, can be used not only to strengthen disease surveillance efforts but to resurrect deadly disease agents. So the challenge in the biological area is both to prevent dual-use technology from being used intentionally for hostile purposes and to prevent unintended harm.

My second takeaway follows logically from the first: governance efforts in the biological technology area are much broader than in the nuclear or information technology area. As in the case of nuclear technology, these governance measures have focused first on nonproliferation, on preventing other countries from acquiring capabilities that could be used to cause harm; for example, by making biological weapons.

A clear example of such a governance measure is the Biological Weapons Convention, which bans the development, production, and possession of biological weapons. Also like the nuclear area, the biological area has strategic trade controls, including export controls at the national level and international controls through the Australia Group – all designed to try to deny countries access to materials and technology that could be used to develop biological weapons.

In addition to these nonproliferation measures, a variety of biosafety measures have also emerged. These have been designed to ensure that individual scientists

do not put human, animal, or plant health at risk in their work with dangerous pathogens. Examples include guidelines developed for biosafety by the World Health Organization and the guidelines for research involving recombinant DNA developed and put in place by the National Institutes of Health in the 1970s.

My third takeaway is that, to a much greater extent than in the nuclear or information technology area, September 11 and the anthrax letters that followed were watershed events in efforts to govern biological technology.

As many of you will recall, five people died and seventeen people were injured as a result of the anthrax letters sent to members of Congress and the media. But the confluence of the attacks in New York and Washington and the dispersal of high-grade anthrax material through the mail led many, both inside and outside the government, to conclude that the question was not whether bioterrorists would strike again but rather a matter of when.

The U.S. government responded to this new threat by following two parallel tracks. The first was to try to make it harder for terrorists and others who would do harm with biological agents to get access to them.

This was done through a variety of means, including tightening the controls on access to dangerous pathogens such as anthrax and plague and other so-called “select agents.” The Patriot Act barred certain restricted persons, including individuals from countries on the government’s terrorist list, from having access to select agents. Other legislation required individuals and facilities

working with these select agents to register with the federal government and to undergo background checks.

These and other governance efforts were intended to prevent individuals who would do harm with dangerous pathogens from gaining access to them. In my judgment, however, this first track was undercut by the second track that the United States pursued. That is, the unprecedented increase in funding for medical countermeasures to protect people from biological attack. At the National Institutes of Health (NIH), the number of grants for work on potential biological warfare agents increased from 33 in the period from 1996 to 2000, to almost 500 from 2001 to January 2005. The amount of funding at NIH for civilian biodefense research increased from \$53 million in fiscal year 2001 to more than \$6.7 billion (budgeted) for fiscal year 2016.

The number of specialized laboratories where scientists can work with these dangerous pathogens tripled from about 400 in the early 2000s to an estimated 1,500 high-containment labs today. And in 2014, the last year for which data are available, 316 facilities and some 11,000 people had been approved by the government to work with select agents.

My fourth takeaway is that this proliferation of scientists and facilities involved in research on dangerous pathogens has taken place against a backdrop of extraordinary advances in science and technology. Today it is increasingly easy to modify pathogens to make them more lethal, harder to detect, and harder to protect against.

A harbinger of this came in early 2001 with the publication of the Australian mousepox experiment, in which scientists in Australia trying to develop a contraceptive to control the mouse population, ended up creating a highly lethal virus.

The National Academy of Sciences recognized the significance of this research

and constituted a special committee to look at the potential risks posed by life sciences research. The committee, known as the Fink Committee for its chairman, MIT professor Gerald Fink, issued a report in 2003, aptly titled “Biotechnology Research in an Age of Terrorism.” In the report, the committee warned that dual-use biotechnology research could cause harm, “potentially on a catastrophic scale.”

To help address this problem, the Fink Committee recommended that seven categories of “experiments of concern” should be subject to oversight locally, at the institutions where the work was being carried out and, if necessary, on a national basis. Four years lat-

Today it is increasingly easy to modify pathogens to make them more lethal, harder to detect, and harder to protect against.

er, a federal biosecurity advisory board that was created in response to the Fink Committee report issued its own recommendations for research oversight of what it called “dual-use research of concern.”

My fifth takeaway is that the U.S. government’s response to the recommendations in these reports to address the risks posed by the most consequential types of dual-use research has been wholly inadequate. After the 2007 biosecurity advisory board report was issued, the government took more than five years to release even an initial U.S. policy on oversight of dual-use life sciences research. The announcement of this policy was prompted by controversy within the scientific community about research that was being carried out involving avian influenza viruses, work that was making those viruses more transmissible via respiratory droplets between mammals.

The 2012 policy was very narrow, applying only to research that was being fund-

ed or conducted by the U.S. government that involved one of fifteen specific select agents. The policy did not apply to classified biodefense or other research, or to relevant research not being funded by the U.S. government.

Two more years passed before the U.S. government released guidance for how the institutions covered by the dual-use oversight policy were to carry out the required oversight. The impetus for this additional policy guidance was another controversy – over research to create viruses similar to the 1918 pandemic influenza virus and to enable the pandemic strain to evade the human immune system.

Today the life sciences research community is more divided over the ethics and risks of certain types of dual-use research than at any time since the emergence of recombinant DNA technology in the early 1970s.

The U.S. government has taken note of the controversy within the scientific community and the concerns about the safety of some of this work. In response, it has enacted a funding pause and begun what it is calling a deliberative process for the most controversial dual-use research studies, so-called gain of function research: studies that add new functions to already dangerous pathogens.

The funding pause and the deliberative process create an opportunity both to develop an effective policy for gain of function research and to remedy the weaknesses in the U.S. government’s approach to the most consequential types of dual-use research more broadly. The U.S. government should use the authority it has under exist-

ing law to make oversight of this narrow but important class of experiments mandatory, something that is not the case today.

To eliminate the loophole for classified research and work that is being done at private facilities, the oversight requirement should apply to all relevant research, not just research funded or conducted by the U.S. government. The United States also needs to undertake a serious effort to develop common approaches and practices internationally. If we address this issue here in the United States but other countries pursue similar research without effective oversight arrangements, we will not be much safer than we are today.



Herbert Lin

Herbert Lin is Senior Research Scholar for Cyber Policy and Security at the Center for International Security and Cooperation and Research Fellow at the Hoover Institution, Stanford University.

Information technology is a very broad term. For example, it includes pencils and telephones. They can be used for bad things, but nobody is talking about dual-use controls or governance of pencils and telephones.

So I am going to talk about cyber weapons, which I define as information technology artifacts that are used to affect other information technology systems in some negative way, such as destroying or stealing the information inside.

A cyber weapon has two parts: a penetration part that allows you to get into the computer system of interest; and a payload part that tells you what you are going to do once you are inside. The two parts are very separate. The importance of this separation is clear when you think, for example, about a computer system controlling a centrifuge or a generator. Computer science skills, hacking skills, are needed to get into the computer. But in order to tinker with the cen-

The most interesting part about cyber weapons is that there is no consensus that the use of cyber weapons is bad. No nation wants cyber weapons used on it, but every nation wants to be able to use cyber weapons on somebody else.

trifuge or the generator one needs knowledge of centrifuges and power plants. I am pleased to report that most hackers do not know much about centrifuges or generators.

Also important to note is that cyber weapons may or may not be designed to be self-propagating. A cyber weapon can be designed to go after one target and one target alone. Such a weapon may appear on another system but not do any damage there. Alternately, a cyber weapon could be designed to do damage everywhere it winds up.

Advances in information technology are driven by the private sector (in which IT is ubiquitous), not by the government. Thus, the technology base for the penetration part of a cyber weapon is ubiquitous. You can find free hacking tutorials on the Internet. You can order your laptops at Amazon or Dell.

The most interesting part about cyber weapons is that there is no consensus that the use of cyber weapons is bad. No nation wants cyber weapons used on it, but every nation wants to be able to use cyber weapons on somebody else.

How you square goodness and badness in that space is obviously not a question of technology. When we do it to them, it is a good use. When they do it to us, it is a bad use.

Another point about cyber weapons is that what you do with them is essentially infinitely scalable. You can use them to do nothing; that is, you could go inside a system, look around a little bit, and then leave without affecting the system at all. Or you can use them to go in and create havoc in the system. And you can do many things in between. The level of effect is scalable to anything you want.

Cyber weapons are already ubiquitous. Most of us have not been the victim of a nuclear or biological weapon. But I would bet that most of us have been the victim of a cyber weapon at some point. Everybody has experienced spam. But why is spam a cyber

Getting a handle on acquisition is essentially impossible. Misguided teenagers are out there right now creating cyber weapons. Fifty years ago, I was one of them. (Back then, it wasn't illegal to use cyber weapons.)

What about governing the use of cyber weapons? There are already agreements constraining the use of cyber weapons, but only to the extent that nations agree that cyber weapons are governed by the laws of war. If in an armed conflict you use cyber weapons in ways that cause certain types of damage prohibited by the laws of war, then those uses would be constrained. But the nations of the world have not all agreed that the laws of war apply to cyberspace.

Second, we have seen that cyber weapons are just too useful to give up as an instrument of national power and influence. They are not just for destroying things. They are used for spying too. And the spying part is really important. Every country's intelligence agencies make use of cyber as just one more way they can spy on everybody else.

Third, because cyber weapons are infinitely scalable, they have no clear threshold. In contrast, once a nuclear weapon goes off, no matter how small, everybody will notice.

Finally, many paths lead to expertise. The expertise needed to create a cyber weapon is not confined to PhDs, or to master's degree students, or to anybody with any degree at all.

The road to getting a good handle on the governance of cyber weapons will be long. Probably the most important step we as a nation could take would be to decide whether we are better off in a world in which everybody is penetrable or everybody is defendable. Until we get a handle on that, we are going to be talking out of both sides of our mouths. ■

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When trying to govern cyber weapons, we can take three approaches. The first is to think about the acquisition of cyber weapons, about acquiring capability. The second is to somehow regulate their use. The third is to institute confidence-building measures or norms of behavior that guide how people or governments should behave in cyberspace.

weapon? Because it wastes your time. You have to delete it, and it makes your system less available than it would otherwise be.

The fact that you can scale the effects to essentially anything you want means these weapons are very usable. And that makes them highly desirable for policy purposes.

When trying to govern cyber weapons, we can take three approaches. The first is to think about the acquisition of cyber weapons, about acquiring capability. The second is to somehow regulate their use. The third is to institute confidence-building measures or norms of behavior that guide how people or governments should behave in cyberspace.

Nations do sometimes agree to norms of behavior. For example, two nations might agree to cooperate with each other in suppressing the criminal use of cyber weapons. That would mean both nations have to agree that a certain use of a cyber weapon is a bad thing and to criminalize that use. But such norms are not binding, except to the extent that each nation individually says, "I will pass a law that will make this particular use illegal."

When thinking about the governance of cyber weapons, you need to consider four things. First is that the technology base is ubiquitous. It really is everywhere.



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

The Poetry of Walt Whitman and Allen Ginsberg

On March 30, 2016, the Academy hosted a program on “The Poetry of Walt Whitman and Allen Ginsberg for Baritone and String Quartet” that featured a presentation by Bonnie Costello (Professor of English at Boston University) and a performance by David Kravitz, baritone, and the Arneis Quartet. The program served as the Academy’s 2035th Stated Meeting. Bonnie Costello’s remarks appear below.



Bonnie Costello

Bonnie Costello is Professor of English at Boston University. She was elected a Fellow of the American Academy in 2004.

Walt Whitman would not have fit in at the American Academy of Arts and Sciences. Here’s a review of Whitman’s 1855 edition of *Leaves of Grass* written by the eminent Charles Eliot Norton, who a couple of years later, in 1860, would join the Academy’s membership:

—Our account of the last month’s literature would be incomplete without some notice of a curious and lawless collection of poems, called *Leaves of Grass*, issued in a thin quarto without the name of publisher or author. The poems, twelve in number, are neither in rhyme nor blank verse, but in a sort

Any reader of “Song of Myself” is immediately impressed by the sweep of American life that it takes in, especially through the poet’s famous catalogs, his “enumerations.”

of excited prose broken into lines without any attempt at measure or regularity, and, as many readers will perhaps think, without any idea of sense or reason. The writer’s scorn for the wonted usages of good writing extends to the vocabulary he adopts; words usually banished from polite society are here employed without reserve and with perfect indifference to their effect on the reader’s mind; and not only is the book one *not* to be read aloud to a mixed audience, but the introduction of terms, never before heard or seen, and of slang expressions, often renders an otherwise striking passage altogether laughable.

And yet he is pulled in . . .

A fireman or omnibus driver, . . . , might have written this gross yet elevated, this superficial yet profound, this preposterous yet somehow fascinating book . . . , it is a mixture of Yankee transcendentalism and New York Rowdyism, and, what must be surprising to both these elements, they here seem to fuse and combine with the most perfect harmony.

Who was Walt Whitman in 1855? A thirty-seven-year-old autodidact, a sometime printer and newspaper man, listening at the theater and opera as often as walking the

beat. *Leaves of Grass* was not quite anonymous since it included a full-page portrait of the open shirted young poet, and midway he announces he is “Walt Whitman, an American, one of the roughs, a kosmos.” “I celebrate myself” began the yet uncelebrated Whitman in 1855, in a poem he would eventually title “Song of Myself.” A year later he added, “and sing myself.”

For Whitman, as for Homer and Virgil, the poet *is* a singer. This is not a bookish work; we experience it as performance. And if the poem is about him, it is also America’s great epic song. We immediately hear a voice full of Biblical cadences; the call and response of church litany without a definite creed; the rhapsodic sweep of great oratory and theatrical soliloquy, of opera, its arias and recitative. Its moods are various – oracular and self-amused; imperial and empathic; gross and elevated; subdued and ecstatic.

In discussing both the experience of performing and the experience of hearing Schubert’s *Winterreise*, a lyric song cycle, Ian Bostridge writes: “It is sometimes said that the measure of a great singer is that it feels as if he or she is singing to you alone; . . . the address to the individual as well as to the mass – is a crucial part of the aesthetic transaction.” He could have been describing Whitman. Here is a poet who addresses “crowds of men and women” not only in his own time, but in the

future, “you that shall cross from shore to shore years hence”; and yet at other times he seems to be speaking in the most intimate tones: “closer yet I approach you” . . . “what is it then between us.” Whitman’s is the voice of the shuttle, at once expressive and receptive; he is, he says, “one of the centrifugal and centripetal gang”: “And what I assume you shall assume, / For every atom belonging to me as good belongs to you.”

