

Projects and Studies

At a morning orientation program for new members, held on October 7, 2006, leaders of current Academy projects presented updates on their work. Their remarks appear below.

Initiative for Science, Engineering, and Technology

Charles M. Vest

President Emeritus and Professor of Mechanical Engineering, Massachusetts Institute of Technology

Science and technology today are conducted in a very rapidly changing landscape. Certainly the role of science, engineering, and technology in our lives has increased dramatically over the past sixty years. (We frequently use sixty years as the yardstick – basically the time since the end of World War II.) The intensity of application of science and technology in our everyday as well as corporate lives has accelerated. Consider the adoption of major technical innovations and products. It took the automobile

about a lifetime to reach 25 percent of America's households. The telephone and radio took about the length of a typical professional career. The amount of time it has taken us to adopt a new technology continually decreased as we introduced television, cell phones, and the Internet. When we got to the World Wide Web, it took only seven or eight years to reach 25 percent of America's households.

As this pace of technological change accelerates, U.S. leadership in science and technology is certainly no longer guaranteed, if ever it was. I, for one, happen to think that's good, because I hope more great science and advanced science education are, in fact, done around the world. Nonetheless, if there is a loss of American leadership it may be more the result of our decline than of others' advance.

Many in this country are beginning to think of science as a cost, rather than understanding it as a key investment in our future. Issues of science and tech-

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nology are beginning to strike dissonant chords with aspects of our nation's culture and politics. This discord has increased rapidly, as we have begun to engineer what most of us think of as the stuff of life. When you begin hearing students in the hallways

at MIT talking about "biohacking," you know things are changing in very profound ways.

What will Tom Friedman's flat world actually mean for the advance of science, engineering, and technology? Will we work more collaboratively across national boundaries? I think the answer is clearly yes. The question is, how will and how should that be accomplished? Looking ten years ahead, will we still be so fortunate to attract the best and brightest young men and women from countries around the world to be educated, to pursue their research, and, for some of them, to stay in the United States and contribute in amazing ways to our institutions and our economy? Or will we wake up in fifteen to twenty years and find that the typical path is for Americans to go to, say, China in order to do the most advanced



Selected leaders of current Academy projects: front (left to right): Patricia Meyer Spacks (University of Virginia), Charles M. Vest (MIT), David Clark (MIT), Steven Miller (Kennedy School of Government, Harvard University); back (left to right): Robert C. Post (Yale Law School), Linda Greenhouse (New York Times), Boyce Rensberger (MIT), Joel E. Cohen (Rockefeller and Columbia Universities), Norman M. Bradburn (University of Chicago)

work in science and engineering? That is certainly possible. After all, in the decades prior to World War II, Americans who wanted to learn and work at the cutting edge of science went to Germany or the United Kingdom. How can the United States maintain its leadership role? What policies should be put in place to achieve that goal?

We face a lot of questions. What will the next sixty years of science look like? What kind of science will be done, how will it be done, where will it be done, why will it be done, and who will do it? The answers to these questions are not very obvious and are at the core of what the Academy's Initiative on Science, Engineering, and Technology plans to consider. The Initiative will examine how the world of science and technology is likely to change. Through this study, we can help the broad public and policymakers understand these changes and their implications, in order to adapt to and lead them better.

I believe – and it's the reason that Neal Lane and I were pleased to cochair this activity – that the Academy brings several important strengths to this enterprise. First, the Academy brings new voices to the debate. It is not a Washington institution. One of the Academy's advantages is the ability to step back and take a more objective view of these matters, in a nonpolitical, nonpartisan way.

Second, the Academy is not a science-advocacy organization. It brings to these questions the assurance that they will be dealt with in a very broad, multidisciplinary, and independent fashion. Science and technology policy today requires not only scientific and engineering expertise but also knowledge of business, economics, law, politics, and ethics. Finally, our understanding of these issues benefits from

a cross-sector discussion, which the Academy can provide. We want to include the voices of scholars, administrators, entrepreneurs, and policymakers.

The Initiative is just getting started. The steering committee has had two meetings, at which we tentatively narrowed our work to three topics. First, we want to examine the public's understanding of scientific information and its trust in science. We see this as a two-way street: not only does the public need to have a deeper understanding of science and technology, but also scientists and engineers and researchers and scholars need to have a better understanding of the public and how to communicate with it more effectively. We also want to take a look at such issues as scientific integrity as well as the state and the future of the peer-review system.

Second, we want to look at science and engineering education, and how young men and women in this culture are making career choices and why. We start this project knowing that perhaps the most profound problems we face are in the K-12 system. But, for now, we want to concentrate our work on the upper end of the pipeline – undergraduates, graduate students, postdocs – with particular attention to the issues surrounding women, underrepresented minorities, and people from various levels of the socioeconomic spectrum. What makes careers in these areas attractive? What makes them unattractive, and what should we do about it?

The third area is science funding and regulation. Science, as I said earlier, is increasingly crossing national borders. Science itself has always been done this way, but now the pace of innovation – and the roles of academic and research institutions, the private sector, NGOs, and others – are

also changing in this global context. What do we need to think about to construct policy to recognize and work effectively with in this context? Are there different ways in which we should think about the balance between intellectual property and the scientific commons? Again, this balance is changing dramatically, especially in the life sciences. Finally, given all of this, how should we structure the funding of science and advanced scientific and engineering education in this country? In particular, what role should both the federal government and industry play?

