Bulletin

Winter 2003
Vol. LVI, No. 2

AMERICAN ACADEMY
OF ARTS & SCIENCES

Annual Fund Seeks to Top $1 Million Again

The Academy's 2002–2003 Annual Fund is nearing its closing date of March 31. Development Committee Cochairs Robert Alberty and Louis Cabot look forward, with the help of generous Fellows and friends, to surpassing the $1 million mark again for another record-setting total this year.

If you have already made a gift to the Annual Fund, we are grateful; if not, we urge you to participate by March 31. The Annual Fund helps to support the planning stages of the Academy's projects and studies, its publications and website, and its meetings and other activities across the country. Every gift counts toward reaching our ambitious goals. Please be as generous as you can.

For assistance in making a gift to the Academy, please contact the Development Office (e-mail: dev@amacad.org; phone: 617–576–5057).

THE BULLETIN OF THE AMERICAN ACADEMY OF ARTS AND SCIENCES (ISSN 0002–712X) is published quarterly. *Periodicals rate postage paid at Boston, Massachusetts, and additional mailing offices. Postmaster: Send address changes to the BULLETIN, American Academy of Arts and Sciences, 136 Irving Street, Cambridge MA 02138.*

CALENDAR OF EVENTS

All members of the Academy are cordially invited to participate in any listed event, as space allows. Special notices are sent to Fellows who reside in areas where specific meetings are held. This feature of the *Bulletin* informs all members of upcoming events, not only in their own regions but also in locations they may plan to visit. A list of forthcoming events appears on the back cover.

Wednesday, March 12, 2003

1868th Stated Meeting—Cambridge

"A Tribute to Herman Feshbach and Victor Weisskopf" by **Carl Kaysen,** MIT

Communication: "Nuclear Terror: Ambling Toward Apocalypse"

Speaker: **Steven Weinberg,** University of Texas, Austin

At the March Stated Meeting in Cambridge, the Academy will honor two of its past presidents: Herman Feshbach (1982–86) and Victor Weisskopf (1976–79). The tribute will be presented by Carl Kaysen, David W. Skinner Professor of Political Economy Emeritus at MIT.

Throughout their careers, both Herman and Viki worked to control the spread of nuclear arms, to foster East-West cooperation, and to champion scientific freedom around the world. They brought their deep concern with these issues to the Academy's studies on international security and to its efforts to advance productive nongovernmental exchange with the Soviet Union and Eastern Europe.

The speaker on this special occasion will be Steven Weinberg, professor of physics and astronomy at the University of Texas, Austin. Weinberg is founder and director of the Theory Research Group at Texas, where he holds the Josey Regental Chair of Science. His research has spanned a broad range of topics in quantum field theory, elementary particle physics, and cosmology.

Weinberg has received numerous awards, including the 1979 Nobel Prize in Physics, the National Medal of Science, and the Cresson Medal of the Franklin Institute. In addition to his well-know treatise *Gravitation and Cosmology*, he has written several books for the general reader, including *The First Three Minutes* (translated into twenty-two languages) and, most recently, *Facing Up: Science and Its Cultural Adversaries,* in which he considers the culture, philosophy, history, and politics of science. He is also a contributor to the *New York Review of Books.* Weinberg has been a Fellow of the Academy since 1968.

The evening will begin with a reception at 5:30 p.m., followed by the program at 6:15.

For reservations, contact Sheri Bugbee (phone: 617–576–5032; e-mail: sbugbee@amacad.org).

Thursday, April 10, 2003

Joint Meeting of the Academy and the Boston Athenaeum

Location: Boston Athenaeum

Communication: "How to Read a Diary"

Speaker: **Patricia Meyer Spacks,** University of Virginia

On April 10 the President of the Academy, Patricia Meyer Spacks, will address the second annual joint meeting of the Academy and the Boston Athenaeum. The topic of her talk is "How to Read a Diary."