Any reader of “Song of Myself” is immediately impressed by the sweep of American life that it takes in, especially through the poet’s famous catalogs, his “enumerations.” He makes long, even canto-long, lists, in sentences paced by syntactic repetition. These create a better sense of America’s unity in diversity than any generalization. “Song of Myself,” with fifty-two cantos that swerve from one mood, stance or topic to another, has an improvisatory feel, but builds on its internal dialogue with the soul, which has its own notes. We hear them in assonance and alliteration: “I believe in you my soul . . . loose the stop from your throat . . . Not words, not music or rhyme I want, not custom or lecture, not even the best, / Only the lull I like the hum of your valved voice.” He takes in external sounds too, not only the wild gander’s “Ya honk” but “The pure contralto” who “sings in the organ loft, / The carpenter [who] dresses his plank, the tongue of his foreplane whistles its wild ascending lisp.” But up to the passage we will hear tonight, which comes in the middle of this long poem, Whitman has been concerned most with visual display and declamation. “Speech is the twin of my vision.” But now he quiets his own speech and becomes a listener, registering the bustling everyday world around him. The passage seems like the aural equivalent of a Brueghel painting, moving from one focus to the next, never lingering but pulling all into his dizzying composition. What a challenge to a composer! But Whitman himself is integrating and

orchestrating the distinct and diverse noises of the world. He starts with the sounds of nature, but already personified, the (“bravura of birds”), and moves on to the sounds of human activity. They are distinct, but run together – Whitman is the poet of connections, not of divisions. Indeed, he moves *toward* places of division and dissonance in order to incorporate them into his unifying song. Even “disjointed friendships” and the “judge’s death sentence” are part of the music. The inaudible is heard as well – the “young man’s heart’s complaint” becomes the “violincello.” The world of the streets becomes a chorus, an opera. This is even more explicit in the 1855 version of the passage where sounds are “tuned to their uses;”

Ginsberg’s expansiveness, his transcendental defiance of space and time, link him to Whitman. But in Ginsberg, Whitman’s optimistic vision has been severely tested by contemporary American realities.

he hears the “Recitative of the fish-pedlar.” These sounds are unconnected in the world, but in the poet’s mind they become harmonized, and as music they “sail” him. Having composed the noise of the world, Whitman comes to a focus in a wonderful account of aesthetic experience. He tells us what it is like to be carried up into the power of music, with the changing movements of a symphony or scenes of an opera. And his own responsive breathing, his “windpipe,” joins in the performance. The poet is momentarily overwhelmed by the power of these effects, tossed in the sea of emotion, going under, losing himself, before coming up again into “Being.”

[Note: At this point in the program, David Kravitz, baritone, and the Arneis Quartet performed “Being Music” – text by Walt Whitman, arrangement by Charles Fussell.]

Allen Ginsberg’s early reception was similar to Whitman’s. Here is John Hollander, another Academy member, and a longtime Yale professor. Writing in *Partisan Review* in 1957 he complained of the “utter lack of decorum” in Ginsberg’s “dreadful little book”:

I believe that the title of the long poem, “Howl,” is meant to be a noun, but I can’t help taking it as an imperative. The poem itself is a confession of the poet’s faith, done into some 112 paragraph-like lines, in the ravings of a lunatic friend and in the irregularities in the lives of those of his friends who populate his rather disturbing pantheon.

Hollander would retract somewhat in 1984:

This review was written in my youth and in a sort of worked-up high dudgeon . . . I only regret now that I hadn’t given “In a Supermarket in California” time to register. I should have certainly commended it. As for not foreseeing that Allen Ginsberg would provide such hymnody and doctrine to the counterculture which was soon to emerge, I have no regrets, having no stake in prophecy.

Ginsberg was elected to the American Academy in 1992.

When he published *Howl and Other Poems* in 1956, one hundred years after the first appearance of *Leaves of Grass*, Allen Ginsberg was a thirty-year old son of a schizophrenic mother, a Columbia drop out, Buddhist and Beat poet living in San Francisco. *Howl*

“Howl” is a protest on behalf of creative souls – dissolute and yet angelic friends and loved ones whose madness and suffering Ginsberg traces to a culture of repression and dehumanizing forces of industry.

and Other Poems, which had been printed in London, was seized at customs for obscenity, though it was exonerated after a long trial. Ginsberg had fallen in love with Walt Whitman while a high school student in New Jersey, and seems to have taken literally Whitman’s closing remarks in “Crossing Brooklyn Ferry”: “Who knows, for all the distance, but I am as good as looking at you now, for all you cannot see me,” as well as “What thought you have of me now, I had as much of you – I laid in my stores in advance.” Did Whitman’s word “stores” prompt Ginsberg’s ghostly “thoughts” of Walt Whitman in a supermarket in California? The ferry now, though, is crossing the river Styx.

Certainly Ginsberg is the closest we have to a modern Whitman. He borrowed the incantatory lines, the lists and litanies. Like Whitman, Ginsberg yokes the sacred and the profane. Ginsberg’s expansiveness, his transcendental defiance of space and time, link him to Whitman. But in Ginsberg, Whitman’s optimistic vision has been severely tested by contemporary American realities. The mood is one of alienation more than connection. Ginsberg’s America is like Dante’s hell or Blake’s London (Blake’s supernatural visions had a strong influence on Ginsberg). The unacknowledged madness of the postwar world is destroying the best minds of his generation. Whitman’s “barbaric yawp” is now a “howl” – an animal cry of pain. Whitman looked out on democratic vistas; Ginsberg on “the Western night.”

However, the scene of “A Supermarket in California” is not so hellish, even if it does reveal itself through neon lights and plastic wrapping. There are families in the supermarket and consumer capitalism is on abundant and colorful display. “A Supermarket in California” shares Whitman’s capacity for humor, though now the humor has an element of the absurd, the surreal – “wives in the avocados, babies in the tomatoes.” Ginsberg gives Whitman’s in-

terrogatives a modern, comic incongruity: “who killed the pork chops? . . . Are you my Angel?” In the supermarket Whitman looks like a homeless man, but poetry, Ginsberg suggests, slips the surveillance.

The consequent emotions are mixed, then: comic and elegiac, celebratory and melancholy, reverent and parodic. Whitman’s sense of connection to everything in the American scene gives way to a profound sense of loneliness. Perhaps, Ginsberg hints, the poet is always an outsider, but Whitman is a “courage teacher.”

[Note: At this point in the program, David Kravitz, baritone, and the Arneis Quartet performed two versions of “A Supermarket in California” – text by Allen Ginsberg; one arrangement by Andy Vores and a second arrangement by Elena Ruehr.]

“**H**owl.” We might call it the anti-*Song of Myself*, with a Who in the place of an I; the Whitmanian imagination and style turned to convey a Cold War toxic Waste Land. Part I explodes into inane noun-noun phrases, wild juxtapositions, the “teahed joyride neon blinking traffic lights” and “hydrogen jukebox” later parodied by Tom Wolfe. “Howl,” an autobiographical work set in New York City (but increasingly cosmic in scope), is a protest on behalf of creative souls – dissolute and yet angelic friends and loved ones whose madness and suffering Ginsberg traces to a culture of repression and dehumanizing forces of industry. In part II Ginsberg names this monster; it is Moloch, the false god of the Old Testament associated with human sacrifice. The modern Moloch is the god of walls – not just a force outside that devours love and art – it is more insidious, burrowing inside, into all our institutions. Moloch is Mind itself – that aspect of mind that divides and negates our being. A Cartesian monster, a head without a body, a destroyer, not a creator, Moloch’s mark is ugliness,

repression, surveillance. He is also Money, the reduction of human value to economics. Moloch is Materialism, including Time itself, in which the transcendental spirit suffers, and from which it flees.

Part II of *Howl* is, then, a kind of exorcism. What makes this passage exciting is the exclamatory, fantastical, grotesque aspect of the allegory. But the wild sublimity of Moloch is matched by history – by the vast, smoking industrial metropolis, and the Atomic Bomb looming over Cold War America.

After casting a wide gaze over the waste land of America, *Howl* in part III turns to address another kindred spirit, Carl Solomon, to whom the poem is dedicated. After the screaming chants against Moloch subside, the voice is quieter at first. The exclamations fall away after the first line, though the refrain “I’m with you in Rockland” creates a mantra like effect that has its own building intensity. A zany spirit enters the poem, perhaps echoing Solomon, a Dadaist poet and performer. Solomon, like Ginsberg’s mother, had been institutionalized. (He saw his eight months in the mental asylum as a Dadaist protest. He would later write about the experience, including his shock treatment.) The poem speaks from the side of sanity, but increasingly identifies with the madness, and indeed the second lines thicken and become more ranting (a sometimes exuberant, sometimes nightmarish rant) as they move toward an apocalyptic vision. “I’m with you,” chants Ginsberg. In the final verses he imagines a “we” – agonistic, yet triumphant and loving – that draws in the reader. The war turns inward against the spirit of Moloch; the castaway reaches the cottage, if only “in my dreams.”

[At this point in the program, David Kravitz, baritone, and the Arneis Quartet performed “Howl” (parts II and III) – text by Allen Ginsberg; arrangement by Lee Hyla.] ■

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Public Research Universities: Serving the Public Interest in Michigan

On April 4, 2016, Mark S. Schlissel (President of the University of Michigan), Mary Sue Coleman (President Emerita of the University of Michigan), Patrick Doyle (President and CEO of Domino's and Chair of the Board of Directors of the Business Leaders for Michigan), M. Roy Wilson (President of Wayne State University), and Lou Anna K. Simon (President of Michigan State University) participated in a discussion at the University of Michigan about public research universities and their role in serving the public interest in Michigan. The program served as the Academy's 2036th Stated Meeting. The following is an edited transcript of the presentations.



Mark S. Schlissel

Mark S. Schlissel is the 14th President of the University of Michigan. He was elected a Fellow of the American Academy of Arts and Sciences in 2015.

The ideas being examined and advanced by the Academy's Lincoln Project are essential to the future of our nation. My predecessor at the University of Michigan, Mary Sue Coleman, has characterized this project as addressing the financial and moral commitment of our country to public higher education. This is a conversation we must have.

Parents often ask me what is special about a research university. They want to know why they should send their son or daughter

At a research university faculty are teaching students not just what we know but how to look around corners, how to ask questions, how to doubt and be skeptical, how to demand proof and evidence.

to be educated at Michigan or Michigan State or Wayne State.

I tell them that at a research university your child will learn from faculty who are redefining the current limits of human knowledge and posing the next questions to be answered, teaching students not just what we know but how to look around corners, how to ask questions, how to doubt and be skeptical, how to demand proof and evidence.

At a research university, students get to participate in the act of discovery by working with faculty on their research projects – a mode of learning that is much more active than what one finds at less research-intensive universities. Great public research universities are thus of tremendous value to the students they educate.

They are also economic drivers. Think about what the United States would be like without the discoveries that came from research-intensive universities. They spawn entire new industries. They produce advances in health care and engineering and communications. The Internet, our ubiquitous iPhones, and all of the other technologies we rely on for modern life are heavily

dependent upon research done at our great public research universities.

However, America's public research universities face big challenges. We are in the midst of a period of massive disinvestment in public goods, especially public higher education, by elected governments, both state and national. Federal support for research is flat or, when you take inflation into account, declining.

We also face demographic challenges. We have had difficulty first diversifying and then maintaining the diversity of our student body and our faculty. Building inclusive learning environments has become increasingly challenging.

The Lincoln Project is bringing together federal and state higher education and business leaders. It is working to encourage the development of new federal, corporate, and philanthropic sources of support to sustain public higher education across our nation. We have an outstanding example of collaboration right here in Michigan with the University Research Corridor, a group started by Mary Sue Coleman and Lou Anna Simon about a decade ago. It is a collaboration

of Wayne State, Michigan State University, and the University of Michigan.

This year the economic impact of these three universities on the state will be \$17.5 billion. For every dollar invested in the three universities, the state gets back \$22 in financial benefit.

We are highly ranked among similar clusters of research universities around the country. We are first in enrollment, first in total degrees granted, first in medical degrees. And we are number two in advanced degrees in high tech fields such as engineering and the sciences.

This is all critical for the economic resurgence and the continuing competitiveness of the state of Michigan, as well as our nation as a whole. This year we are issuing a special report on the work being done, collaboratively and individually, by Michigan's three public research universities to promote Detroit's recovery.

Michigan State, Wayne State, the University of Michigan-Dearborn, Western Michigan, and Michigan Tech, the center launched the Michigan Corporate Relations Network. This public/private partnership has helped small and medium-size businesses access research expertise and students from our institutions. With essential support from the Michigan Economic Development Corporation, the center has worked to facilitate tech transfer from Michigan universities to Michigan businesses.

Recently, I welcomed attendees to the first meeting of a new leadership council called MForesight, a federally sponsored think tank of leaders from research-intensive industries, research-intensive universities, and federal research support agencies. The council's mission is to identify emerging technologies from universities that can lead to the next generation of tech industry development, as well as to help identify

The Internet, our ubiquitous iPhones, and all of the other technologies we rely on for modern life are heavily dependent upon research done at our great public research universities.

The Business Leaders for Michigan, represented today by Patrick Doyle, is a state-wide organization made up of the chief executives of major businesses from the different sectors of the state's economy, including the leaders of the major public research universities. This group is involved in promoting the importance of investment in public higher education to the citizens of Michigan as part of its plan for the economic revitalization of the state.

We have a business engagement center here at the University of Michigan that has partnered with many state universities as well as businesses of all sizes. Along with

which new technologies the manufacturing sector in particular should be paying careful attention to and which we need to develop into platforms for future economic growth.

A better Michigan will mean a better future for all of us. We all share a passion and sense of optimism, and I believe that the institutions of public higher education in Michigan – thanks to their complementary missions, complementary strengths, and shared values – can propel our state forward. We can make Michigan a powerful global leader in economic prosperity once again.



Mary Sue Coleman

Mary Sue Coleman is President Emerita of the University of Michigan and President of the Association of American Universities. She was elected a Fellow of the American Academy of Arts and Sciences in 2001.

The focus of our discussion today is on public research universities, their role, and the ways in which they integrate themselves into the intellectual infrastructure of the country and why keeping that infrastructure strong is so important. I thought I would start out, though, by giving some background about the Lincoln Project, which is nearing the end of its third year. The stated goal of the project is to look at the condition of public research universities across the country.

The first thing we had to do was pick a cohort. So we looked at the Carnegie Classification of Institutions of Higher Education and picked the “Very High Research Activity” and “High Research Activity” universities. There was a method to our madness in doing this! By picking these 143 institutions, we had at least one in every state.

These institutions also educate about 75 percent of the undergraduates in the coun-

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As a consequence of our work, we have released four publications so far. The first describes the benefits of public research universities as well as the changing demands on these institutions. The second examines state financing of higher education, describes the challenges state governments face, and assesses the prospects for greater state support in the future.

The third report details the most common financial models that sustain public research universities, describes institutional responses to the changing financial climate, and examines new ideas for diversifying and enhancing funding sources in the future. The fourth describes the impact of public research universities on economic growth, civic engagement, scientific and technological discovery, and the well-being of individual students.

On April 7 at the National Press Club in Washington, D.C., Robert Birgeneau – my cochair on the Lincoln Project and chancellor emeritus of the University of California, Berkeley – and I will present our final recommendations on how states, the federal government, and private corporations and foundations can help support public research universities in the future.

Although public research universities are but one slice of a higher education pie that also includes community colleges and private colleges and universities, this particular group of institutions provides a service for the country and for corporate America that is unique. In the state of Michigan, five

institutions are classified as part of the Lincoln Project cohort: Michigan Tech, Western Michigan University, the University of Michigan, Wayne State University, and Michigan State University.

In the course of formulating our recommendations, we held regional meetings all over the country. We did so at a particularly interesting time. As a result of the Great Recession, public universities have found themselves having to adapt to a funding landscape that is very different from only ten years ago. Seeing how the institutions have adapted to their changing circumstances provided both moments for optimism and cause for alarm, because we are in jeopardy of losing a very valuable resource.



Patrick Doyle

Patrick Doyle is President and CEO of Domino's Pizza and Chair of the Board of Directors of Business Leaders for Michigan.

There are moments in your life when you are sitting somewhere and wonder exactly how you got there. So here I sit, the pizza guy, with four of the great academic leaders, not only in the state but in the country.

One of the strengths of our country is that we have the single finest public university system in the world. But we think it is in peril. The financing of public universities has changed dramatically over the course of the last three or four decades.

My involvement with higher education, apart from attending the University of Michigan, began about six years ago, as part of Business Leaders for Michigan, an organization of the 80 largest businesses in the state of Michigan, as well as the state's three public research universities. The inclusion of the universities was purposeful. We be-

lieve our state and country have been blessed with truly extraordinary public research universities.

The strength of the university system in Michigan reflects investments made by the state over many decades. As business leaders, our goal is for Michigan to again become a top-ten state for personal income and job growth. Our sole purpose is to help the economy in the state of Michigan grow and prosper.