We have put before ourselves a very rich set of questions. We will be calling on many members of the Academy to do the actual work. I look forward very much, as I know Neal does, to working with all of you and to the opportunity, not too far in the future, to report on some of the committee's findings.

Securing the Internet as Public Space

David Clark

Senior Research Scientist, Massachusetts Institute of Technology Computer Science and Artificial Intelligence Laboratory

In an Academy Induction talk three years ago, Tom Leighton, Professor of Applied Mathematics at MIT and Co-Founder and Chief Scientist at Akamai Technologies, suggested that we develop a study of Internet security. This topic is very much in the tradition of the spirited studies the Academy has done in the past, including projects on traditional security, international relations, and nuclear issues. The Internet may seem very different, but, in fact, it clearly draws on the research strengths of the Academy.

Do I need to persuade anybody that the Internet has a security problem? Spam is perhaps just a nuisance, but we also have phishing. Here, con artists attempt to steal sensitive information by sending emails that purport to come from a reputable organization. They say, "Please go to this website and type in your personal information again."

If phishing doesn't catch you, there are zombies. (At least computer scientists give our problems good names.) Zombies are creepy pieces of code that get onto your computer, allowing it to be bent to the will of an evil master. After the evil master has accumulated ten thousand or one hundred thousand zombies, what does he do with them? He rents them out by the hour. Why would someone bother to rent out a botnet (as a collection of zombies is called in this world) for an hour or two? A person could use it to send spam from your email address to everyone in your address book. Or he could take all ten thousand machines and launch them in a savage attack on a target site. By sending a lot of traffic simultaneously to the site, he can completely overwhelm it, preventing it from doing anything useful. Why would he do that? The answer is old-fashioned extortion. Take a porn site or a gambling site, for example – a business that may be socially uncomfortable. You could tell the operators of such a site to leave a bag containing \$10,000 on a street corner in exchange for not taking their site offline for a day. And you'll actually get paid. This is organized crime.

If I've convinced you that we have a problem, the next question is, why did the Internet turn out this way? You might look back to its roots and ask, why did it start like this? One obvious answer is that all of its designers were idiots. But putting

it less harshly, we could say that, in the beginning, they were really working on basic issues, and it was hard to imagine having to deal with zombies. After all, the people who worked on creating the internal combustion engine didn't think about air bags and crumple zones.

There's another, slightly deeper answer, which is that the Internet was designed for people who trusted each other. Since everybody trusted each other, we did not need lots of security mechanisms; we designed a system optimized for trust. How did we do that? We built a system free of constraints, where people could do what they wanted; we knew that if they were left on their own, they would make the right decisions.

To maximize security on the Internet, we do not need better technology or encryption. We need the perspectives of people who understand behavior: political scientists, sociologists, lawyers, economists, philosophers. That spectrum matches the breadth of Academy Fellows.

The Internet does not observe, examine, judge, filter, or modify the information you send. It just forwards it. This means you and I could invent a new application, turn it on, and let it communicate across the Internet – and that's great. But it also means the Internet very effectively and stupidly delivers every zombie and every virus – so maybe we didn't quite get that right in the beginning.

If you think about most of the social interactions we have on a regular basis, we often may not trust the person with whom we're interacting. What do you do under those circumstances? You turn to constraints that make the interaction safe enough to carry out. One obvious example of a constraint would be a trusted third party. Credit card companies represent a trusted third party. When you buy and sell a house, you don't just give someone a large bag of money and have them give you a piece of paper that purports to be a deed. You involve lawyers, title insurance companies, and registrars of deeds. This complicated and cumbersome structure gives us confidence when we carry out the transaction, even though we don't trust each other.

That current state of communication between people who don't trust each other is entirely different from the circumstances that defined the early stages of Internet security research. Early Internet security research was funded by the military and intelligence communities. They had a very simple model of the world: it was composed of "good guys" and "bad guys." Good guys want to communicate; bad guys want to steal classified information. We wanted to have open channels between trusted good guys. How do we let the people with the white hats communicate? Well, we have this technology where we can encrypt all the bits. The bad guys could maybe disrupt the Internet, but they couldn't see the bits and then steal them, or modify them.

That classic notion of security on the Internet divided the world into two groups of people: those you completely trusted and those you did not. When that idea was carried into the civilian world, though, it hit an interesting brick wall. Law enforcement agencies,

like the Department of Justice, FBI, and NSA, said, 'Wait a minute. I would like to be able to listen to what the bad guys are doing.' So they swapped labels and traded hats – the communicating parties are now the bad guys. How then did they proceed in this space? In the name of "national security," they tried to prevent people from using encryption. They made it at least difficult, and in some cases illegal. This stunned the people who designed Internet security in the first place, because good security had meant disclosure control (via encryption), and now there were people moving in the completely opposite direction.

There are several insights you can take away from this story. I started out by saying we need to improve Internet security, but we don't even have a definition of security. It's not better disclosure control. It's not perfect privacy. It's probably not the "best of" anything. In fact, when you look at the way the real world works, you know there's no such thing as perfect security. How do you decide whether or not a park is safe for children to play in? It's not because the park has perfect security. You assess the mix of risks and benefits and decide what to do. In fact, security, in the real world, is defined as the acceptable outcome of a tussle among parties with adverse interests. There are not just good guys and bad guys.