As Spacks explains, "It's not hard to understand why people enjoy reading diaries of the famous: in order to get an inside glimpse of exceptional lives. Nor is it difficult to know why Boswell's *London Journal* was a best-seller: good stories, bawdy bits. Pepys provides similar appeal; Virginia Woolf's diaries supply mini-essays on the literary life; one can multiply examples. But what is the attraction of diaries that offer only records of uneventful and undistinguished lives? Two such diaries, kept over long spans of time by eighteenth-century writers unknown except for their daily accounts, provide

test cases for assessing the interest of what might be called 'hidden narratives.' The writers, an American Quaker woman living in Philadelphia and an English country clergyman, both lived through the years of the American War for Independence, although neither makes that war a primary subject for reflection. Investigation of these diaries reveals techniques for analyzing and appreciating the superficially unappealing and demonstrates the rewards of analysis."

The Edgar F. Shannon Professor of English at the University of Virginia, Spacks is an authority on eighteenth-century English literature. She has written on the poets and novelists of the time in such books as *The Poetry of Vision* and *Desire and Truth.* She has also authored books and essays on cultural as well as literary subjects, including adolescence, boredom, gossip, and women writers from the eighteenth century to the present. Her new book, *Privacy: Concealing the Eighteenth-Century Self,* will be published this spring by the University of Chicago Press. Spacks is chair of the board of directors of the American Council of Learned Societies and a trustee of the National Humanities Center.

The program will begin at 6 p.m. at the Boston Athenaeum, 10½ Beacon Street, Boston. Seating is limited.

For reservations, contact Sheri Bugbee (phone: 617–576–5032; e-mail: sbugbee@amacad.org).

Occasional Paper on the Costs of War in Iraq

A new Occasional Paper—***War with Iraq: Costs, Consequences, and Alternatives***—has been published under the auspices of the Academy's **Committee on International Security Studies** (CISS). An Associated Press story on the paper was carried by over fifty media outlets, including the three major US television networks, as well as newspapers in the United States, England, India, and Russia. *War with Iraq* has been downloaded over 100,000 times from the Academy's website.

William D. Nordhaus (Yale University) estimates the costs of war with Iraq in scenarios that are both favorable and unfavorable to the United States. He projects that the war could cost $99 billion over the next decade in the best case, or in excess of $1.9 trillion during the same period in less favorable circumstances. The latter figure is nearly ten times the comparable worst-case estimate offered by the Bush administration.

Analyzing the few publicly available studies of the cost of a potential war with Iraq, Nordhaus finds that they have largely ignored a number of postwar factors, including:

- Prolonged occupation and peacekeeping, which could cost between $75 and $500 billion;
- Iraq's reconstruction, potentially requiring about $105 billion in funds;
- Humanitarian assistance, with a price tag of $10 billion at minimum; and
- A macroeconomic impact over the next decade that could result in a gain of $17 billion in the best case, or a loss of nearly $400 billion if the war causes a disruption of oil markets and a resulting recession (as have previous Middle East wars).

"The economic ripples of a war with Iraq are likely to spread beyond the direct budgetary costs, with the prospect of raising the cost of imported petro-

leum, slowing productivity growth, and possibly triggering a recession," writes Nordhaus. "The dangers of tipping into recession are real," he contends, "particularly given that the US economy was growing very slowly in the fall of 2002."

Steven E. Miller (Harvard University) challenges claims that war with Iraq will be cheap, beneficial, and hard to avoid. He examines these assertions in light of a number of potentially disastrous outcomes of a war with Iraq, all of which could realistically occur but have received scant public attention. Miller considers how Iraq's use of weapons of mass destruction, its disruption of the flow of oil, its drawing the United States into urban combat in Baghdad, or its attacking Israel (among other outcomes) would affect the American war effort.

Miller also examines the impact that a conflict with Iraq might exert on the administration's war on terror, as well as its longer-term effect on the United States's position as a global superpower. He concludes that although the administration's case for war against Iraq is attractive, it is also a gamble with enormous stakes and a significant risk of adverse consequences.

Carl Kaysen (Massachusetts Institute of Technology), **John D. Steinbruner** (University of Maryland), and **Martin B. Malin** (Academy) examine the broader national security strategy behind the move toward a preventive war against Iraq. They find that the new strategy differs sharply from a long tradition in American foreign policy, particularly in its neglect of the utility of international law and institutions for achieving the United States's principal aims. They suggest that the strategy's reliance on US military force, maintained at a standard that aspires to be "beyond challenge," is impractical—and likely to stimulate precisely the "asymmetric responses" to America's global dominance that the strategy is designed to prevent.