As we looked at where we need to invest more as a state in order to strengthen existing assets, we identified a handful of areas, at the top of which were our public universities. We have made some progress on that front.

One of the strengths of our country is that we have the single finest public university system in the world. But we think it is in peril. The financing of public universities has changed dramatically over the course of the last three or four decades.

We have moved away from a model in which most funding came from states, with significant funding for research and support for students (in the form of Pell grants) coming from the federal govern-

ment. We now have a system where more and more university revenue is borne by tuition. This has led to a situation in which access to public universities has been restricted financially.

We think this is something that needs to be addressed. We also believe that the research and knowledge being generated by

universities are and will continue to be critical to American economic growth, especially as economies become more and more about knowledge and potentially less about making things – although, if you are making things, the future will be about how to make them more efficiently and with fewer resources.

Our public research universities give us, as a country, an extraordinary competitive advantage and extraordinary strength. This must not only be maintained but strengthened. And so that is how the pizza guy wound up sitting at the table.



Lou Anna K. Simon

Lou Anna K. Simon is President of Michigan State University.

We all want to lead with cutting-edge knowledge and make it broadly accessible. That is the essential role of the modern-day land-grant university.

So in 2007–2008, at the depth of the difficulty in Detroit, Michigan State University made a decision to open an office on Woodward Avenue, because we believed in Detroit. That is what a land-grant university does, and we do it across the state. We have a new research building in Grand Rapids and medical facilities in Midland, Traverse City, and the Upper Peninsula.

In Detroit, we are working with organizations to look at food and food systems. In Holland, we have a bio-economy institute. In Flint, a proposal to the Mott Foundation five years ago for a new curriculum in medicine and public health soon proved to be very useful when the Flint water crisis occurred.

Our goal is to ensure that access to cutting-edge knowledge is available to people in a variety of ways. To achieve that, we are

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Faculty, even within the same department, might compete on individual grants – that will never change – but in looking at the bigger picture it is not about competition. When it comes to the really big things, we are looking at how we can pool our efforts.

That is how the Facility for Rare Isotope Beams came about. Working with the University of Michigan and the U.S. Department of Energy, we were able to imagine something really big for the state. And if we can succeed with a project like that, we can have more. That is the attitude we have to have as we look at outreach and engagement.

And we are engaged. We are in every county in the state. We have 13 food systems experiment stations scattered around the state. Through our medical programs we reach as many residents as the University of Michigan. We bring cutting-edge knowledge to the community.

One of the things I appreciate about the work of Business Leaders for Michigan is that they have taken a tough look at us. They didn't just listen to a bunch of university presidents and their tale of woe. They looked at the data, challenged us to be best in class in a variety of things, challenged us to be innovative in how we think about the work we do, both in the community and with each other, and they challenged us to think in ways that promote partnership.

That has been extraordinarily valuable. We have taken what we have learned and tried to apply it across our operations, col-

laborating wherever we can. We are still going to run a few of the same programs in the same places, but rather than simply competing we are going to try to do it in a way that is collaborative and augments the strengths we each bring to the table.



M. Roy Wilson

M. Roy Wilson is President of Wayne State University.

Universities have been engaged with their communities for a long time; this is nothing new. But over the past ten years the nature of the engagement seems to have changed. In the past, universities engaged with their community by doing something for or to the community (for example, conducting a study of the local population).

Now there seems to be more of a two-way street and a deeper financial commitment to the communities of which universities are a part. This is true not just of our land-grant universities. Over the past couple of decades, urban universities across the country, including Wayne State, have had a tremendous impact on the environments of which they are a part.

Wayne State's contribution to Midtown Detroit Inc., an organization working to revitalize the Midtown area, is one example. Thanks to such anchor institutions as Wayne State and the Henry Ford Health System and ongoing financial contributions from the

In the past, universities engaged with their community by doing something for or to the community. Now there seems to be more of a two-way street and a deeper financial commitment to the communities of which universities are a part.

Kresge, Ford, and other foundations, \$80 million has been raised that goes directly back to the community for beautification, retail development, and all kinds of activities related to the development of Midtown.

Another initiative is the M-1 rail, which runs north-south on Woodward Avenue, right through the Wayne State campus. Obviously, this is something that will be enormously beneficial for us. In recognition of that fact, we have invested \$1 million a year for the past three years in the rail line's development, because it is a public-private partnership that will benefit the entire region, and we thought we needed to show our commitment to its development.

In the past, particularly in urban universities, public safety officers patrolled the university campus but nowhere past the university perimeter, which would often be marked by an actual physical barrier. Our public safety officers, however, have broadened that boundary to include all of Midtown. As a result, the response time for any crime in the Midtown area is less than 50 seconds or so.

Businesses feel safe locating to the area because they feel like they have their own police force. Residents feel safe because the police force is not confined to the Wayne State campus but patrols throughout Midtown. What benefits Midtown benefits Wayne State.

We are involved in a lot of building projects too. As with many universities, we are fortunate to own some of the land surrounding us, and we have been deliberate about what gets developed on those pieces of land. A defining factor for us has been how each development will impact the community.

One major development involves mixed retail—higher-end residential units, with perhaps a boutique hotel that would benefit the community. These sorts of projects will really enhance the Wayne State perimeter.

We also own some land where the M-1 rail will go through. There, despite offers from people wanting to buy or lease this land from us, we have decided to take a wait and see approach because we do not know what is going to happen in that whole area once the M-1 rail goes through. We are not ready to give up the option to develop that piece for something the university needs.

We have also been more engaged with the business community in other ways. A good example is the Mike Illitch School of Business, which we are building on property owned by the Illitches, right next to the new Red Wings hockey arena.

What I am most excited about, though, is the curriculum. One of the things we have talked about with the Illitches is having them help us with the curriculum that focuses on entertainment and sports. They have agreed to be active partners with us in developing that curriculum and in offering internships and other opportunities to our students.

These are just some of the examples of the new ways we are engaging with the community. The university has always been engaged, but this feels different, and I look forward to seeing where these kinds of new engagement might take us.

Panel Discussion

Mary Sue Coleman

Patrick, you came from the corporate perspective and have been advocating for increased funding for higher education in the state of Michigan. That effort has had some success. We are not back to where we were in 2002, when I was recruited to Michigan, but we are not being cut anymore. When you went to talk to legislators, what was the most persuasive thing you could tell them? What worked best for you?

Patrick Doyle

First, we needed to dispel some myths; for instance, the perception that tuition and tuition increases are a direct reflection of spending increases in the universities. That is simply incorrect. Tuition increases are, fundamentally, a reflection of the cut in financial support from the states. The offset has been almost exactly dollar for dollar.

So we need to lay out the facts for legislators, explain that what looks like a cost problem is actually a shifting of resources. Second, we need to look at the economic impact of the universities – both direct, from a research and employment standpoint, as well as on family income.

And while you will read stories about how some people with a four-year degree are not yet employed, the reality is that income levels for people with a four-year degree are higher than those with a two-year degree, a high school degree, or no degree at all. Compared to having only a high school education, having a four-year degree adds, on average, about \$1 million in earnings over the course of the career of the person who receives the degree. That is a straight economic return to the state for investing in higher education. The dollars are being wisely spent.

We need to dispel some myths; for instance, the perception that tuition and tuition increases are a direct reflection of spending increases in the universities. That is simply incorrect. Tuition increases are, fundamentally, a reflection of the cut in financial support from the states.

Universities have to continue to look at efficiencies in the system and find ways they can collaborate and be transparent about the expenditures that are being made, but the bottom line is that states realize a good return on investment from putting more dollars into higher education, and we have started to turn the corner on that.

Lou Anna K. Simon

Patrick, from my perspective, business leaders understand how to shift money around, how to make cuts in one area in order to be able to expand in another. And that is a hard message for people to understand.

At Michigan State we have had a 38 percent increase in STEM student credit hours. That is an expensive shift if we do it right, if we offer great lab experiences and all the hands-on stuff that goes with it. But over a long period of time, we have had funding losses that amount to real dollars, not just inflation-adjusted dollars. Business leaders seem to understand what it means to make adjustments in one area to fund something else that is higher value and in demand, but that requires making tough decisions.

For a big organization in the public sector to make those kinds of changes, however, is incredibly tough, which is something people don't understand. Whether it is picking up the loss of financial aid from the state and trying to make that up in some way; whether it is STEM credit hours; whether it is deal-

ing with all your legacy costs – business leaders were great at helping us clarify our message and carry it forward, because you were already doing that in your own businesses.

M. Roy Wilson

I don't want to be critical, but some states have valued their research universities more than others. One in particular that comes to mind is New York. Between 5:00 and 6:00 every morning I tend to watch one of the news stations – typically CNN, but the others as well – and every morning on whichever station I am watching, a commercial comes on; it is the state of New York trying to bring businesses into the state.

One of the factors they tout for why business should go to New York is the life sciences research that is going on in Buffalo now. The medical school has moved from the suburbs into the city of Buffalo, and that is a \$375 million investment, plus all of the peripheral things that go along with life sciences research. The state thought this was important enough that it is on national television every morning between 5:00 and 6:00.

Lou Anna K. Simon

If you look at the aggregate enrollment in the research universities in the state, they have not declined. But the proportion of the state's higher education budget that goes to research universities has declined.

Mary Sue and I sometimes reminisce about the Sputnik era and how the country galvanized its support for science and technology. We were determined to win this competition with the rest of the world. It is the same today, but with higher education.

Mary Sue Coleman

The interesting thing we discovered as part of the Lincoln Project was that during the Great Recession, over the last ten years, the sector of public education that was cut

I was in Nashville last week talking to a group of legislators, and I pointed out the money being spent in Tennessee as a consequence of research being conducted at universities in Michigan, Wisconsin, and Illinois. They were astounded. They had assumed that if research money went to Michigan State or to Wayne State or to the University of Michigan, that it all stayed in East Lansing and Detroit and Ann Arbor.

No, no, no. That money gets spread across the country, because the researchers have to buy goods and services to conduct their re-

search in the state of Nebraska. Only three institutions did such research, and we ended up getting \$17 million a year, in perpetuity, to put toward our medical research. The state's return on that money turned out to be \$21 for every \$1 invested.

I had the opposite experience – a lost opportunity, really – when I was at the University of Colorado. This was before marijuana was legal, but the state was contemplating legalizing it. I knew that fighting legalization was a losing battle, so I tried to prevail upon the university to insist that part of any tax on the sale of marijuana be used for medical research. For various reasons, that wasn't done.

But the marijuana bill passed, and a ton of marijuana is now being sold in Colorado. It would have been great to have some of that money set aside for medical research at the University of Colorado, because Colorado is one of the states that may not only further diminish but discontinue funding for public higher education. ■

The interesting thing we discovered as part of the Lincoln Project was that during the Great Recession, over the last ten years, the sector of public education that was cut the most severely was public research universities. Yet by the end of the Great Recession we were educating 30 percent more students than at the beginning.

the most severely was public research universities. Their funding was cut by 34 percent per full-time-equivalent student. Yet by the end of the Great Recession we were educating 30 percent more students than at the beginning.

We were cut more than comprehensive universities, more than community colleges, more than K-12, which was hardly cut at all. That is not to say that investment in K-12 is not important – it is important – but what we wanted to highlight in this project is how much this slice has been put at a disadvantage, relative to other sectors of higher education.

This is part of the economic engine of the country – a very important part. Because one of the things we have become aware of is how widespread the financial impact of our public research universities is.

search. This kind of impact is so important to the nation, and we have got to get the message out.

M. Roy Wilson

I think we can all agree that the typical or historical way that states allocate money to universities is not going to grow appreciably. We are not going to see some huge windfall from the states because they have decided to increase – out of the general fund – the proportion that goes to higher education versus one of the other areas.

So we have to think about innovative ways of getting more support. When I was in Nebraska, the chancellor of the University of Nebraska Medical Center and I prevailed upon the state to dedicate a third of its tobacco settlement dollars to medical re-

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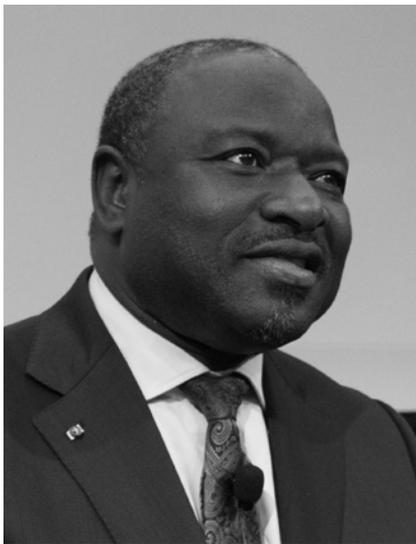


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2016 Distinguished Morton L. Mandel Annual Public Lecture

The Comprehensive Nuclear-Test-Ban Treaty at 20

On May 19, 2016, **Lassina Zerbo** (Executive Secretary, Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization), **Rose E. Gottemoeller** (Under Secretary for Arms Control and International Security, U.S. Department of State), **Siegfried Hecker** (Senior Fellow, Freeman Spogli Institute for International Studies and the Center for International Security and Cooperation; Research Professor of Management Science and Engineering, Stanford University), and **Robert Rosner** (William E. Wrather Distinguished Service Professor in the Departments of Astronomy & Astrophysics and Physics, and the Enrico Fermi Institute and the Harris School of Public Policy Studies, University of Chicago) participated in a discussion on the prospects for ratifying the Comprehensive Nuclear-Test-Ban Treaty and the challenges presented by nuclear testing. **Arun Rath** (Correspondent, NPR and WGBH) moderated the discussion. The program, which served as the 2016 Distinguished Morton L. Mandel Annual Public Lecture and the 2039th Stated Meeting, was live streamed to Fellows and guests gathered in Palo Alto, Chicago, and Washington, D.C. The following is an edited transcript of the presentations.



Lassina Zerbo

Lassina Zerbo is Executive Secretary of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO).

The first time I toured the Academy, Francesca Giovannini, who directs the Academy's projects in global security and international affairs, said to me, "You will be having lunch with Jonathan Fanton, our president, and you have to convince him that the Comprehensive Nuclear-Test-Ban

The importance of moving forward with the treaty is undiminished and still urgent. We need the CTBT for international peace and stability. Help us build the public awareness that is needed for the CTBT to enter into force.

Treaty is an important matter that needs to be discussed here."

After that lunch, Jonathan Fanton made me a promise and that promise gave me hope. Keeping the promise has built trust between the CTBTO (Comprehensive Nuclear-Test-Ban Treaty Organization) and the Academy. Three to four hundred people in Vienna are working, day in and day out, for this treaty, which opened for signatures twenty years ago and has yet to enter into force. The importance of moving forward with the treaty is undiminished and still urgent.

For the past twenty years the CTBTO has been busy laying the groundwork for the effective implementation of the treaty and preparing for its entering into force. But where are we? After twenty years, we are still considered a preparatory commission, even though nothing about the work we do is preparatory.

We are fighting to ensure the treaty enters into force. My good friend Rose Gottemoeller is sparing no effort in making sure the educational framework in the United States is well on the way to prepare for the ratification of the CTBT (Comprehensive Nuclear-Test-Ban Treaty), a ratification that President Obama has made a priority.

How is the CTBT contributing to the international community? Many states, including the United States, have their own technical means of detection, but we bring legitimacy to the potential detection that could come from any state or from the international organizational framework we have in Vienna.

However, we have a risk that if the treaty doesn't enter into force, this cooperation framework we have built might fall apart. If we have one, two, three, four, or five countries that refuse to send data to Vienna, then

that is it. You can forget about the international monitoring system as a whole, and we don't want that.

So that is why we are here, and that is why we fight to show that we are ready in Vienna. The international monitoring system is ready. The verification regime of the CTBT is ready.