You have to think about Internet security in a space that matches real-world experience. Most of the time, you are in a space where you don't necessarily trust the people with whom you're working. But you believe there is an acceptable set of constraints that allows you to decide whether or not it's safe to go forward. In most of the real world, people don't have black hats and white hats. The Internet has to support

the paradigm that people wish to communicate but do not necessarily trust each other.

The last point I want to make is that third-party solutions are not purely technical solutions. Why do you trust the registrar of deeds? It's not because the registrar is operating in a system technically designed so that it can't screw up. It is because the registrar is embedded in a social space with very strong constraints on him to do the right thing. Why do you trust the lawyers? Why do you trust the credit card company? There are places where you wouldn't trust these people. Social constructs differ from place to place.

This brings us back to the question of why the Academy is a good place to do this kind of study. To maximize security on the Internet, we do not need better technology or encryption. We need the perspectives of people who understand behavior: political scientists, sociologists, lawyers, economists, philosophers. That spectrum matches the breadth of Academy Fellows. That's why the study is so much fun to do here. The goal of the study is to have a conversation about the technical and social building blocks of a secure Internet. I can now explain what I mean by a secure Internet. It is an Internet that is safe enough so that we're prepared to continue going there.

Every project should have a bumper sticker. Ours is simply: "Kill the Zombies."

Confronting Nuclear Peril

Steven Miller

Director, International Security Program, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University

It is my privilege to offer a few words about the work of the Committee on International Security Studies, a long-standing group of the Academy that convenes scholars from all over the country to work on various issues of national and international security.

Our work in this domain goes back more than half a century. In the late 1950s, the world was on the cusp of a new and (it was widely believed) much more perilous nuclear world. There had been innovations in the manufacture of nuclear weapons that made mass production of these weapons possible. Very quickly during the 1950s there was a dramatic upward spiral in the number of nuclear weapons in the arsenals of a few major nuclear weapons states, with the production of hundreds to thousands of weapons. This led to the nuclearization of almost all spheres of military activity. We had everything from nuclear backpacks to nuclear artillery shells to nuclear torpedoes – all the way up to long-range intercontinental delivery systems. Most importantly, in the late 1950s, we were on the edge of the missile age. In fact, one of the more famous works in the field of security studies is a book by Bernard Brodie called *Strategy in the Missile Age*. Missiles were just another way of delivering weapons that already existed, but they had one very powerful implication: they greatly reduced the timeline associated with a nuclear crisis or confrontation.

Suddenly among the more fateful decisions ever to be made by humankind were those that had to be made within a ten or twelve-minute time frame. This led to various schemes to buttress deterrence by creating reprisal opportunities, such as hair-trigger alert postures and launch on warning doctrines. Of course, all of this occurred in the context of missile systems that were not only quick but also unrecalable. If you made a mistake, it was truly an irrevocable mistake. The arrival of the missile age compounded the portentous dangers associated with nuclear weapons.

What the Committee on International Security Studies is aiming to do is to assess comprehensively the global nuclear order. Where are we? What path are we on? What does it mean if the present restraint structure seems to be eroding just at the moment when we are faced with one nuclear crisis after another?

In the late 1950s, we were also in the early but vigorous pursuit of ballistic missile defense. Analysts very quickly realized the tremendous potential for an offense-defense arms race, where we could see a prodigious escalation in the arsenals of the competing sides. The obvious answer to missile defense was the expansion of offensive forces that would neutralize and overwhelm the opponent's defensive capabilities.

In short, the late 1950s was a perilous moment and a time when we were struggling to create frameworks for managing what Albert Einstein and Bertrand

Russell called in their famous manifesto of 1955 “a species threatening technology.” It was in this context that the Academy sponsored, over a several-year period, the body of work that turned out to be absolutely formative in creating the notion of arms control and validating it as a useful and feasible instrument of national policy. These studies led to the creation of what you might call governance mechanisms: negotiated restraint on the pursuit and deployment of nuclear weapons. Several decades of subsequent arms control policy found its conceptual and intellectual grounding in this path-breaking work. In a substantially unprecedented way, arms control came to play a major role in shaping the nuclear competition between the Soviet Union and the United States and in constructing the international non-proliferation regime.

The Academy's work on national security affairs and broad issues in international security continued in the decades to come. During the 1970s the Academy continued to carry out important work on strategic arms control. In the 1980s, it undertook a very influential study of missile defense and the concept of President Reagan's Star Wars initiative, among other things. In the 1990s, under the direction of Carl Kaysen and others, there was thoughtful work on sovereignty and intervention, especially as we worried about Rwanda, Somalia, and Bosnia and the circumstances under which we could apply military power legitimately and effectively for humanitarian purposes. We've had a whole slate of recent work on the militarization of states, on the security implications of biotechnology, and on the implications of the collapse of the Soviet Union and the struggle to impose order on the post-Soviet states – a project led by Robert Legvold. A few of us at

the Academy, including Martin Malin, did some work in the advance of the Iraq War, trying to assess the possible costs and risks of that unhappy intervention.

The specific project for which I now have some responsibility examines the global nuclear order. It is rooted in the premise that as in the late 1950s, we are presently at a moment of transition. There are numerous indications that cause foreboding about the health and effectiveness of the global nuclear order. As we sit here today, we're on the edge of an expected North Korean nuclear test. The UN Security Council has missed the boat on sanctions for Iran in reaction to its protracted noncompliance with the safeguard obligation under the IAEA. We are currently bogged down in the horrible mess in Iraq, a mess that was motivated primarily by the fear that Iraq was going to gain weapons of mass destruction, above all nuclear weapons, and that it might be harboring terrorists. The nuclear order that we face today is one of uncertainty and it's also one with new agenda items.