To order *War with Iraq,* call 617–576–5024. This Occasional Paper is also available on the Academy website at *www.amacad.org/publications/occasional.htm.*

Kirk Varnedoe Speaks at Academy Stated Meeting in New York

On December 5, 2002, the Academy held its second meeting of the fall in New York City. President **Patricia Meyer Spacks,** Vice President **Louis Cabot,** and Executive Officer **Leslie C. Berlowitz** greeted more than 150 Fellows and guests from academia, business, foundations, and the media. **Thomas Sakmar,** acting president of Rockefeller University, cohosted the Academy event at Rockefeller's Caspary Auditorium.

Dr. Harold Varmus, president of the Memorial Sloan-Kettering Cancer Center in New York, introduced the speaker, **Kirk Varnedoe,** as a "cultural phenomenon" whose work as a curator and art historian is "a happy reminder of how scientific thought can shape cultural understanding." As Varmus noted, Varnedoe argues in his book *A Fine Disregard* that conventional accounts of transitions in art should be replaced by "a Darwinian notion of evolutionary origins and growth" and that modern art demonstrates "the creative force of contingency—the interaction of multiple mutations with special environments . . . and has yielded an amazing, diverse world of thriving new forms of life." Varnedoe served as chief curator of the Department of Painting and Sculpture at the Museum of Modern Art (MoMA) for thirteen years. He is currently

Left to right: Kirk Varnedoe (Institute for Advanced Study) and Harold Varmus (Memorial Sloan-Kettering Cancer Center)

professor of the history of art at the Institute for Advanced Study in Princeton.

In his talk, "Matisse, Picasso, and the Idea of Influence," Varnedoe suggested that the concept of influence is too crude an indicator of the relation between and among artists. Using Picasso and Matisse as examples, he presented slides demonstrating that the two artists carried on a lifelong dialogue in paint, marked by both competition and emulation. Underlying their very different styles, Varnedoe detects some common vocabularies and a shared interest in reinterpreting earlier masters such as Ingres, Delacroix, and Cézanne. In a seemingly paradoxical way, he observed, both Picasso and Matisse found that the challenges of each other's work often helped them to see new possibilities within their own art and to produce some of their most potently original works. After Matisse's death, Picasso told friends that he felt he was, in some of his art, carrying on Matisse's work; for instance, he saw a "legacy" of Matisse in his own figures of odalisques painted after 1954. Varnedoe's new exhibit on Matisse and Picasso opens at MoMA's Queens location on February 13, 2003.

The New York meeting was another important step in advancing the Academy's presence in the tristate area and in expanding opportunities for Academy members to meet in locations beyond the Cambridge headquarters and the regional centers.

Humanities Indicators Workshop

As part of its broader Initiative for the Humanities and Culture, the Academy is developing a new set of educational databases for the humanities. The creation of humanities indicators will involve a systematic attempt to build a statistical profile of the humanities disciplines that will examine teaching and curricular trends and monitor labor and employment issues for the humanities profession. To achieve this goal, the Academy has organized an advisory committee led by Academy Fellows **Francis Oakley** (former president of Williams College and currently acting president of the American Council

of Learned Societies) and **Stephen Raudenbush** (professor of education and statistics at the University of Michigan School of Education and senior research scientist at the Institute for Social Research).

Although there have been independent efforts to compile humanities data in the past, a study commissioned by the committee—***Making the Humanities Count: The Importance of Data***—established the need for a more systematic approach that will address the serious gaps and inconsistencies in the information currently available. The advisory committee organized a workshop at the House of the Academy in early January, bringing together a distinguished group of educational researchers, policymakers, and leaders of learned societies concerned with the state of the humanities. The meeting opened with a consideration of the most important educational policy issues today and their relation to the humanities. Following a review of the information provided in current humanities databases, participants considered ways to overcome the limitations of available information by building on research that is under way or in development and by undertaking new studies.

The recommendations from the meeting will be discussed with the Academy's Humanities Indicators Consortium, an informal leadership group comprising representatives of organizations and public agencies interested in improving data collection in the humanities. Reports on the meeting will appear in future issues of the *Bulletin* and on the Academy's website at *www.amacad.org*. The Academy Occasional Paper *Making the Humanities Count* is available on the website and in print; to obtain a free copy, contact the Office of Publications (phone: 617–576–5085; fax: 617–576–5088; e-mail: publications@amacad.org).