But we need your leadership too – you, the members of the Academy, as well as our youth, our future leaders, who are really the leaders of today because they lead the world of social media. I would like you to help us by using the leadership you have on social media to push for this treaty and help us build the public awareness that is needed for the CTBT to enter into force.

I feel we missed some opportunities with Iran. Even though I understand why the CTBT was not brought to the discussion, I think it was a missed opportunity both in Iran and in Syria, and I think we should not miss any further opportunities to make a case for the CTBT. But the Iran deal is offering something in the Middle East, where the CTBT can be used as background to create the conditions necessary for a WMD-free zone in that region.

In India and Pakistan we need to work with the younger generation and see what we can do together. With North Korea, I am an advocate of keeping dialogue open, even if we have to be very firm with them. We have to keep in mind that the more we let them do tests, the more opportunity we give them to improve what they have already. Ultimately, we need the CTBT for international peace and stability.



Rose E. Gottemoeller

Rose E. Gottemoeller is Under Secretary for Arms Control and International Security at the U.S. Department of State.

I would like to thank the Academy for the invitation to speak today. Jonathan Fanton, the Academy's president, said something earlier: "We don't have the luxury to surrender to skepticism." That has been my watchword in this process over the past several years.

In the United States we have a lot of work to do to remind the American public of the enormous value that the CTBT has for U.S. national security.

Over the past 71 years, more than two thousand nuclear explosive tests took place around the world. Since 2000, only North Korea has tested, however, so I consider it somewhat of a victory that the voluntary moratorium that was put in place in the 1990s on explosive nuclear testing is so far holding pretty well.

But we cannot count on that. There are pressures on the moratorium at every turn. Recently I was in Pakistan and India. They recommitted to the moratorium, but we

Thanks to the science-based Stockpile Stewardship Program we now understand more about how nuclear weapons work than we did during the period of nuclear explosive testing.

know from watching the development of their nuclear arsenals that they are itching to test. They would really like to develop new nuclear weapons capabilities, so we need to get to the point where we have a legally enforced treaty, both to strengthen the norm and to give us a way to monitor and verify compliance with the treaty. So this treaty is very important for U.S. national security.

The aboveground tests conducted last century created a wealth of problems for health around the world. Here in the United States I remember very well when I was a child how radioactive and cancer-causing particles such as strontium-90 got into the milk supply, into the food supply, and led to a lot of concern among parents about explosive nuclear testing in the atmosphere.

That was the first push. Then the Cuban Missile Crisis occurred, and that gave President Kennedy the opportunity to step forward and say, "We need to begin the process of banning nuclear weapons." In just one year he was able to take a significant step in that direction, negotiating and bringing into force a limited test ban treaty that banned the atmospheric testing explosions that were causing the problems with the food supply.

That happened in 1963. Years later we moved forward to a threshold test ban treaty in the early 1990s, placing additional constraints on nuclear testing. But only in the

mid-1990s were we able to negotiate a verifiable comprehensive test ban treaty banning all nuclear explosive testing.

The United States did sign the CTBT. In fact, President Clinton was the first to sign the treaty. But we have not been able to ratify it. The Senate, in 1999, failed to give its advice and consent to ratification. At that time, the senators asked two questions. First, they asked, “How do we know this thing can be verified? How do we know it can be properly monitored? You have promised us an international monitoring system, but it hasn’t been built yet. How do we know it is going to be built? How do we know the whole world will join in putting these sites on their territory – seismic sites, radioactive-nuclide sensing sites, infrasound sites? How do we know the world will join in this effort?”

Second, they asked how we would maintain our own stockpile without explosive nuclear testing for as long as nuclear weap-

Furthermore, the international monitoring system is now the heart of the verification regime for the treaty. But the treaty also provides for on-site inspection, and in December 2014 I was in Jordan to observe an exercise designed to show whether it could be verified in this way. To see countries from all over the world, including some countries you would not expect to be working together, such as Iran and Israel, was amazing. We have come a long way since 1999, and I think we are in good shape to be able to answer the questions the senators raised that year.

The treaty is in the national security interest of the United States for other reasons too. Specifically, India and Pakistan are interested in developing more and different types of nuclear weapons, in modernizing the capabilities they already have. China is developing and modernizing its nuclear arsenals.

We must be concerned about these pressures on nuclear testing, and I see the treaty

states where we once tested nuclear weapons, visiting communities that are downwind of former nuclear test sites and thus suffered from radioactive contamination back in the 1950s and 1960s.

Did you know we tested nuclear weapons in Mississippi? Believe it or not, tests were conducted there in salt domes. Students in the journalism school at the University of Mississippi have made a really interesting film, *Atomic Mississippi*, about that testing series and the resulting contamination.

Young people are getting excited about this. Once students learn what is going on here and what the treaty can do for the United States and for our national security, it becomes a no-brainer. We have to make the treaty’s value to the United States clear to people around the country, both young and old.

When we get the treaty to Capitol Hill, we have to take the same approach we took with ratification of the New Strategic Arms Reduction Treaty (New START); that is, let the senators ask a lot of questions at briefings, hearings, and individual question and answer sessions.

New START had over a thousand questions for the record. The senators really wanted to dig down deep about the value of the treaty for U.S. national security, and I am confident that once we take CTBT up to the Hill and start to talk about the value of the comprehensive test ban for U.S. national security, we will be able to make that case very clearly.

But we have a lot of work to do. There is no question about it. Nevertheless, I think we have an excellent case to make, and as former Reagan-era Secretary of State George Shultz said, “Senators might have been right voting against the CTBT some years ago, but they would [also] be right voting for it now.”

I see the treaty as a clear and significant way to place barriers in the way of a nuclear arms race in Asia. Such an arms race would profoundly affect the national security not only of the United States but of countries around the world.

ons continue to exist. They did not believe that the science-based Stockpile Stewardship Program, which our laboratories were just beginning to undertake, would actually be able to maintain the arsenal without explosive nuclear testing.

That program, which the Department of Energy maintains through our national laboratories, has been very successful. We believe that thanks to the science-based Stockpile Stewardship Program we now understand more about how nuclear weapons work than we did during the period of nuclear explosive testing.

as a clear and significant way to place barriers in the way of a nuclear arms race in Asia. Such an arms race would profoundly affect the national security not only of the United States but of countries around the world. We need to think about what is in our national security interest, and halting or placing barriers in the way of an arms race in Asia is a significant way to ensure the continued security of the American public.

Now how do we go about it? First, we continue to do exactly what we are doing today: we have a conversation with the public. I have been all over the country, visiting



Siegfried Hecker

Siegfried Hecker is Research Professor in the Department of Management Science and Engineering and a Senior Fellow at the Freeman Spogli Institute for International Studies and the Center for International Security and Cooperation at Stanford University. He has been a Fellow of the American Academy since 2002.

Twenty years ago, when I was director of Los Alamos National Laboratory, I was in the middle of the debate over ratification of the CTBT. I was asked by the president and by the Pentagon, “Can we deal with the risks of stopping nuclear testing?” – that is, the risk to the U.S. nuclear stockpile.

At the time, my job was to deal with those risks and give the technical answer. I said, “At this point, our stockpile – that is, the nuclear arsenal – is safe, secure, and reliable. However, you need to ask that question again in the coming years.” And, indeed, presidents have asked that question every year since.

President Clinton clearly believed in 1996 that the CTBT was in the security interests of the United States. However, it has not yet been ratified, so clearly some people don’t

believe it is in the interest of the United States. I am not one of them.

Testing is important to the United States. You lose something when you don’t test. However, we gain more today than we lose when others don’t test. The United States has conducted 1,054 nuclear tests, some of which were done with the United Kingdom. Russia has conducted 715; France, 210; Britain, 45; China, 45; Pakistan, 6; India, 6; North Korea, 4.

For North Korea, Pakistan, India, and China, an additional test or so will allow them to increase the sophistication or perhaps the diversification of their arsenals, and that can only come back to be a national security risk for the United States.

So, today, the CTBT provides us with an enormous benefit, and I believe we should do everything we can to set the barriers as

particular concern is, “Can we ensure the safety, security, and reliability of our aging nuclear arsenal without nuclear testing?”

The proponents of the test ban point out, “Look, we have had science-based Stockpile Stewardship. It has been enormously successful. You can do it all with computers today. You don’t need nuclear testing.”

The opponents say, “That’s not true. We are concerned about safety, security, and reliability.”

We need to listen to both sides. Science-based Stockpile Stewardship has been successful, but you do lose some confidence when you don’t test.

The essence of my testimony in 1996 was that we will have to do everything we possibly can to ensure safety, security, and reliability using science-based Stockpile Stewardship without nuclear testing. As we look

We must pay attention to the fact that quite a few people who have a lot of experience in the national security arena do not favor ratification of the CTBT. Their particular concern is, “Can we ensure the safety, security, and reliability of our aging nuclear arsenal without nuclear testing?”

high as possible for other countries to resume or begin testing. The North Korean example illustrates how alarming nuclear testing is. Everything changed for North Korea in 2006.

But now one has to ask, “Why aren’t all Americans in favor of this? Why are we not able to ratify the test ban today?” Part of the answer is political, the Washington scene, the “anything but Obama” attitude.

However, we must also pay attention to the fact that quite a few people who have a lot of experience in the national security arena do not favor ratification of the CTBT. Their

back now over all of those years, we understand the fundamentals of things nuclear and how nuclear weapons work better than we did in 1996.

However, the U.S. nuclear weapons complex has problems that most people are not aware of. More than just science-based Stockpile Stewardship is needed to make sure the nuclear arsenal is safe, secure, and reliable.

I have concerns about the viability of the entire nuclear complex. I have concerns about the fact that it is so difficult today in our regulatory, compliance-based environ-

If we make sure that the nuclear complex has the ability to perform the whole range of laboratory experiments and computations necessary for us to take care of the arsenal, perhaps then we might actually convince the opponents of the test ban that it is indeed doable, and that ratification, if it helps to prevent these other countries from testing, is to the great benefit of the United States.

ment to actually do the laboratory tests that would allow me to assure people that these weapons will still be safe, secure, and reliable when the plutonium or the high explosives age.

I have sympathy for those people who have concerns. However, in my opinion, what we are missing is not actually nuclear testing but the ability to do all the other things in the laboratory, to bring the experiments together with the computational capabilities to be able to make the appropriate assurances.

What I suggest is that we look at what the proponents and the opponents have in common. What is the common ground? Both sides believe in a safe, secure, and reliable arsenal; in other words, that the United States continues to have the nuclear deterrent both for itself and for its allies. Both sides believe that is important.

If we focus on that, then we understand that testing is only one piece and in fact not

even the most important thing to do today. If we can agree that what is most important is the stockpile and if we make sure that the nuclear complex actually has the ability to perform the whole range of laboratory experiments and computations necessary for us to take care of the arsenal, perhaps then we might actually convince the opponents of the test ban that it is indeed doable, and that ratification, if it helps to prevent these other countries from testing, is to the great benefit of the United States.

That would be an appropriate direction to go if one wants to take up, as one should, the ratification of the test ban. The other thing I would say is that ratification is sort of a no-brainer once you already do not test. Since we don't test, we are already subject to the risks of not testing, but we have none of the benefits we would get from a ratified international treaty.



Robert Rosner

Robert Rosner is William E. Wrather Distinguished Service Professor in the departments of Astronomy & Astrophysics and Physics, as well as in the Enrico Fermi Institute, the Computation Institute, and the Harris School of Public Policy Studies at the University of Chicago. He has been a member of the American Academy since 2001 and serves as Cochair of the Academy's Global Nuclear Future Initiative.

As we contemplate the twentieth anniversary of the CTBT, the obvious question is, why modernize the weapons production complex? At least a partial answer lies in the three magic words that Sig already mentioned: *safe, secure, and reliable*. What are they about? The last one in particular is closely related to demonstrating the general competence of the United States in matters of nuclear weapons, in particular from the point of view of credible deterrence.

This is an issue that becomes more important as we go in the direction that many of us want the United States to go, which is to zero. That is, as the nuclear pile shrinks in size, the reliability of the weapons in the stockpile becomes increasingly important.

In this context, what has the United States actually done? We have the science-based Stockpile Stewardship Program, which involves (1) surveillance of the existing stockpile that is married to a life extension program (LEP), and (2) designing and building a new generation of modeling codes, together with an extensive program to build and maintain certain critical experiments and facilities, such as the National Ignition Facility (NIF), that are designed to increase our understanding of weapons physics and to validate the modeling codes.

Much of our belief in the reliability and the predictive capabilities of the codes rests upon these codes' abilities to in fact replicate the results of the experiments. Some of these experiments, in particular those involving ignition on the NIF, are probably substantially more challenging to model than nucle-

known production facilities such as Y-12 in Tennessee and the Kansas City Plant (KCP). What is interesting about this rebuilding effort is that we are not only putting in place the infrastructure to support the Life Extension Program, but we are also putting in place the infrastructure to accomplish in the modern era, at scale, what the United States was able to do when building weapons back in the 1960s, 1970s, and 1980s.

Finally, we have encouraged new technologies. For example, the Nuclear Regulatory Commission approved in 2012 a construction and operating license application from General Electric for a commercial-scale laser enrichment facility at GE's Wilmington (NC) plant. (Given current uncertainties regarding the price of natural and enriched uranium, it is unclear how quickly GE will move ahead with this project.)

We have the capability of designing new weapons and new generations of weapons without necessarily relying on testing.

ar weapons, mostly because certain aspects of the physics involved in driving ignition on NIF remain poorly understood, but are not relevant to weapons physics. This has the important ancillary benefit of allowing the training of weapons scientists without resorting to direct testing of nuclear weapons; in other words, allowing the maintenance of nuclear weapons design capabilities into the indefinite future even in the absence of an actual weapons testing program.

As just mentioned, the stockpile surveillance program is complemented by a refurbishment program, more commonly referred to as the Life Extension Program (LEP). In concert, the Obama administration has moved forward with a thorough modernization of the nuclear weapons production complex, including rebuilding well-

What are some of the consequences of these kinds of activities? First, we have the capability of designing new weapons and new generations of weapons without necessarily relying on testing.

Our certainty in getting things right is diminished because we no longer test, but we also know, for example, from the design competition between Los Alamos and Livermore for the Reliable Replacement Weapon (RRW) that assuring that these weapons will work can be dealt with in the design process. That is, you can dial back on the complexity of a weapon in order to have increased assurance that it will in fact work as designed.

This means that there is a fundamental asymmetry between what the United States is capable of doing and what the vast majority of the other signatories to the CTBT can

There is a fundamental asymmetry between what the United States is capable of doing and what the vast majority of the other signatories to the CTBT can do: We can do without testing; virtually all of the others cannot.

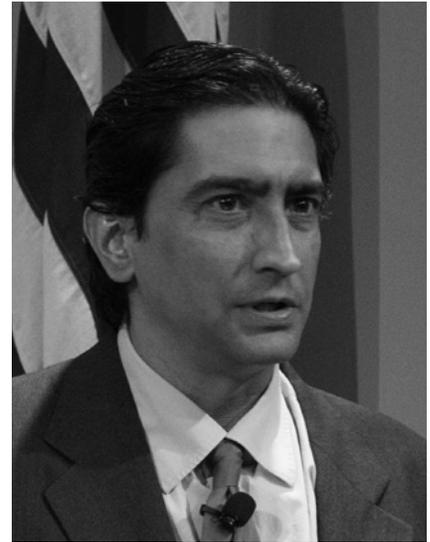
do: We can do without testing; virtually all of the others cannot.

The experimental data from the more than one thousand tests the United States has conducted form a critical part of the experimental basis for validation of the computer design codes. The other signatories – other than Russia, China, and our allies France and the United Kingdom – do not have this type or scale of data, and thus are reliant on testing to make further progress in building new weapons.