Further, while the world is full of invocations of 9/11, there is another interesting date – 10/11, October 11, 2001, when an intelligence agent named Dragon Fire reported that Al Qaeda had nuclear weapons and had smuggled one into the United States, supposedly in New York City. On October 11 this possibility was reported to President Bush. The question was whether this report was plausible. The answer was yes. Was it conceivable that Al Qaeda could get its hands on a nuclear weapon? The answer was yes. Was it plausible that Al Qaeda could actually detonate a nuclear weapon? The answer was yes. Was there any way that you could say to the president that this was a wholly dismissible claim? The answer was no.

In fact, the U.S. government went through some scary weeks before it became apparent that this was a false report. The seriousness with which it took the claim is evidenced by the fact that Vice President Cheney spent many weeks hiding in an undisclosed location, subjected to the ridicule of late-night television comedians, but in fact behaving in a manner that reflected the seriousness with which the U.S. government took the threat of nuclear terrorism. We did not take nuclear terrorism seriously during the Cold War. We never imagined it would be a problem when the Cold War ended.

In sum, new nuclear problems have arisen, old solutions (including arms control) have faded or (at least occasionally) failed, and the global nuclear order built up over several decades of the Cold War, which proved to be so durable and effective in that era, is now eroded and its effectiveness and relevance is in doubt. What the Committee on International Security Studies is aiming to do is to assess comprehensively the global nuclear order. Where are we? What path are we on? What does it mean if the present restraint structure seems to be eroding just at the moment when we are faced with one nuclear crisis after another? If the answers of the past half century are no longer effective or sufficient, what should be done now? What is the future role of negotiated restraint? What is going to be the relationship of nuclear power and nuclear weapons in a greenhouse gas-restrained world? If we're going to live in a world that is populated by more nuclear arms states, how do we manage that world in a safe fashion? If we are on a path that is heading in an unfortunate and unattractive direction, what alternative exists that is better and how do we achieve it? As in the late 1950s, we are on the cusp of a new and

more perilous era. And as was the case in the late 1950s, the Committee on International Security Studies hopes to contribute work that will help safely navigate the dangers of this new era.

Academic Freedom

Robert C. Post

*David Boies Professor of Law,
Yale Law School*

We have come a long way since 1918 when Nicholas Murray Butler, the president of Columbia University, issued a "last and only warning to any among us . . . who are not with whole heart and mind and strength committed to fight with us to make the world safe for democracy." Butler's harassment of antiwar faculty famously caused Charles Beard to resign from Columbia in disgust.

Although that kind of crude threat to academic freedom may not now be a problem for many of us, my suggestion today is that academic freedom is very much at risk in the contemporary United States.

I do not refer to such issues as the surveillance of email, the monitoring of library use, the wiretapping of phones, or the ever-growing restrictions on contacts with our foreign colleagues. Nor am I referring to how the greatly increased need for funding has led the modern research university to privatize knowledge and to outsource funding to corporations that threaten to co-opt the use and distribution of knowledge in ways that are inconsistent with academic freedom.

I refer instead to the fact that for the first time in a long time the modern American university is now the object of sustained and coordinated ideological attack.

Those of you who are scientists know well enough the explosive controversies that surround issues like evolution, stem cell research, or cosmology. But this morning I shall talk about a different kind of assault. I shall discuss the growing movement to condemn the American university as an illegitimate bastion of "liberalism."

At the cutting edge of this movement is something called the "Academic Bill of Rights" (ABR), which rests on the plainly correct premise that university scholars should be judged on the merit of their work rather than on their political views. The ABR uses this premise to reach toward a conclusion that is truly disturbing. Noting that in many university departments, most particularly in departments that concern the humanities and the soft social sciences, registered Democrats far outnumber registered Republicans, proponents of the ABR conclude that universities have discriminated against conservatives, and they demand as a remedy that universities take account of "intellectual diversity" in their employment decisions. In this way, intellectual diversity has become a fighting slogan for those who advocate that universities judge scholars based upon their political affiliation rather than upon the professional merit of their work.

The effort to impose "intellectual diversity" has become part of the legislative agenda of many organized groups. It has been proposed to state legislatures throughout the country. In 2003, it was included in the proposed International Studies in Higher Education Act as a criterion for the distribution of federal Title VI funds to foreign language and area study centers, and this proposed bill passed the House of Representatives in a nearly unanimous vote.

In this context, several Fellows of the American Academy thought the time had come to intervene and to attempt to defuse this assault on basic values of academic freedom. We came to the Academy because it could stand as an honest broker; the Academy has no ideological agenda. It has no disciplinary or ideological bias. Besides myself, our project committee includes Robert Berdahl, former chancellor of UC Berkeley, now president of the Ameri-

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can Association of Universities; Nancy Cantor, chancellor of Syracuse University and chair of the American Council on Education; Jonathan Cole, former provost at Columbia; and Geoffrey Stone, former provost at Chicago.

Our plan is to develop a succinct statement on the relationship between intellectual diversity and a proper understanding of academic freedom. We hope to work with the nation's leading higher education organizations, professional associations, and

learned societies to promote the dissemination and endorsement of this statement. Our aspiration is to offer a compelling account of academic freedom that will defuse the current controversy threatening to compromise professional academic independence, which for so long has proved a mainstay of higher education in the United States.

Universal Basic and Secondary Education

Joel E. Cohen

Abby Rockefeller Mauzé Professor of Populations, Rockefeller University; Professor of Populations, Columbia University

In 1930, there were two billion people on the planet; in 1999, there were six billion people. The twentieth century was the only century in human history to experience a tripling of the human population. What can we anticipate in the next half century?

Today, the population numbers 6.6 billion. If current fertility rates persist without decline, we will be at 11.7 billion by 2050, a near doubling. Since roughly 1960, however, worldwide annual growth rates have dropped by half, from 2.1 percent per year to 1.1 percent per year. It's reasonable to anticipate a moderate and continuing decline in levels of fertility. If that happens, the United Nations projects a population of about 9.1 billion people in 2050. That number is extremely sensitive to what happens between now and then, and particularly to what we do today and tomorrow to educate people and provide them with reproductive health care.

By 2050, we can reliably anticipate four major changes. One, a

much bigger population: whether it's two billion or four billion more people, we don't really know. All of that growth will be in poor countries. Two, we anticipate that the population will be growing more slowly, and it's possible that worldwide population growth will end. Three, the population will be much older than any human population before. For example, in the year 2000, for the first time in human history, the number of people sixty years and older exceeded the number of people between the ages of zero and four. By 2050, we anticipate that there will be three and a half times as many people sixty and older as between zero and four. A minority of grandparent-aged people will have grandchildren. Four, the world will be more urban. From 2007 on, there will be more people living in cities than in the countryside. All of the billions more people that we'll add by 2050 will be living in the cities of the poor countries. It will be a world different from the one we grew up in.

I did a survey of the kinds of panaceas people have proposed for dealing with the problems associated with widespread poverty, environmental impact, political and cultural conflicts, and rapid population growth. Panaceas come in three varieties: a bigger pie, fewer forks, and better manners. A better pie means let's increase productive capacity. Let's use technology to make more of what we want and reduce the unwanted effects of our affluence. The fewer forks proposal says let's slow population growth, and let's moderate or eliminate irrational consumption. The better manners school says let's reduce violence as a means of solving our differences. Let's eliminate corruption in governance. Let's reduce inequities between rich and poor, young and old, male and female. Let's

If we do not educate all of the world's children well, with the skills required to master information, we prevent them from participating at the leading edge of the world's economy. And if we do not educate all children well, with the values required to solve the problems of poverty, the environment, conflict, and rapid population growth, those problems will still be with our children after we are gone.

have more efficient markets globally and locally.

The idea occurred to me that educating all children well for ten to twelve years could support all three of these approaches, depending on the values instilled by such education. It could increase global capacity to produce and use technology. It could facilitate lower fertility. It could increase demand and competence for better governance. This idea became, with the visionary leadership of Leslie Berlowitz, the basis of the Academy's program on universal basic and secondary education. I've been fortunate to lead this program since 1998 with David Bloom, an Academy Fellow at the Harvard School of Public Health.

Reports of this project are now available on the Academy's website. A book on *Educating All Children: A Global Agenda* will be published in January 2007 by MIT Press, and we published an essay on this project as the lead article (June 2005) in the journal *Finance & Development*, which is distributed by the International Monetary Fund. That was the

first issue the IMF ever devoted to education, and it was a privilege to write the lead essay for them. We also published a lead article on the goals of universal basic and secondary education in the September 2006 issue of *Prospects*, UNESCO's review of comparative education.

We have a modest goal. We want to understand what the world would be like if all children had ten to twelve years of high-quality education, and what it would take to achieve such a world by 2050 or sooner.

One of the obstacles is the belief that we can't afford to provide a high-quality education to all children. We disagree, although it's difficult, for several reasons, to find out how much it would cost. First, the cost per child who is not now in school probably differs from the cost per child already in school. The children not in school live in more remote areas; they are poorer; they are often a minority; they may be handicapped. Second, access to schooling at the present level of quality, which is poor overall, may not entice parents to send their children to school in developing countries. We don't know how much more it would cost to get the quality improvements we need to make schooling attractive. Third, the Western model of the school, with a teacher in a building, is very expensive. It may not be the model that the developing world can afford or will want to use. With technological change, it may not even be the best way to deliver education. For all these reasons, costs of universal education are uncertain.

My colleagues, the economists who participated in this study, did some pioneering work. They estimated that universal basic and secondary education for developing countries would cost somewhere between \$34 billion

and \$69 billion more per year than these countries are presently spending on primary and secondary education.

But money is not the only problem. First, we lack good data about the situation. We guess that 100 – 115 million children are not in primary school, while hundreds of millions more are not in secondary school. It is a partially informed guess, but nevertheless a guess. Then there are *economic disincentives*. Families value more the time their children spend working and earning an income or handling chores than the time children spend in school. There are *competing demands*. Education competes for scarce national resources with building roads, providing medical care, strengthening national defense. There are *political obstacles*. When there's a civil war, school is the last thing that people think about. Some leaders may not want all their children educated. There are *cultural barriers*. Discrimination may inhibit educational participation for girls and ethnic minorities. And there's the *historical context*. Different countries have different histories, and it may well be that the needs for education systems differ. One size does not fit all in education.

Looking forward, at the current rate of progress, roughly one in six children at the primary school level will still not be enrolled by 2015. That's the year when the Millennium Development Goals promised that all children would be in primary school. Thirty percent of secondary-school-aged children are still not enrolled in school. Yet the participants in the Academy's UBASE project believe that universal, high-quality primary and secondary education is achievable by 2050.