So the CTBT is not an obstacle for us if we were to choose to build a new nuclear arsenal, but it most certainly is an obstacle for almost all of the others. So here is one conundrum: The United States has an interest in maintaining this asymmetry, as it benefits us but not the others. Yet, while we are a signatory to the CTBT, we are the ones who have not ratified it.

A second conundrum involves the Treaty on the Nonproliferation of Nuclear Weapons (NPT). The NPT also has an asymmetry built into it between the “haves” and “have-nots,” and since the signing of the NPT this has been a critical issue for the “have-nots.” They have asked the “haves” – in particular, the permanent members of the UN Security Council (the so-called P5) – why they have not fulfilled their part of the NPT bargain, namely moving expeditiously toward reducing their nuclear stockpiles to zero. In light of that challenge (and here is the conundrum), one may ask: how is the refurbishment program of the U.S. production complex – as actually implemented – consistent with going to zero?

These arguments suggest that the desire to reduce our nuclear stockpile is inherently in conflict with the need to ensure that as long as the stockpile exists, its weapons are reliable, and hence credible: that is, the activities necessary to ensure the reliability of the stockpile are the very activities that also ensure that we maintain the capability to rebuild the stockpile at any time, well into the future. This is not good news for those of us who want to see the nuclear stockpile eventually disappear altogether.



Arun Rath

Arun Rath is a correspondent for NPR and Boston-based public broadcaster WGBH News.

I would like to ask our distinguished panel some questions. First, is there a way to talk about history and to get across to people that there is a stake in this? Our country is often criticized for not being too aware of history.

Rose E. Gottemoeller

History is certainly important. I have found one of the biggest challenges we have is conveying a sense of the horrors of nuclear war to the young generation. Since the end of the Cold War, nuclear weapons have gone on the policy back burner as well as the back burner of public consciousness.

So I have been looking for ways to re-enliven that history. One way is to mention the history of the spies who were so important to the Soviet nuclear weapons program. The recent film *Bridge of Spies* is a good look at the battle over the secrets that led to nuclear weapons programs being successful in the 1950s.

The second point is to wake people to the horrors of nuclear war and an attack on our cities. I remember in 1983 seeing *The Day After*, which was a television film about a nuclear attack on the United States.

More recently, I was glad to see that *The Americans*, a TV show about spies embedded in American society, built an episode around the showing of *The Day After*. If you have not seen it, I recommend it because it is a really good way to get your head around some of the horrors of nuclear war.

Arun Rath

Under Secretary Gottemoeller, in 2010 you were involved in negotiating the New Strategic Arms Reduction Treaty. The context was different from what we have now – you were negotiating with the Russians not the U.S. Senate – but can you draw lessons from that experience?

Rose E. Gottemoeller

That is a very good question. The senators who were willing to take the ratification process seriously really dug deep to understand the technical details of New START.

If we have the opportunity to make the case for the Comprehensive Nuclear-Test-Ban Treaty, at least some senators will be willing to dig deep . . . some will listen and will be willing to engage on this treaty.

They wanted to understand how the central limits of the treaty fit together. They wanted to understand its impact on our future nuclear forces. They wanted to understand how the onsite inspection regime worked. That is why we answered over a thousand questions for the record and why I was up on the Hill countless times, briefing individual senators and meeting with groups of senators to answer their questions.

What I found – and I think it is a hopeful sign for our system – is that they took their constitutional responsibility seriously. Once they got over the hump of the politics, they really wanted to dig down, understand the treaty, and make a sound decision on behalf of the nation.

That is why I feel if we have the opportunity to make the case for the Comprehensive Nuclear-Test-Ban Treaty that at least some senators will be willing to dig deep. Not all. Some will say, “It’s the Obama administration. Forget about it.” Some will say, “It’s a nuclear treaty. Forget about it.” But some will listen and will be willing to engage on this treaty.

Siegfried Hecker

In my discussions with Chinese nuclear colleagues about the CTBT, they say, “We’ll ratify five minutes after you do.” So, if we had ratified in 1999, we would have China in play, and, although I don’t think it would have made much difference with North Korea, probably Pakistan and India also. So, as far as our own situation goes today, our problems are self-inflicted.

Some people have worried that ratification would lead the United States to forget altogether about its nuclear weapons complex, and things might actually be worse. I don’t think so. I think we just have not made the case sufficiently clearly.

Robert Rosner

This is pure speculation, but I think the credibility of the design labs might have been much stronger had we actually ratified. Without ratification, the importance of design labs to the whole enterprise has been, quite frankly, neglected, as evidenced, for example, by the serious decreases in the design lab budgets as funds have been shifted to the production complex.

Arun Rath

I am a reporter and maybe I am part of the problem of why people are not interested. There seems to be a feeling that people, at least in this country, are not as concerned as they should be about this issue and about issues around nuclear proliferation in general. What can I communicate to them? What is not getting out there? What is not being reported?

Robert Rosner

The great fear I have is that the longer we proceed without ratification, with the treaty not in force, the more some countries will be rethinking their nuclear posture.

Pakistan is an example of that. They are thinking of going in directions that are be-

ginning to blur the distinction between strategic and tactical weapons. So the risks of actually having a real nuclear exchange are going up. That is what is at the heart of the issue. In a world without the CTBT in force, the risks are just going to get worse and worse.

Siegfried Hecker

I teach students at Stanford. One of the classes I teach (along with Secretary Bill Perry) is about technology and national security, which has had an enrollment of about 250 people each year for the last ten years.

Typically, the way I try to get the students interested in nuclear issues is by helping them to understand the incredible power of splitting the nucleus. With that power you

the front pages. Instead, it is the terrorism threat, it is ISIL, it is our election campaign. And it is not just nuclear issues but WMD issues in general that get crowded out.

Sometimes they jump to the fore again. For example, when chemical weapons were used in Syria, chemical weapons were on the front pages for a while. But the media space is crowded, and unless we have another Cuban Missile Crisis – which would be terrible – not much attention gets paid to nuclear weapons.

Arun Rath

Can we talk about the beneficial side effects that have resulted from the work that has been done on this treaty, particularly the system of sensors that has been developed?

global coverage of the International Monitoring System.

But the sensors can do much more than just monitor for potential nuclear tests. For example, they can contribute to tsunami warnings. More recently, Fukushima showed how we could contribute to monitoring the dispersion of radioisotopes emanating from a nuclear accident.

With an accident of this nature, people learn more about what the CTBT can do. We always seem to wait for disasters or for catastrophe before we realize the importance of this great achievement of the modern world, which is how Secretary Kerry has described the International Monitoring System. ■

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The sensors can do much more than just monitor for potential nuclear tests. Fukushima showed how we could contribute to monitoring the dispersion of radioisotopes emanating from a nuclear accident.

can either electrify the world, do good, or you can destroy the world. The key is, how do you manage that? How do you get the good but not destroy the world?

I tell them, “It is going to be your job because we haven’t quite figured it out.” We still have potential arms races, still have not ratified the CTBT. I try to get them to focus on the benefits, on electrifying the world while hopefully making some dent in global climate change. Global warming is the part they are actually most concerned about. So I try to put it in those terms.

Rose E. Gottemoeller

I would say the problem is the crowded media environment. Nuclear issues are not on

Lassina Zerbo

For the past ten years we have been discussing the construction of a station in Luxor, Egypt, trying to get an agreement to start the civil work. We have done the site survey, and we have done the training necessary for the Egyptians to operate and maintain the station after it has been built, but things have been stuck for some time now.

But we are stationed in Israel and contributing to the International Monitoring System, and we have a station in Turkmenistan, and we are hoping that the station that was certified in Iran will, before long, resume sending data to the International Data Centre in Vienna and thus improve the



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Russia Beyond Putin

On June 1, 2016, Timothy J. Colton (Morris and Anna Feldberg Professor of Government at Harvard University) and George Breslauer (Professor of the Graduate School and Executive Vice Chancellor and Provost Emeritus at the University of California, Berkeley) gave a presentation on “Russia Beyond Putin,” the subject of the upcoming Spring 2017 issue of *Dædalus*. The program, which served as the Academy’s 2040th Stated Meeting, took place following an authors’ conference for the *Dædalus* issue. The meeting included a welcome from Jonathan F. Fanton (President of the Academy). The following is an edited transcript of the presentations.



Timothy J. Colton

Timothy J. Colton is Morris and Anna Feldberg Professor of Government at Harvard University. He was elected a Fellow of the American Academy in 2011, and is the guest editor, with George Breslauer, of the Spring 2017 issue of Dædalus on “Russia Beyond Putin.”

The essays discussed in our authors’ workshop today for the upcoming issue of *Dædalus* will be published in 2017, which is, of course, the centenary of the Russian revolution of 1917. This is a useful reminder of the fact that change has been the rule rather than the exception in contemporary Russia in its various guises and personae: as an empire, as the Soviet Union, and now as post-Soviet Russia. What we have been thinking about in our workshop is “Russia

Looking ahead – ten to fifteen years – what can we say about the prospects for fundamental or significant change in Russia’s political order? If change does occur, what can we expect in terms of the direction it will take? And what are the sources that might trigger change?

Beyond Putin.” We are asking after his reign ends – and naturally we don’t know when that will be – whether it is time for those of us on the outside and for Russians on the inside to be thinking about a new or significantly different way of governing a country. It goes without saying, however, that any choice and movement on this matter can and must only be made by Russians.

We have had a government, or we may say a regime, in place now for the better part of two decades. Vladimir Putin was made prime minister in 1999 and elected president in 2000, and he is still at the top of the heap, showing no signs of stopping. But biology being what it is, and the Russian constitution, for all of its flaws, being what it is, we can say for sure that he is now on the back nine of his career as president of Russia. He served two terms as president, and then bowed out for four years and worked as prime minister while his protégé and lieutenant, Dmitry Medvedev, was president of the country for four years. Then, of course, Putin came back as president in 2012. This was permissible under the constitution, which limits a president to two consecutive terms but says nothing

about what might happen subsequently. Putin could have had the constitution amended on this point at almost any time, but he has chosen not to do so. Assuming he runs for reelection in 2018, he would be able to serve a six-year term, at the conclusion of which he will have been Russia’s principal leader for a quarter of a century; not much shorter than the time Joseph Stalin spent as leader.

Looking ahead – ten to fifteen years – we pose three general questions. First of all, what can we say about the prospects for fundamental or significant change in Russia’s political order? Secondly, if change does occur, what can we expect in terms of the direction it will take? Western Democrats like most of us like to think that any political change anywhere has got to move toward more democracy, but a look at the headlines suggests that is not necessarily so. There’s plenty of room for Russia to become more authoritarian than it is today, more autocratic; alternatively, it could move in a more democratic direction, or there is also the possibility that there will be change toward a sort of disorder or breakdown. And thirdly, what are the sources that might trigger change?

My introduction to the issue is, to some extent, a summary of the status quo: Russia is being governed in a tighter, less competitive, less inclusive fashion than it was before Putin came to power. Its recent history has been marked by stability. Previously, though, as Putin has said, Russia's twentieth century was one of turbulence and radical change: a popular revolution, a civil war, a revolution from above culminating in terrible purges, a devastating foreign world war with a foreign adversary that killed almost thirty million people, de-Stalinization, the ups and downs of the Brezhnev period, and then Gorbachev's well-intentioned efforts at reform that did some very good things, but also led to the breakdown of the Soviet Union as a country. In the decade after the Soviet Union fractured, Boris Yeltsin tried to build democracy and radical market reform overnight, but had limited success dealing

had been sorely lacking in the fifteen or so years before, and he had a particular lever for bringing stability about, and that was, of course, the state. So it was his mission in life, and I think it remains his mission today, to rehabilitate and consolidate the Russian state. And in strengthening the state, I think Putin, in fact, was much more concerned with strengthening particular parts of the state than dealing with the state as a whole. Those parts were principally the central government: Russia is a country of regions and he wanted to strengthen the center as opposed to the periphery, and at the center, in Moscow, he strengthened the executive branch at the expense of the legislature. Many of the particulars, I think, are pretty well-known: the second war in Chechnya, which Russia eventually won, the appointing of the so-called *siloviki* (individuals from the secret services and other agencies of that

to judge him in comparison to his predecessors, who were understood to be lacking. The economic boom was facilitated by the bull market for Russia's principal economic asset: oil. The new government actually managed the economy reasonably well and I think its macroeconomic policy was quite prudent, on the whole, and enlightened. And so the wind was certainly in his sails, until roughly 2009–2010, when problems started to accumulate, but I won't dwell on the particulars here.

Putin came back in 2012. He got Medvedev to support him for a third term as president. But his reentry into the presidency was accompanied by a time of considerable civil unrest in Russia, particularly in the big cities. Keep in mind, it was only a few years ago that there were massive demonstrations protesting electoral fraud. So from the outset, the tone of his third term was different. It was more restrictive, it was more control-oriented, and it was more nationalist, anti-foreign, and anti-American.

Now, Russians generally continue to have a very high opinion of Putin. And I know there is controversy about what those poll numbers really mean, and I concede there is some artificiality. But by almost any reasonable measure, he has the approval of a very large majority of the population, more than ever, in fact. But that doesn't mean that the system doesn't have problems; it clearly does. In our authors' workshop today, we looked at some public opinion data about assessments by ordinary Russians in public opinion surveys about whether they think the country is on the right track or on the wrong track. If you look at the results for this kind of questioning, you see a pattern that is actually quite different from the almost uniformly high opinion that Russians have of their individual leader. Russians are often pessimistic about their collective future, but they are seemingly past the point of changing their opinion of Putin. Beneath

In strengthening the state, I think Putin, in fact, was much more concerned with strengthening particular parts of the state than dealing with the state as a whole. Those parts were principally the central government.

with the problems that Russia faced. As Putin saw it, Russia in its most basic sense was greatly diminished by the breakup of the Soviet Union. And he was convinced from the beginning that unless compensating steps were taken, the new Russia had a good chance of suffering the fate of the Soviet Union by entering another cycle of decline.

And so Putin stepped into a very difficult situation, wanting to deal with Russia's problems in a different way, and he seems to have known pretty well in advance what he wanted to accomplish. As I have said, he wanted to bring about stability, which

kind) to watch over the civilian bureaucracy, fixing the state's budget problems, enlarging and enriching the government civil service, and exercising control over Russia's new borders.

And during his first two terms as president, he was entitled to view these as very successful political accomplishments, if we are to use electoral success as a measure of that. After his second term, he handed over power, in a limited sense, to his lieutenant, Medvedev. Until that point, he had one enormous asset – an economic boom – in addition to the fact that Russians tended

the surface, problems are there, and have been there, to a greater extent than perhaps we on the outside realize. From this point of view, the post-Crimea spike in government approval may be a honeymoon period, not likely to last.

I would now like to discuss briefly the essays that will be published in our upcoming *Dædalus* issue. Our first essay, by Stephen Kotkin, is entitled “Russia in the World: Past, Present, Future.” Steve argues that Russia’s biggest problem, and the one that is going to determine what direction it takes in the next ten to fifteen years, has to do with its relationship to the international environment. Russia, he says, has found itself recently where it often was historically: it had ambitions to have an effect in the international system that were not matched by its resources.

Valerie Bunce discusses the so-called color or colored revolutions, of which there have been about a half-dozen in the post-Communist and post-Soviet space in Europe and Eurasia. Her essay addresses the question of whether a Putin or post-Putin Russia could experience its own color revolution: the overthrow of a government from below with significant mass participation. Valerie assesses the potential vulnerability of Russia to such upheaval, but also discusses the resilience of the regime, concluding that such an outcome is not likely, but not impossible.