We'll need many changes. One is open discussion of the goals of education. What do we want edu-

cation to achieve? We need improved effectiveness and economic efficiency in education. Right now, it's a costly and ineffective process. We need a commitment to high-quality secondary education. We need international recognition that different kinds of education systems are appropriate. And finally, we need more money – which will follow from giving a higher priority to education.

Let me step back and propose a bigger picture. In the nineteenth century, the countries that mastered the chemistry and physics of the day and put materials to work by means of the Industrial Revolution had the economies at the leading edge of the world's economy. In the twentieth century, the countries that were at the leading edge of the world's economy mastered energy, principally from the fossil fuels of oil, coal, and natural gas, and put that energy to work driving their economies. We're now living with the consequences and problems of those achievements of the nineteenth and twentieth centuries. In the twenty-first century, I submit, the countries that will be at the leading edge of the world's economy are those whose people best master information and put that mastery to work in their economies.

If we do not educate all of the world's children well, with the skills required to master information, we prevent them from participating at the leading edge of the world's economy. And if we do not educate all children well, with the values required to solve the problems of poverty, the environment, conflict, and rapid population growth, those problems will still be with our children after we are gone. This applies to America's children and to children around the world.

Humanities Initiative

Norman M. Bradburn

Tiffany and Margaret Blake Distinguished Service Professor Emeritus, University of Chicago

In 1997, the American Academy of Arts and Sciences began work on an Indicators Project in the humanities. Its purpose is to establish a framework for the compilation, analysis, and publication of comprehensive trend data about the humanities that will serve researchers, policymakers, universities, foundations, museums, libraries, humanities councils, and other public humanities institutions. Better statistical tools will provide answers for basic questions about undergraduate and graduate degrees in the humanities, employment of humanities graduates, levels of program funding, public understanding and impact of the humanities, and other areas of concern within the humanities community. The project is supported by a generous grant from the Andrew W. Mellon Foundation.

The Humanities Indicators Project is modeled on the *Science and Engineering Indicators* produced biennially by the National Science Foundation under the auspices of the National Science Board. Although the National Endowment for the Humanities has had authorization since 1985 to support the production of similar data and indicators for the humanities, the agency's leadership has not felt financially able to launch such an undertaking, and Congress has not appropriated specified funding for such an effort.

What do we mean by the phrase "humanities indicators"? *Indicators* are descriptive statistics that chart trends in an area of interest. They describe; they do not explain. If done well, they

can provide a common starting ground for arguments about the nature or rate of change in, for example, funding or employment. They answer "what" questions, not "why" questions. They can be somewhat like the Delphic oracle. Their interpretation is not always straightforward. They may mean different things to different observers.

We are currently organizing the Indicators around four large themes: 1) education in the humanities; 2) research and funding for the humanities; 3) the

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humanities workforce; and 4) the humanities in American life. There will be several subdivisions within each of those large categories, such as primary and secondary education; postsecondary education; graduate education and the scholarly pipeline; public and private funding; careers in humanities professions, particularly the fate of Ph.D.s in the humanities; public participation in the humanities; and the status of libraries and museums. We would like to have at least four indicators within each category that cover different aspects of the topic; although at present we think that we can do

better than that. We are restricting ourselves to existing data from reliable sources. While we would like to disaggregate data both geographically and by discipline, it may be impossible to do so for many indicators. At a minimum, we will present national data and data, where appropriate, that contrast the humanities with other broad fields of scholarship. We are not commissioning any new data collection, although we are working with some groups to assemble existing data in new ways.

For some indicators there may be no available data that meet our quality standards. One of the tasks of the Indicators Project will be to call attention to areas where there are little or no data with the hope that some agency will find it important to gather such data.

Our goal is to have a prototype set of indicators by spring 2007 and to circulate them widely for comment. Because the meaning of the term “indicators” may be ambiguous, we will commission a series of essays for each of the main themes. Some of the essays will describe the apparent trends in the data and explain the data’s limitations. Other essays will be more interpretive in nature and give the authors’ views about what the data mean for the status and future of the humanities.

At a series of conferences to discuss the essays and critique the Indicators, we hope to get constructive feedback for revision of the Indicators. Our final goal is to produce a first edition of the Indicators in several forms – hardcopy, CD, and on the web – by the spring of 2008. The creation of a website in the near future will enable us to post progress reports and perhaps try out some ideas about possible indicators, as well as provide an opportunity for a wider audience to suggest new indicators.

The project will undoubtedly generate a lot of interest and possibly a lot of controversy. For example, I am sure there will be disagreement about the meaning of various indicators. Our aspiration is to provide a solid base of data that everyone will argue from, whether it is a glass that is half full, half empty, or has a hole in the bottom with the lifeblood draining out rapidly.