Henry Hale’s essay is entitled “A Change from Change? Patronal Politics Beyond Putin.” He applies his model of patronalism to contemporary Russia, and concludes that a breakout from this pattern, which emphasizes the provision of clientelistic and such services through a single political pyramid, is not terribly likely, although he does discuss certain conditions under which it might occur.

Fiona Hill’s essay, “The Next Mr. Putin: The Question of Succession in Russia,” most directly addresses the high politics of

Putin’s reentry into the presidency was accompanied by a time of considerable civil unrest in Russia, particularly in the big cities. So from the outset, the tone of his third term was different. It was more restrictive, it was more control-oriented, and it was more nationalist, anti-foreign, and anti-American.

the next decade or so. She reviews the possibilities, telling us quite a bit about Putin and how he has operated, and argues that the most likely thing we are going to see, at least in the next eight to ten years, is an “operation successor” – an attempt by Putin to revisit the theme of succession to him as national leader, which he did address once before in a preliminary fashion with Medvedev. That experiment didn’t really work out, and she thinks he is likely going to return to the question.

Brian Taylor discusses the Russian *siloviki* and political change. The *siloviki*, again, are high-placed officials who come from agencies like the FSB (the neo-KGB), the Russian military, the ministry of the interior, and so forth. Brian finds that the *siloviki* are, in fact, internally divided on many issues. They may not be eager to defend the current regime with blood, or with their blood, which is an important thing to note. But he thinks that all past precedent and their current profile suggest that they will play this game, as he put it, “from the side and not from the front.”

Stanislav Markus wrote an essay on the Russian oligarchs and the prospects of their leading a reform movement. He finds that the wealthiest members of Russian society are not a likely source of challenge to the status quo. But he does think that they want what he calls “de facto elite accountability”; that is, more accountability of those in power to society and better relations with the

West. He points out that some recent maneuvers of the government, including the re-nationalization of property, have been met with puzzlement from Russian big business.

Elena Chebankova has written about what she calls “the critical intelligentsia.” She considers whether it is possible that there would be trouble or potential instability originating from that sector. She thinks probably not, but doesn’t rule it out entirely. She also discusses what she calls paradigmatic pluralism: that the Russian public space actually hosts quite a few ideas about the future. There is no consensus about any in particular, and this has created a kind of equilibrium, which she thinks is quite likely to persist for a while.

Marlene Laruelle wrote an essay on Russian nationalism as a potential source of change. One of the things she does is clarify the many things that Russian nationalism means. She points to some specific actors who might bring it into the central political arena.

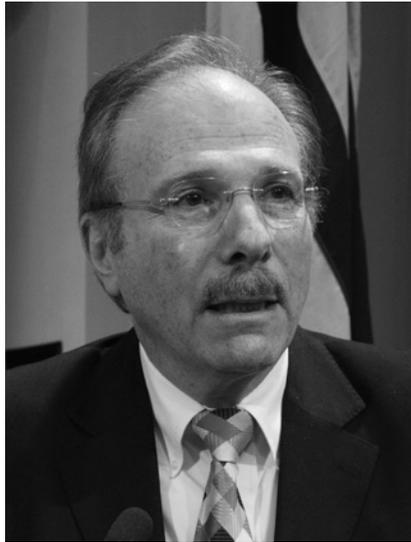
Maria Popova talks about Russia as potentially a rule-of-law state. Her view is that although one can look comparatively to examples where movement in this direction has occurred, it is very unlikely to occur as long as the Putin system is still essentially intact, because that system has so successfully found ways to blunt the momentum toward rule of law.

Samuel Greene’s essay on “Hardship, Mobilization, and Russia’s Social Contract” is

about Russian civil society at a time of considerable economic shrinkage and hardship. Sam portrays the government, on the one hand, and civil society, on other hand, as undergoing a process of mutual adaptation, which may turn out to be fairly durable.

And finally, Keith Darden has written about the international environment, which is also the subject matter of Stephen Kotkin's essay. Keith places a lot of emphasis on the interconnections and echo effects between the external environment and the internal environment. He thinks that this may prove to be the key to understanding what is going to happen, but he puts a somewhat different spin on it than Steve does.

This collection of essays is a work in progress – we are thinking about the Russian future, but we don't have a single picture to draw. I would venture to say that there is not a lot of extreme optimism about a change in the direction that might be popular on this side of the Atlantic, but we feel we are in no position to foreclose any of the possibilities. We just hope that this issue of *Dædalus* helps to spark an intelligent discussion of the possibilities.



George Breslauer

George Breslauer is Professor of the Graduate School and Executive Vice Chancellor and Provost Emeritus at the University of California, Berkeley. He was elected a Fellow of the American Academy in 2014, and is the guest editor, with Timothy J. Colton, of the Spring 2017 issue of Dædalus on "Russia Beyond Putin."

My concluding essay, in the upcoming, Spring 2017 issue of *Dædalus* on "Russia Beyond Putin," will be called "Images of the Future," and will relate the arguments of the authors' essays to my own thinking about Russia's alternative futures. When we think of alternatives to the Putin regime, we can recall how, after the collapse of communism, Western observers were eager to hope that Russia might eventually evolve into a liberal democracy. We all thought a great deal about indicators of and strategies for a transition to democracy and sought to apply those insights to analysis of Russia under Gorbachev and Yeltsin. Under Putin's regime, there is widespread acknowledgement that Russia is not headed in that direction. Indeed, in the collection of essays that will be published in the upcoming issue

of *Dædalus*, not one author predicts a democratic breakthrough toward rule of law, toward proactive self-mobilization by civil society, or, to use the phrase of Sam Greene, toward a long list of modern democratic attributes. Transition to democracy, if by that we mean a liberal democracy and not a more watered-down version, is now viewed, at least within the next ten to fifteen years, as slightly chimerical.

What might be the alternative? At the other end of the spectrum, one can imagine a "Russite" or imperialist-fundamentalist reaction, a reversion to some kind of revanchist fascism, which is the nightmare of moderates and liberals along the political spectrum in Russia today. None of the essays in this issue assigns this scenario a high probability in the next fifteen years, but, given Russia's travails at home and abroad, it is not difficult to imagine that a political-economic breakdown of some sort could lead to the ascendance of a revanchist regime.

With liberal democracy and Russite fundamentalism at the two extremes, a middling alternative to the current regime is what I call "elitist liberalism." Maria Popova would call it "authoritarian constitutionalism" – not rule of law, but rule by law. This intriguing possibility, analogous in a way to what Marxists might have called a "bourgeois revolution" but without the violence, is driven by the urge on the part of business elites to ensure their property rights. While it would provide formalized political representation and stable expectations to business elites, it would still be an authoritarian regime vis-à-vis the masses. Brian Taylor's evidence about the security services and military asserting themselves principally to avoid a breakdown of the state speaks to the possibility of an impending elitist liberalism, because such an alternative would broaden the state but not require its collapse as a precondition for such broadening. It also accords with Stanislav Markus's argu-

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ment that many business elites have a material stake in remaining open to the global capitalist economic order. Thinking about the possibility of elitist liberalism is a useful antidote to thinking that the only alternatives to Putinism are a breakthrough far to the left or far to the right.

Whether one anticipates systemic alternatives to Putinism hinges in part on how one understands the regime currently in place. Many scholars would call it competitive authoritarianism, led by a strong presidency, in which the formal institutions that might check the power of the presidency have been hollowed out and/or are held together through competing and interlacing patron/client networks, both within the state and in nonstate institutions.

A major feature of this "patronal" regime, as Henry Hale calls it, is its ideological signature. It is supported by a broad, centrist coalition that marginalizes both the radical liberals or democratizers on the left and the radical nationalists or fascists on the right. And this, because it is such a broad coalition, allows Putin, as a politician and as the ultimate arbiter in this political system, to tack back and forth among points on the broad ideological spectrum as circumstances suggest. Elena Chebankova expounds on the breadth of this ideological spectrum, writing about what she calls "paradigmatic pluralism," or a multitude of paradigms that all stay within the parameters that the Putin regime has defined as legitimate – or politically persuasive – discourse. Addi-

tionally, Putin can make side payments that keep people under the umbrella, even as he curries support from the other side. As he is the ultimate arbiter among competing networks, he is able to play them off each other. He may not always get his way, but he chooses his battles and has the resources to define the general course and to punish defiance.

Now, within this broad coalition, there is a spectrum that ranges from economic reformers at one end, to nationalist-statist consolidators, at the other. Those are not necessarily mutually exclusive paradigms, since they focus on different types of issues and therefore do not compete

What might be the response to anomic outbursts (like labor activism), shocks to the economy, sustained austerity, growing popular anger about corruption, or a drop or a surge in the president's popularity?

along the same dimension. In principle, one could imagine a highly nationalistic, national-consolidating economic reformer, though you will have to look hard for them. When Dmitry Medvedev was president, the rhetoric that he endorsed was more in the direction of the economic reformists, or modernizers, whereas Putin, since he came back to power in 2012, has embraced rhetoric that goes more toward the nationalist, statist consolidators. The coalition has

a built-in tension, since most economic reformists are skittish about the prospect that nationalist consolidators would constrict both political and economic freedoms, while most nationalist consolidators are apprehensive that economic reformists would unleash forces that might diminish political controls and opportunities for rent-seeking through corruption.

What factors might drive change within this broad coalition? And, what would determine whether the Putin pendulum swings to the moderate left or to the moderate right? International events and the international environment are certainly among the factors, though people may differ as to which direction they predict he would go in the event of this or that type of international climate. A very tense international situation could reinforce the credibility of the nationalist consolidators – or could undermine their credibility if the price of defiance were widely viewed as exorbitant. Short of such swings, the international environment puts constant pressure

on Russian business interests. Thus, there are incremental international pressures resulting from spontaneous adjustments dictated by global markets. Putin, in his rhetoric, may be expressing his disillusion with the United States and with the European Union, and talking more about integration with the Asia Pacific. But even integration into the Asia Pacific region is going to generate international pressures that would force a certain amount of rationalization and

The absence of a break-out to either liberal democracy or revanchist fascism does not mean that no significant change has taken place. The very breadth of the reigning coalition, and the looming possibility of elitist liberalism, mean that Russia beyond Putin might be marked by any number of significant changes.

openness of the Russian economy that the economic reformers within this coalition would welcome.

Another set of factors concerns society. What might be the response to anomic outbursts (like labor activism), shocks to the economy, sustained austerity, growing popular anger about corruption, or a drop or a surge in the president's popularity? These kinds of issues may not lead to a breakout toward either liberal democracy or Russite fundamentalism, but they are likely to lead to shifts of emphasis within this coalition, and growing contradictions if those shifting emphases don't work.

On the elite side of things, we might think of focal points – elections, political succession, incapacitation of the leader – during which people start thinking about alternatives, and perhaps acting upon them. Those are the instances that can become moments for mobilization of pressure, both within the political elite and within the broader society. Of course, there could be shocks along the lines of internal terrorism that, depending upon its scale, location, and intensity, could shift the political calculus. Or there could be a split within the elite – ministerial officials, the security services and the military – with political activists coalescing toward those with whom they have greater sympathy, because they now, as a result of having observed that split, perceive change as possible or feasible.

A question that occupies my mind is how much political skill and political instinct does it take to manage this expansive coalition? If you imagine steering a sailboat, it may all seem fairly automatic. But one gets the sense that it requires a lot more than automatic responses, because the winds are continually shifting, and the commitments that you make during one wind shift might affect your ability to deal with the next. I wonder whether we should think of Putin as just bobbing and weaving and reacting, with little sense of strategy. Or should we instead imagine that, having been doing this now for over sixteen years, and prospectively doing it for another eight, the ultimate historical judgment on Putin may well be that he showed a great deal of political skill and strategic thinking in a very difficult situation.

A second question that I ask myself, in light of the paradigmatic pluralism reflected in Russian political debates, is whether there is a poverty to the dominant American media depiction of the Russian media. As one colleague who reads the Russian press every day said to me, he sees more plurality of opinions expressed in the Russian press than he does in the American press. That is not an absurd statement. Yes, you can find those areas like television, where the government's control has been much more suffocating, knowing that television reaches such a large proportion of the population, but there is also a great deal of public discussion about

alternative possibilities in Russia, and it behooves us to pay attention to that.

And finally, I think about the level of corruption: both petty and grand corruption and inequality in Russia. I think of that in the context of eruptions, like the Arab Spring and color revolutions, the main goal of which was dignity, and the main emotion during which was indignation. These two concepts – dignity and indignation – come from the same root. There is indignation about the fact that corruption and inequality have marginalized people to feel as if there is no justice in the cards that they have been dealt. The question in my mind is, if dignity is a key issue in regimes that are of that sort, is such corruption sustainable in a high-income, highly educated country? And if so, for how long?

As we ponder the possibilities, we must bear in mind that the absence of a break-out to either liberal democracy or revanchist fascism does not mean that no significant change has taken place. The very breadth of the reigning coalition, and the looming possibility of elitist liberalism, mean that Russia beyond Putin might be marked by any number of significant changes within the current parameters of the imaginable.

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Oral Narratives and the Disappearing Past

Gail Hershatter

Twenty years ago I set out with a Chinese friend and research partner, Gao Xiaoxian, to seek from elderly women in northwest Chinese villages their memories of socialist collectivization in the 1950s.¹ We wanted to hear from them before advancing age and death silenced their stories. Between 1996 and 2006 we recorded life histories of 72 women and a much smaller number of men. (Our main interest was in women's gendered memories, but in any case far fewer men than women were alive and able to talk by the time we did our interviewing.) Some women had been famous labor models; others had been local cadres; many were ordinary village women. We asked very basic questions about daily life and family history: what sorts of labor had they performed, within and beyond the home? What aspects of life had changed the most, and when, over the course of their lifetimes?

Gao Xiaoxian was interested in how collectivization had addressed or not addressed the particular needs of rural women, and how insights from that process might help to inform economic and social policy today. My interest was in the intersection of Big History – the events that structure our syllabi, such as wars and revolutions – and daily life. In my teaching, I could refer to a richly elaborated list of state political campaigns, but I had little material to draw from in understanding the cultural and social history of early Chinese socialism.² I wanted to learn how a vast and ambitious state project – land reform, collectivization, and the mobilization of women for year-round fieldwork – had changed life (or not changed it) far from the center of state power in Beijing.

In rural communities, the daily lives of girls and women did not look like those of boys and men, even within the same households. State policies targeted women in specific ways, reworking gendered village space through literacy classes, newspaper illustrations, choral singing, opera performances, and, most centrally, the mobilization of women to participate in fieldwork on a regular basis. Across the years of collectivization, from the 1950s to the early 1980s, the specific content of gendered work and behavior kept shifting, as the state mobilized women for new farming tasks and participation in local leadership. And yet, gender difference itself remained a central organizing principle of rural life, accepted by officials and ordinary rural dwellers alike. To paraphrase historian Joan Kelly's

famous question – did women have a Renaissance? – I wanted to know, did women have a Chinese revolution? If so, when, and what sort of revolution?

Doubly marginalized by virtue of rural location and gender, women were nonetheless key to the success of changes in agriculture during the Mao years. As men were increasingly drawn out of agriculture into infrastructure projects, small-scale local industry, and contract labor in the cities, women in many northwest China villages took on much of the burden of farm work. The feminization of basic agriculture began early in the socialist period. Women's labor, in the fields and at home, fueled what some analysts have called "primitive socialist accumulation" – the process by which the Chinese state drew resources out of the countryside to build up national infrastructure, industry, education, and public health. The problems and catastrophic failures of this process must not be minimized, but by many measures China in the early 1980s was far better off than China in 1949. The post-Mao economic reforms then proceeded to build upon the changes of the Mao years, even as collective institutions were dismantled and criticized. To note these achievements is not to engage in nostalgia for the difficult living conditions, inequalities, and injustices of the collective era. It is merely to recognize that the gendered labor of some of China's poorest citizens helped to underwrite economic development both before and after the economic reforms. Rural labor in general, and women's labor in particular, was an important component of that success. Rural women did have a Chinese revolution, in the sense that space and time, as they lived and understood them, were profoundly reordered in the 1950s. The revolution they had, however, was shaped in particular ways by gender.