Patricia Meyer Spacks

Edgar F. Shannon Professor of English Emerita, University of Virginia

The Indicators Project, with the splendid guidance of Norman Bradburn, and the Template Project, expertly led by John Hammer, compose two important parts of the Humanities Initiative, one of the Academy’s long series of undertakings in the humanities. The Initiative, however, pursues other enterprises as well. Its long-term purpose is to make the importance, meaning, and history of the humanities more widely comprehensible. The statistical information provided by the indicators offers one way of demonstrating the place of the humanities; various kinds of discursive prose supply others. Last year, we published two collections of essays on the recent history of humanistic academic disciplines. One, edited by David Hollinger, was issued by the Johns Hopkins University Press with the title, *The Humanities and the Dynamics of Inclusion since World War II*. The title pretty much says it: the essays concern the effects on humanistic disciplines of the new forms of diversity that developed in American colleges and universities in the twentieth century. The other collection, which I edited, was published as the Spring 2006 issue of *Dædalus*. It took a longer perspective on the histories of seven disciplines in the human-

We have two projects in view. One entails convening a group of college and university presidents and provosts to discuss the actual current situation of the humanities in higher education. . . . The second undertaking would begin with a symposium, one that included scholars and critics of the arts, practitioners, and museum curators and administrators. . . . Eventually, there would be a book of essays, one that articulated the tensions between preservation and innovation, and between those who make art and those who discuss it.

ities, enunciating general principles of those academic pursuits.

We expect, in the long run, to publish several more collections of essays, expanding to an international perspective and considering various institutions that support the humanities. How have changes in libraries and museums reflected changes in the understanding of humanities? What about funding sources? Have they increased or diminished? Have they altered their priorities for support? How have changes in funding affected projects pursued? What do the humanities look like in Europe, in Asia? Such questions have received little attention in recent years; even speculative answers to them would further a fruitful discussion.

More immediately, we have two projects in view. One, for which we’ve already secured funding, entails convening a group of college and university presidents and provosts to discuss the actual current situation of the humanities in higher education. If you read the *Dædalus* issue I mentioned, you will discover, from an essay by Steven Marcus, that the humanities originally filled a quasi-religious function in American institutions of higher learning, exemplifying the good, the true, and the beautiful; inculcating morality; and insisting on the students’ attention to what the poet William Butler Yeats called “monuments of unaging intellect.” Their purposes now, one suspects, are not quite the same. At any rate, those purposes are not articulated in the same way. It would be illuminating to know what the people who run universities see as the role of humanities in their institutions, what trends they perceive, and what they anticipate. A collection of essays that will ultimately emerge from the discussion should provide valuable perspective.

The second undertaking is at an earlier stage of development. It, too, would begin with a symposium, one that included scholars and critics of the arts, practitioners, and museum curators and administrators. The humanities, among other things, deal with artistic production of all kinds, particularly through such disciplines as literature, art history, and music history. This symposium would raise the question of the critic’s responsibility to the present as well as to the past. The function of the humanities most widely understood is probably that of preserving and transmitting understanding of past art to the present. But scholars and critics must also engage in what is happening now. Dialogue between practitioners and critics rarely occurs; the proposed sym-

posium would provide an opportunity for it. Eventually, there would be yet another book of essays, one that articulated the tensions between preservation and innovation, and between those who make art and those who discuss it.

Both the volumes that have already appeared and those projected express controversy. The aim of the Humanities Initiative is not to provide answers for our questions about the humanities, but to help provide terms for discussion as well as facts to support the discussions. Controversy is part of the point.

There's one more project that's barely a gleam in our collective eye, something we've just started thinking about in tentative terms. An interest in the humanities implies interest in writing as a human activity. Writing, of course, is a means of communication, and academic prose often, notoriously, fails to communicate beyond a specialist audience. We've been pondering the possibility of initiating a writing workshop for academics, to be led by a professional editor, in which participants from diverse disciplines could talk together about their writing and, ideally, develop some new procedures for reaching broader audiences on occasion. Exactly how participants would be selected, how long the workshop would last, whether shifting populations for it would be possible, as is the case with many writing workshops – such questions remain to be worked out. If it happens, it will be an important new kind of experiment for us.

Of course new experiments take place all the time at the Academy. I hope many of you will want to take part in them.

Media and Democracy

Boyce Rensberger

Director, Knight Science Journalism Fellowships, Massachusetts Institute of Technology

In a democracy, the people are supposed to rule. But they can't be good rulers without access to good information and some skill and understanding in how to think about and analyze that information. In a rapidly changing democracy, shared new sources of information come from the news media. The American Academy is interested in evaluating how well the news media – newspapers, magazines, broadcast media, and the web media – inform the people. It is also interested in helping the media do a better job in covering changes in society. The Media and Democracy project was started just last year with funding from the Annenberg Foundation. It is an effort to understand how journalists influence public understanding and policymaking. We want to identify the strengths and weaknesses in the process, and to see if there is some way we can help make the media function better, so that the rulers, both the people and their governments, rule wisely.

This project is working on separate tracks in two different spheres: one is on science and technology, the other is on business and the economy. Each has its own committee. The business and the economy committee includes business leaders, economists, business journalists, and academics. One early product of that committee is a symposium on the future of news, to be held in New York City in early December. [The event took place on December 7, 2006.] Norman Pearl-

The American Academy is interested in evaluating how well the news media – newspapers, magazines, broadcast media, and the web media – inform the people. It is also interested in helping the media do a better job in covering changes in society. . . . It is an effort to understand how journalists influence public understanding and policymaking.

stine, the former editor-in-chief of Time Inc., is heading that initiative.

The science and technology committee – of which I am a member – includes scientists, science journalists, and academics. It is cochaired by Donald Kennedy, former President of Stanford University and the current editor of *Science*, and by Geneva Overholser, former editor of the *Des Moines Register* and now a professor at the University of Missouri School of Journalism. Our group is concerned that the American public is weak in its understanding of science, science facts, and scientific ways of thinking. This is an acute problem when you look at the increasing rate at which science and technology are penetrating our lives. We think, not surprisingly, that the public ought to have a better grasp of scientific processes, especially in a democracy where they have to vote on issues that often have scientific dimensions and vote for candidates who take positions on these issues. You only have to think about some current examples to realize how important this is. Should the government fund embryonic stem cell research? Should we restrict the

emissions of carbon dioxide? Should we teach evolutionary biology as science?

In a capitalist democracy, people need an understanding of science and technology if they are going to make sensible decisions in the marketplace, including, just to take one example, the market for health-care services and products. The drug industry is becoming ever more sophisticated in marketing new drugs to a public that has very little capacity to evaluate clinical trials and the nature of evidence as it pertains to the advertising claims for these drugs. We want the nation's science and medical reporters to get more sophisticated about these questions. The role of a journalist is important. I used to be a journalist, and I like to think I had some influence on my readers, in addition to entertaining them for a few minutes. For many people, their science education stops when they leave school, even though science keeps changing. The only way we can help people keep up is through the mass media, and that's a challenge when almost all the news organizations are cutting their staffs and budgets – not because they're losing money but because they want to keep profits extremely high.

Our committee is looking for ways to improve that situation, and we are working on several projects. One is to develop a mechanism that would consider each of the controversial or important scientific issues of the day. A group of experts would distill the evidence into some kind of "state-of-the-science" report that would provide an informational platform for national discourse on those issues. We would not take a position; we simply want to evaluate which sorts of evidence would apply. Some kinds of science should be more convincing than others. We also want to work to improve

the training of scientists because scientists need to be more knowledgeable about the public. We want scientists to get out of their labs and engage with the public, in small communities to the national stage. This means fighting one of the major cultures of academia, which very strongly discourages scientists from doing that kind of thing.

These two groups that I mentioned have proceeded on separate tracks, but there is one area where they come together, and that's the impact of technology on the way people get their news and the way journalists gather the news and deliver it to the public. We think these changes are going to have profound effects, altering the news business and how well the people are able to govern themselves.

We know that profound changes are taking place in newsrooms all across the country. It is exciting to be involved in this project.

Congress and the Court

Linda Greenhouse

Supreme Court correspondent, The New York Times

As some of you know, meetings at the Academy often include a musical interlude, but we've been so action packed with our verbal presentations today that we have not had any music. So, for three minutes, I'm going to interject a little musical interlude as an introduction to my brief discussion about the Academy's interest in the future of the judiciary.

[Editor's note: *At this point, the audience hears a recorded song parody in which "federal judges" proclaim, "I'm always right" and "think of me as royalty." The song is followed by audience laughter and applause.*]

Of course, we're all very amused by that, but it's a cultural artifact with some significance because we do have judges who are depicted as arrogant, unaccountable, and, as the song says, "appointed forever." There are a growing number of attacks on the judiciary, and the fact that this song is out there on the Internet (from which a law student downloaded it for me) underscores that this is an issue we need to address.

The Academy's current interest in the judicial process is an outgrowth of a project that we started a few years ago called "Congress and the Court." The project responded to the fact that the Supreme Court, in a series of cases, had started constraining the power of Congress in a way that had not been seen since the days of the New Deal. The project facilitated several conversations between members of the Supreme Court and members of Congress. With that era of Supreme Court decisions now in abeyance, the project has evolved to reflect what retired Justice Sandra Day O'Connor said in late September in the *Wall Street Journal*: "The breadth and intensity of rage currently being leveled at the judiciary may be unmatched in American history." This anger is not new, but in her perception and the perception of a number of people, it is unmatched. Justice O'Connor herself recently cochaired a conference at the Georgetown University Law Center on what she called "Fair and Independent Courts."

What the Academy is trying to do, at this early transitional stage of our project, is to stimulate some fruitful conversations about the state of the judiciary. Let me point to just one example of how judicial independence can be compromised. A recent story in the *New York Times* tied political campaign contributions made to members of the Ohio Supreme Court to the way its judges voted.

What we are trying to do, at this early transitional stage of our project, is to stimulate some fruitful conversations about the state of the judiciary. . . . We hope that the Academy's sustained interest in the independence of the judiciary will lead to new insights into the judicial process and greater opportunities to educate the public on this important issue.

This revelation was a reminder that the issue of judicial independence goes beyond the federal judiciary to the state courts, where 90 percent or more of the litigation in this country takes place.

In April 2007, I will chair a panel on this topic at a joint meeting of the American Academy and the American Philosophical Society in Washington, D.C. We are honored that Justice O'Connor will be one of the participants, along with Judith Kaye, Chief Judge of the New York State Court of Appeals.

Unlike many institutions that have taken an interest in the vulnerability of the judicial system, the Academy has the advantage of being a neutral arbiter with a broad-based fellowship. Lawyers are a tiny minority of the Academy's members, but all of us are stakeholders in the fairness and independence of our judicial system.

We have just heard Boyce Rensberger speak about the public misunderstanding of science. I would like to add that civics education is no longer part of many public-school curricula. An Annenberg survey, commissioned

specifically for Justice O'Connor's conference, revealed a shocking amount of ignorance about the basic structures of our government in general and of the judiciary in particular. For instance, only a bare majority of the American public thought that the President had to obey a constitutional ruling of the Supreme Court. We hope that the Academy's sustained interest in the independence of the judiciary will lead to new insights into the judicial process and greater opportunities to educate the public on this important issue. ■

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