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Half a century after the fact, aging village women recalled all this labor and social change with a combination of satisfaction and indignation.

Even as the state exhorted them to come out and work in the fields in the 1950s, they remained responsible for domestic work, which was theorized in state discourse mainly as a remnant destined to disappear in the indefinitely receding communist future. Women remembered very clearly staying up most of the night, making by faint lamplight (in the years before electricity came to the villages) the cloth and the clothing and the shoes their families needed. The problem was compounded by the growing number of children in rural families. The state's very success in lowering infant mortality, combined with its inattention to birth planning before the 1970s, contributed to women's general exhaustion. One woman observed, *When we were working in the collective, the state was in charge of everything. They took charge of telling us to grow the grain properly, harvest more, and eat more. But they didn't take charge of births. They did not control child-birth. To have more children means to suffer more, to be worn out. I have 8 children and you might think it's too funny, 2 sons and 6 daughters. I had lots of children, I starved, I endured extreme bitterness. After Liberation, I had so many children that I got angry. Why didn't they control it and tell people not to have more children? It was pitiful.* The oral narratives of village women were punctuated with tales of children injured, frightened by animals, left tied to the *kang* [brick platform bed], drowned, or dead of diseases not treated in time. And the childbearing and childrearing experiences of this generation ensured that when the single-child family policy was announced in 1979, they were often its most enthusiastic proponents – responsible for mobilizing reluctant younger village women, who were coming of age in a very different time, to terminate pregnancies.

Many women structured their stories around a recitation of how they had met every life challenge with hard work and virtue. These enduring themes are prominent in traditional accounts of women across Chinese history, and also punctuate revolutionary narratives. Women told us how they worked, suffered, provided for their families, cared for their aging in-laws (in a patrilocal society, this task continued to fall to the daughter-in-law), and helped increase production of cotton and grain. Even those who characterized themselves as marriage rebels and village activists were proud of having fulfilled family obligations that would have been completely legible to the mother of Mencius (he lived ca. 372–289 BCE; we don't, of course, know his mother's date of birth, though her death date is recorded as 317 BCE). Although norms and expectations for village women changed dramatically across the 1950s and 1960s, they themselves saw continuity in how a virtuous person was

supposed to behave, and they expressed satisfaction with having exceeded those standards.

At the same time, women were very aware that the collectives for which they had labored were now a repudiated form of social organization. They knew that their own children and their children's spouses, facing new economic pressures, were unlikely to support them as they had supported their own elders. They praised the relative material abundance of the present and did not mourn the lost collectives, voicing both direct and implicit criticisms of the inequities and poverty of the collective era. But their stories were also suffused with indignation at the contemporary shape of family relations. The desire to be valued for who they had been and what they had accomplished animated many of their stories.

Working with oral narratives poses particular dilemmas for a historian. Chief among them is the ethical imperative not to create difficulties for the people we write about. Here anthropologists have clear protocols: change all names, in order to protect places and people. For historians, the imperatives are mixed. We want to give as complete and accurate a picture as possible, and in the case of non-elite women, we hope to restore an occluded past to visibility. With this particular research project, it was also evident that many of our interlocutors were longing to be heard and recognized; all of them consented eagerly to use of their real names. (Fear of political fallout did not seem to be a factor. Although I did not record her exact words, one woman snorted at the idea, saying something like, "What could anyone do to me – send me down to the countryside to be a farmer?")

Nevertheless, the stories women told us often involved many others in their families and communities who had not consented to speak to us, involving painful details of past conflicts and present injuries. We were also conducting this research at a moment when the boomerang effects of the Internet were just becoming evident. We worried that stories, circulating back, could do unforeseen personal damage to aging women whose vulnerability was evident. So in the end we chose to identify only the labor models who were already public figures, and to assign pseudonyms to all other women and their communities, regardless of consent.

Although the term "oral history" has a venerable pedigree, I no longer use it. The practice of "History" requires sifting and weighing many kinds of sources, shaped unavoidably by professional conventions that shift over time, in pursuit of a definitive reconstruction of the past that endlessly eludes us. History is not fixed, but it is slippery in different ways and for different reasons from those that shape individual and community stories about the past. Although I am never absent from the picture when I write histo-

ry, it is (hopefully) not primarily or directly about me. The women who spoke to us, in contrast, were directly and eloquently representing themselves and their pasts, talking back to a contemporary world that neglects them and a posterity that may well acknowledge no trace of their lives. For me, “oral narrative” better captures the composite nature of their memories of the past, recalled many years after the event, in light of everything that has happened since, under current circumstances that engender new significance in how those stories are spoken and understood. The listener should be aware that when people are recounting past unsettled controversies, or ones that continue to ramify into the present, they often draw the researcher into the case they are making, in conversation with their former opponents (alive and dead) and with posterity. In a single community there may be people with many kinds of stakes, political and personal. Those who draw upon oral narratives need not just to listen but also to discern; this is one of the biggest challenges of this sort of work. Collecting oral narratives is not a matter of “listen and it shall be revealed.” It is more like “ask, and every answer will raise more questions, some of which are unanswerable.”

Oral narratives are thus a hopelessly complicated – one might say contaminated – source. But they are no more contaminated than the archival documents I collected in many months of research in Shaanxi, which told me a great deal about state goals, the obstacles to achieving them, and (sometimes) the pressure to lie about whether they had been met. Like archival documents, oral narratives are nodal points in the complicated itinerary of historical facts. Each fact carries with it the traces of its own construction. Each acquires new significance over time. Each requires careful reading, listening, decoding, cross-checking, and a hefty dose of humility that you may not have gotten either the fact or its meaning right and that your own work is, like the sources, ephemeral. In telling us their stories, rural women in Shaanxi let us glimpse the process by which they made meaning out of their personal and collective past, a world that has now all but completely disappeared. Their accounts do not provide everything a historian might want to know, but they convey lessons – about enduring social inequities in China, and also about what counts as a historical event, in memory and in retelling – that we need to hear.

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ENDNOTES

1. This essay draws on a number of my earlier publications, including *The Gender of Memory: Rural Women and China's Collective Past* (Berkeley, Calif.: University of California Press, 2011), and “Disquiet in the House of Gender” (Presidential Address, Association for Asian Studies), *Journal of Asian Studies* 71 (4) (November 2012): 873–894.
 2. Because we had overlapping interests but diverse questions and readers in mind, Gao Xiaoxian and I decided to interview together but write separately.
-

An Embrace of Africa

Robert I. Rotberg

In 1956, while working in the summer as a fledgling reporter for the then family-owned *Hartford Courant*, I persuaded the editors to let me write what turned out to be a seven-part series exposing the extent of housing segregation in “liberal” Hartford. When “Where Can a Negro Live?” began to appear, day-after-day, I started to receive hate mail. One particularly memorable postcard urged, “If you like them so much, why not go live there [in Africa].” So I did.

There are many more nuanced reasons why I decided to make the study of Africa a life’s work. A strong exposure to human rights concerns during my undergraduate years at Oberlin College and an introduction during graduate research at Princeton’s Woodrow Wilson School of International Affairs about what was and was not changing in the American South (the Hartford interlude occurred between my first and second years at Princeton; the Greensboro sit-ins were yet to occur) obviously also influenced my desire to learn whether or not the impending end of colonial rule in Africa would greatly improve indigenous outcomes in the far continent. Would Africans achieve their rights even before African Americans in the South?

When I finally landed in Africa early in 1959, after four terms as a Rhodes Scholar at Oxford and special dispensation to use Rhodes funding to do D. Phil. thesis fieldwork in Africa, I was immediately thrust into heady discussions about how rapidly and how dramatically to decolonize East, Central, and southern Africa. Two anti-Rhodesian and anti-British insurgencies (in Zambia and Malawi) unfolded in real time. So did major political shifts in Tanzania, Kenya, and Zanzibar. I was privileged to know and record the efforts of struggle leaders (including many prison detainees and a few future national presidents) and to pursue live research while also digging deeply into local archives.

For several years, I traveled back and forth from Harvard, where I began researching and teaching in 1961, to African colonies on the cusp of independence. For example, my late wife and I were with Jomo Kenyatta when he emerged from post-Mau Mau detention in Kenya. I wanted to ask him questions about Mau Mau; he insisted on quizzing Joanna about her important research on the diseases of bananas (a critical local commercial crop).

I also came to know segregated Rhodesia and apartheid South Africa well, and to steep myself for purposes of research and advocacy in the work of those who were attempting to free Nelson Mandela and remove the yoke of apartheid.

Later, despite being banned from South Africa for five years and from Rhodesia (before it became Zimbabwe) for eight years, my

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research and teaching at Harvard and then at MIT focused on how best to strengthen African assertions of their own rights and, additionally, on how insiders and outsiders could best contribute to African economic and social growth. What should foreign policymakers do to help the leaders of Africa to foster good indigenous outcomes? Again, with the object of improving outcomes for Africans generally, what were the more effective and responsible choices available in the policy arena for African politicians?

In order to pursue such goals; in order to teach both undergraduate and graduate students about the real Africa in all of its variety and idiosyncratic forms (now forty-nine sub-Saharan African countries), their different indigenous and colonial heritages, different languages and ethnicities, different post-colonial trajectories, different economic growth potentials, and much more; and in order to carry out an expansive social science and historical research agenda, I ended up writing a number of books on an array of relevant subjects, editing more (including both conference collections and two African autobiographies), producing reports on regional or individual country advances, writing four biographies, and attempting through the power of the pen – and with limited success – to encourage the outside world to combat famine in Ethiopia (and now in southern Africa), to urge local audiences to battle creeping authoritarianism in their own countries (e.g., Nigeria, Zimbabwe, and Malawi), and to persuade the greater world not to be fooled by the sugar-coating that Afrikaner spokesmen were applying to the curse of apartheid.

Because African politics and development are such vast subjects, and because I was as much interested in its past as its future, my writing and teaching ranged originally from the origins of man and the discovery of Africa to the revolutionary processes that created the new nations of the continent. First at Harvard, where I inaugurated the teaching of African history to large numbers of under-

graduates (a President of Harvard, chancing upon me in the street in front of his house, asked me what I did. When I told him, he exclaimed: “We do that [teach about Africa] here?”) and supervised smaller numbers of graduate students in history and government (while running research projects at the Center for International Affairs – now the Weatherhead Center), and second at MIT, where I taught both the history and political science of emerging Africa, I attempted to explicate the richness and complexity of the African situation so that those of us who were studying modernization or development, patrimonialism, one-party systems, or militarism in politics could strengthen our theoretical appreciation of the African “fit” and African exceptionalism.

Research and writing naturally followed. There was so much to learn and to share. When I wrote *The Rise of Nationalism in Central Africa* and edited *From Protest to Power in Africa*, early books, I sought to show how Africans were reclaiming their authenticity, sometimes through militant and chiliaric means. *Suffer the Future: Policy Choices in South Africa* examined how apartheid worked and what to do about it. *Ending Autocracy, Enabling Democracy: the Tribulations of Southern Africa* analyzed the freedom struggle from Cape Town to Lusaka. Volumes such as the edited collections *When States Fail: Causes and Consequences*; *On Governance*; *China into Africa*; and *Corruption, World Security, and Global Order* were attempts to discuss many of the larger issues bedeviling African and other developing world states as they matured in the twenty-first century. More recently, *Africa Emerges: Consummate Challenges, Abundant Opportunities and Transformative Political Leadership: Making a Difference in the Developing World* explored African aspirations and how to achieve better governance and sustainable progress. The Index of African Governance, which I created to quantify the results of African methods of governing themselves, showed which of the sub-Saharan nations had succeeded well and which had not. (Along the way, I also wrote about similarities and structural differences in Haiti, Burma, Sri Lanka, Cyprus, and Israel/Palestine, and organized collective volumes on truth commissions, ethnic cleansing, genocide, and conflict prevention.)

During the academic year 2015–2016, I was privileged to chair the Academy’s Africa Study Group. The objectives of the discussion group were to engage the Academy with Africa, to explore key topics of interest to its members (drawn as they largely and inevitably were from the ranks of Massachusetts-based medical, educational, scientific, and social scientific faculties, as well as the corporate community), and to begin to discover how the Academy could best partner with the new Africa. Since I have spent the better part of an adult lifetime encouraging and enabling such partnerships, and advocating for and with the peoples of Africa, the focus on Africa’s needs drew on decades of familiarity willingly shared.

Without even attempting to summarize what we learned, it is evident that sub-Saharan Africa’s contemporary population explosion (Nigeria will become the third largest nation on the planet, Tanzania the fifth), and what those hugely swelling numbers will mean for urbanization, educational opportunity, and health outcomes, overshadows the equally serious deleterious shifts that will flow from the impact of global warming on Africa’s diminishing ability to feed itself. Electrical generating capacities, already minuscule, and insufficient roads, rails, and harbors are further hindrances to necessary growth and improved living standards. To cope effectively with these and other pressing concerns, sub-Saharan Africa’s peoples cry out for more skillful leadership and fair-minded governance (including reduced corruption and attention to the rule of law).

These are the kinds of problems on which I have been working for twenty years, and in many respects for fifty or so years. Laying out the various well-researched alternative policy paths – the available choices for Africa – is what we must continue to do if Africans are to prosper, if the African middle class is to be enabled to exert a greater influence than before on its own benevolent political and social outcomes, and if Africans, like Asians, are to achieve a thoroughgoing demographic dividend for themselves and for the continent.

Africa has never been an easy collection of countries to study. But the purposes for which I first ventured to the far continent still drive my research and my writing today. There is much still to learn from Africa, and to share with students, colleagues, the Academy, and the public at large.

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What Evidence Should We Trust?

Jerome Kagan

When forced to decide between a career in biochemistry or psychology in the spring of 1950, I chose the latter because of a gnawing puzzlement provoked by the observation that apparently sane people living in the same community held different beliefs about love, honesty, and whom was entitled to respect and whom to scorn. It would take another twenty-five years before I appreciated that the answer to my adolescent confusion was that people trusted different sources of evidence when establishing their beliefs. Some trusted their feelings; others their observations; and some relied on the statements of respected authorities. Millions of Americans of my generation who reached adulthood during the first half of the last century relied on a feeling when they decided that Freud's explanation of the causes of their doubt, anxiety, and guilt were probably right. A majority of equally anxious Americans, reflecting on different evidence in 2016, find the same explanations deeply flawed.

Before the invention of machines that allowed humans to observe phenomena hidden to their senses, everyone understood that A's statements about B's fears, honesty, prejudices, or talents were based on observations of B or descriptions of B by those who knew him. Following the invention of new forms of evidence for human properties – questionnaires, the speed of a motor response, changes in the amount of sweat on a finger, and brain activity – many investigators borrowed the same words to describe different evidence. Adolescents who report on a questionnaire that they are among the most popular youths in their class are often observed to be consistently rejected by their classmates. A fair number of neuroscientists believe that a particular pattern of blood flow in the brain of a person looking at a face displaying the wide eyes and open mouth characteristic of fear means that the individual is in a state of fear, even if the person vehemently denies any semblance of fear or anxiety. The neuroscientists implied that the meaning of anxiety had not changed despite the change in the evidence.

Contemporary populations have become more dependent on the claims of scientists than earlier generations. Unfortunately, the average citizen is unable to judge the validity of the evidence behind most declarations. Most adults who learn that the universe is 13.8 billion years old assume that this statement must be based on impeccably trustworthy evidence. A majority do not appreciate that the temperature of the universe the moment after the Big Bang, which is necessarily an estimate that is subject to revision, is one of the critical pieces of evidence. Lord Kelvin, the most respected physicist of the nineteenth century, intimidated Charles Darwin by declaring that his evidence on the cooling of the earth's interior implied that the planet could not be older than 25 to 30 million years – too short a time for the changes that Darwin's arguments required.

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Lord Kelvin's evidence turned out to be flawed, as was the evidence for an aether as the medium through which light traveled.

Linda Bartoshuk provides a persuasive example of the dependent relation between the truth of a statement and its source of evidence.¹ She was surprised to discover that adults who had many taste buds for sweetness on their tongue and those with few taste buds gave the same judgments when they evaluated the sensation of the sweetness of a sip of soda on a scale that went from "not sweet" to "very sweet." But when she asked these adults to adjust a lever controlling the loudness of a sound so that the intensity of the sound corresponded to the sweetness of the soda, those with more taste buds for sweetness selected a loudness corresponding to a train whistle. Those with fewer taste buds chose a sound resembling a dial tone. Hence, the answer to the question, "Do individuals with more taste buds for sweetness experience a food as sweeter?" is "It depends on the evidence." This principle, which the physicist Niels Bohr articulated a century ago, applies to every scientific statement.

New sources of evidence often alter earlier conclusions. The observations of the European voyagers of the fifteenth, sixteenth, and seventeenth centuries as well as the later discovery of fossils made evolutionary ideas possible. Declarations about the nature of anger, fear, sadness, and joy were changed after the invention of the camera, which allowed more detailed measurements of the muscle patterns in facial expressions. Genetic evidence, which is replacing fossil evidence, suggests that dogs evolved from wolves more than 120,000 years ago. It is possible that optogenetics, which allows more precise activation of neurons with light, will replace the measurement of blood flow to sites containing many thousands of neurons. Each new source of evidence is accompanied by the replacement of some old conclusions with new ones.

Contemporary American and European scientists, and a fair number of non-scientists, place greater trust in biological measures than behaviors when deciding on the truth of claims about

psychological states. A woman who typically feels anxious when talking with strangers learns about a new drug that reduces anxiety. She assumes that patients' reports saying that the drug muted the intensity of their anxious feelings comprised the evidence. She would be surprised to learn that a major basis for the claim was the drug's ability to tempt mice, who naturally prefer to remain in a dark chamber, to explore a brightly lit chamber. The scientists who argued that a mouse's avoidance of light was a sensitive index of anxiety assumed that because humans avoid experiences that make them anxious, it must be the case that a mouse who avoids a brightly lit place must be afraid of this experience. These scientists forgot, or chose to deny, the obvious fact that humans who avoid spicy foods, large cities, or country music are not afraid of these events. They simply do not like them.

Statements about human consciousness have, until recently, relied on a person's behaviors or subjective reports. Consciousness assumed a new meaning when investigators discovered that neurons in a motor region of the brain of a woman who had been in an uncommunicative, vegetative state for more than five months became active when a scientist asked her to imagine she was playing tennis.² Advances in genetics may alter the truth of statements about illness. Is a woman who feels perfectly healthy ill if she possesses genes that are known to place women at risk for breast cancer?

The current bias favoring the truth of statements about human traits that are based on biological evidence has serious implications when judges and juries are deciding on the guilt or innocence of a defendant accused of a violent crime. Respected experts have argued that the immaturity of the adolescent brain is a major reason for the high prevalence of homicides committed by American youths. These scientists often fail to acknowledge that poor black youths living in one of the Southern states committed the majority of violent crimes in the United States in 2014. There is no evidence to suggest that the brains of these adolescents were less mature than the brains of black adolescents from affluent families living in the Northeast. One measure of an immature brain is incomplete elimination of the synapses that connect neurons. This process, which is a normal phase in maturation, is accompanied by a thinner level of gray matter in the cortex. Measures of gray matter thickness in individuals aged 10 to 50 years revealed that some 10 year olds had thinner cortices than some 30 year olds and most youths between ages 12 and 18 had similar thickness levels.³ Equally important, men between ages 25 and 45, most of whom possess a mature brain, commit more rapes and murders than adolescents.

Predicates that are appropriate in sentences that have an animal or human as the noun are inappropriate when a brain profile is the noun. Sentences with the predicates *see*, *feel*, *plan*, or *remember* re-

quire an animal or person to be the agent. This issue was the theme of a debate between Maxwell Bennett, a neuroscientist, and Peter Hacker, a philosopher, who objected to using predicates that implied psychological processes in sentences in which the brain was the noun. Philosophers Daniel Dennett and John Searle saw nothing wrong with this practice.⁴ Dennett and Searle argued that it was legitimate to write, "The hippocampus remembers a name" because neuroscientists understood this sentence to mean that activity in the hippocampus contributes to and is necessary for remembering a name. Because neuroscientists agree on the special meaning of *remember* in the sentence above, it is not a serious error to attribute psychological properties to the brain. That conclusion is reasonable when the language community consists only of neuroscientists. It has the potential for misunderstanding when others read the same sentence. That is why neuroscientist Joseph Le Doux⁵ suggested that the predicate *fear* assumes a conscious human and should not be used to describe a brain profile.

Social scientists studying human traits, symptoms, or past experiences typically rely only on a person's verbal reports and assume that the verbal statements are faithful proxies of the evidence that would have been found if these individuals had been observed. Sadly, this premise is flawed. An adult's description of a psychological state, trait, past behavior, or experience often fails to correspond to what direct observations would have revealed. This claim applies to how well one slept, the quality of memory, a feeling of well-being, penis length, prior use of cocaine, or the stress of public speaking.⁶ For example, a mother's description of her child as restless, fearful, or confident does not always match what observers record when they film the child in a laboratory or at home. Almost two thirds of New Zealand mothers whose four-year-old children had stayed in a hospital at least one night did not remember that hospitalization when asked about it one or two years later.⁷ If a parent cannot recall an event as emotionally salient as a child's prior hospital admission, it is likely that many memories of 20 year olds recalling less salient childhood events are of questionable accuracy. Current explanations of relations between childhood experiences and later traits assume that the early events occurred, not that the individual thought they occurred.

The inability to judge the trustworthiness of most scientific claims allows the average citizen to dismiss statements he or she prefers to forget or deny. As a result, the sentiment of the majority exerts a palpable influence on legislation. The evidence implicating the dangers to human health posed by the molecule bisphenol A, which is used in the manufacture of plastics, is as firm, some would say firmer, as the evidence implying the dangers of passively inhaling cigarette smoke. But neither the public nor Congress is ready to

outlaw the use of this molecule. Facts and the relevant evidence join reasoning, intuition, and community sentiment in determining the beliefs that a society is prepared to accept as a basis for action. ■

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ENDNOTES

1. Linda Bartoshuk, "The Measurement of Pleasure and Pain," *Perspectives on Psychological Science* 9 (2014): 91–93.
2. Adrian M. Owen et al., "Detecting Awareness in the Vegetative State," *Science* 313 (2006): 1402.
3. Jerome Kagan and Norbert Herschkowitz, *A Young Mind in a Growing Brain* (Mahwah, N.J.: Erlbaum, 2005).
4. Maxwell Bennett, Daniel Dennett, Peter Hacker, and John Searle, *Neuroscience and Philosophy: Brain, Mind & Language* (New York: Columbia University Press, 2003).
5. Joseph E. Le Doux, "Coming to Terms with Fear," *Proceedings of the National Academy of Sciences* 111 (2014): 2871–2878.
6. David Veale et al., "Beliefs about Penis Size," *Journal of Sexual Medicine* 11 (2014): 84–92; David Torrents-Rodas et al., "No Effect of Trait Anxiety on Differential Fear Conditioning or Fear Generalization," *Biological Psychology* 92 (2013): 185–190; Kate M. Scott, Don A. R. Smith, and Pete M. Ellis, "A Population Study of Childhood Maltreatment and Asthma Diagnosis," *Psychosomatic Medicine* 74 (2012): 817–823; Glenn J. Landry, John R. Best, and Teresa Liu-Ambrose, "Measuring Sleep Quality in Older Adults," *Frontiers in Aging Neuroscience* 7 (2015): 166, doi: 10.3389/fnagi.2015.00166.
7. Nataliia Burakevych, Christopher J. McKinlay, Jane M. Alswailer, Jane E. Harding, and CHYLD Study Team, "Accuracy of Caregivers' Recall of Hospital Admissions: Implications for Research," *Acta Paediatrica* 104 (2015): 1199–1204; Sean P. Wojcik et al., "Conservatives Report, but Liberals Display, Greater Happiness," *Science* 347 (2015): 1243–1246.

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Bruno Coppi (Massachusetts Institute of Technology) was awarded the 2016 Antonio Feltrinelli Prize, by the Accademia Nazionale dei Lincei.

Ingrid Daubechies (Duke University) has been selected as a 2016 Simons Investigator.

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Ray Hilborn (University of Washington) was awarded the 2016 International Fisheries Science Prize.

Eric Lander (Broad Institute of Harvard and MIT) is the recipient of the 2016–2017 James R. Killian Jr. Faculty Achievement Award of the Massachusetts Institute of Technology.

John Levi (Legal Services Corporation; Sidley Austin, LLP) is the recipient of the Sargent Shriver Equal Justice Award, given by the Sargent Shriver Center on Poverty Law.

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Sarah Maza (Northwestern University) has been awarded the Dorothy Ann and Clarence L. Ver Steeg Distinguished Research Fellowship Award.

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Michael J. Murrin (University of Chicago) is the recipient of the Norman Maclean Faculty Award, given by the Alumni Association of the University of Chicago.

Michel C. Nussenzweig (Rockefeller University) is the recipient of the 2016 Robert Koch Award.

Bjorn Poonen (Massachusetts Institute of Technology) has been selected as a 2016 Simons Investigator.

Ellen Rosand (Yale University) was awarded the William Clyde DeVane Medal, given by Yale University.

Carla Shatz (Stanford University) was awarded the 2016 Kavli Prize in Neuroscience. She shares the prize with **Eve Marder** (Brandeis University) and Michael Merzenich (University of California, San Francisco).

Michelle Simmons (University of New South Wales) has been awarded the Foresight Institute Feynman Prize in Nanotechnology.

Peter J. Stang (University of Utah) is the recipient of the 2015 International Science and Technology Cooperation Award of the People's Republic of China.

Joan Steitz (Yale University) was awarded the William Clyde DeVane Medal, given by Yale University.

Madhu Sudan (Harvard University) has been selected as a 2016 Simons Investigator.

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Edward Witten (Institute for Advanced Study) is the recipient of the 2016 Albert Einstein World Award of Science, given by the World Cultural Council.

Mark Yudof (University of California, Berkeley School of Law) is the recipient of the 2016 Maimonides Award from Hillel International.

New Appointments

Carolyn Bertozzi (Stanford University) has been appointed a member of the Scientific Advisory Board of Symic.

Martin J. Blaser (New York University) was appointed Chair of the Presidential Advisory Council on Combating Antibiotic-Resistant Bacteria.

David E. Clapham (Harvard Medical School; Children's Hospital Boston) has been elected Vice President and Chief Scientific Officer of the Howard Hughes Medical Institute.

Christopher B. Field (Carnegie Institution for Science; Stanford University) has been named Director of the Stanford Woods Institute for the Environment.

Richard Huganir (Johns Hopkins University) has been appointed President of the Society for Neuroscience.

Jonathan Levin (Stanford University) was named Dean of Stanford Graduate School of Business.

Barry Posen (Massachusetts Institute of Technology) has been appointed Henry A. Kissinger Chair in Foreign Policy and International Relations at the Library of Congress John W. Kluge Center.

Anne Walters Robertson (University of Chicago) has been named Interim Dean of the Division of the Humanities at the University of Chicago.

Paul Romer (New York University) has been appointed Chief Economist of the World Bank Group.

David Rubenstein (The Carlyle Group) was elected to the Harvard Corporation.

Maria Zuber (Massachusetts Institute of Technology) was elected Chair of the National Science Board.

Select Publications

Poetry

Calvin Trillin (*New Yorker*). *No Fair! No Fair! And Other Jolly Poems of Childhood*. Illus. by **Roz Chast** (*New Yorker*). Orchard Books, September 2016

Rosanna Warren (University of Chicago). *Earthworks: Selected Poems*. American Philosophical Society, June 2016

Nonfiction

Jane Alexander (New York, NY). *Wild Things, Wild Places: Adventurous Tales of Wildlife and Conservation on Planet Earth*. Knopf, September 2016

Alain Berthoz (Collège de France). *The Vicarious Brain, Creator of Worlds*. Harvard University Press, January 2017

R. Howard Bloch (Yale University). *One Toss of the Dice: The Incredible Story of How a Poem Made Us Modern*. Liveright, November 2016

A.S. Byatt (London, United Kingdom). *Peacock & Vine: On William Morris and Mariano Fortuny*. Knopf, August 2016

Harvey Cox (Harvard University). *The Market as God*. Harvard University Press, September 2016

Lawrence M. Friedman (Stanford Law School). *Impact: How Law Affects Behavior*. Harvard University Press, September 2016

Donald K. Grayson (University of Washington). *Giant Sloths and Sabertooth Cats: Extinct Mammals and the Archaeology of the Ice Age Great Basin*. University of Utah Press, May 2016

Siegfried S. Hecker (Stanford University). *Doomed to Cooperate: How American and Russian Scientists Joined Forces to Avert Some of the Greatest Post-Cold War Nuclear Dangers*. Bathtub Row Press, June 2016

E. D. Hirsch, Jr. (University of Virginia; Core Knowledge Foundation). *Why Knowledge Matters: Rescuing Our Children from Failed Educational Theories*. Harvard Education Press, September 2016

Alice Kaplan (Yale University). *Looking for “The Stranger”: Albert Camus and the Life of a Literary Classic*. University of Chicago Press, October 2016

James T. Kloppenberg (Harvard University). *Toward Democracy: The Struggle for Self-Rule in European and American Thought*. Oxford University Press, June 2016

Joseph Loscalzo (Brigham and Women’s Hospital; Harvard Medical School), Albert-László Barabási (Northeastern University), and Edwin K. Silverman (Brigham and Women’s Hospital; Harvard Medical School), eds. *Network Medicine: Complex Systems in Human Disease and Therapeutics*. Harvard University Press, February 2017

Charles S. Maier (Harvard University). *Once Within Borders: Territories of Power, Wealth, and Belonging since 1500*. Harvard University Press, October 2016

Joel Mokyr (Northwestern University). *A Culture of Growth: The Origins of the Modern Economy*. Princeton University Press, October 2016

Venkatesh Narayanamurti (Harvard University) and Toluwalogo Odumosu (University of Virginia). *Cycles of Invention and Discovery: Rethinking the Endless Frontier*. Harvard University Press, October 2016

Dale Purves (Duke University). *Music as Biology: The Tones We Like and Why*. Harvard University Press, February 2017

Matthew Rubery (Queen Mary University of London; Visiting Scholar, 2011–2012). *The Untold Story of the Talking Book*. Harvard University Press, November 2016

Amartya Sen (Harvard University). *Collective Choice and Social Welfare*. Harvard University Press, November 2016

David Shulman (Hebrew University). *Tamil*. Harvard University Press, September 2016

Peter Stansky (Stanford University). *Edward Upward: Art & Life*. Enitharmon Press, June 2016

Alan Taylor (University of Virginia). *American Revolutions: A Continental History, 1750–1804*. W. W. Norton, September 2016

Adrian Vermeule (Harvard Law School). *Law’s Abnegation: From Law’s Empire to the Administrative State*. Harvard University Press, November 2016

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