Prior to the National Induction Ceremony on October 5, 2002, the Academy held an orientation session for newly elected members at its House in Cambridge. President **Patricia Meyer Spacks** (University of Virginia), Vice President **Louis W. Cabot** (Cabot-Wellington, LLC), Secretary **Emilio Bizzi** (MIT), and Executive Officer **Leslie C. Berlowitz** welcomed the inductees and provided an overview of the Academy's history and mission. Five project representatives gave progress reports on Academy studies: **John Steinbruner** (University of Maryland), **Francis Oakley** (Williams College), **Robert C. Post** (Boalt Hall School of Law, UC Berkeley), **David Bloom** (Harvard School of Public Health), and historian **James Carroll**. Their remarks are published here, in the order presented.

Reconsidering the Rules of Space

John Steinbruner

The Committee on International Security Studies is embarking on a study of space policy—an area we think is likely to be an emerging and major concern in this country and abroad. Let me begin with a fact that is probably familiar to all of you: over the past two decades, with sustained investment in military capability, the United States has acquired a degree of military superiority that is arguably unprecedented in history. The buildup was originally articulated as a balanced response to external threats and was not explicitly intended to provide global superiority. Nonetheless, the American political system as a whole has endorsed a program of military investment that will sustain our military superiority over at least the next twenty years. This raises important questions about how, in what manner, and for what purpose this military capacity is to be used.

Implicit in these questions is the degree to which the United States addresses itself to issues of international security, as distinct from national security,

John Steinbruner (University of Maryland)

and the degree of influence we allow other countries to have over the way we develop and use our military establishment. These issues are now prominently in question in Iraq—but they are not solely, or even primarily, about Iraq. Very significant and unresolved security issues are being played out in relationships that are more enduring than the current situation with Iraq. In the background, and meaningfully affected by our actions toward Iraq, are our relationships with Russia and China.

These latter two countries represent, in some sense, the broader world—certainly, the broader world not formerly involved in US alliances. The Moscow treaty on nuclear weapons, concluded in May, announced, in effect, the end of an era of arms control. The whole process of arms control, from the end of World War II until very recently, has been an attempt to balance the capabilities of opposing military establishments—to make them equitable enough to provide stability. The Moscow Treaty abandons the objective of balancing capability and sets conditions that increasingly legitimize significant US military superiority. Russia, unable to avoid the fundamental fact of US military superiority, has signed on to that inevitability.

Under the circumstances, the prominent question for the Russians, and for the Chinese and others, is whether the United States will use its increasing

capability to intimidate or to reassure. Obviously, countries outside the United States—in particular, those outside our alliance system—strongly need us to, and hope we will, use it to reassure.

The answer to the question of how we will use our capability will depend heavily on rules of activity in space. Space capacity is critical to the particular forms of superiority that the US military establishment has acquired and continues to develop. Space capacity is also exceedingly vulnerable, and therefore, although it is an area of common interest and accommodation, it is also a logical focus for the famous "asymmetric reaction" about which the Pentagon rightly worries. What does a military establishment do when it cannot match US military capability globally? One response is to focus on the vulnerability and the criticality of US space assets as a way of negating a lot of what the United States otherwise can do with its military. This is a major concern that must be taken into account in developing rules of deployment in space.

If you listen carefully to what leading areas of our military establishment are saying, the United States is projecting the capacity to observe everything on Earth, to attack what we do not like, and to deny similar capability to everyone else. Needless to say, that message is received with profound discomfort in many parts of the world, particularly in Beijing. The Chinese, in raising their concerns, are basically saying, "It won't work out that way," and they are asking for negotiations to develop rules of accommodation that would ban direct weapons and set other guidelines for mutual protection in space.

For the last decade, the United States has been refusing to negotiate over the whole subject of space policy, saying that it will do as it pleases. The participants in our study feel that the American public needs to be more engaged in determining what our balance of interests should be and what kinds of rules we want, knowing that we carry out more than military activity in space. Important commercial activities and scientific exploration, as well as traditional military support operations, could be placed severely in question if current conditions

persist and if no agreement on rules is negotiated. It is overwhelmingly in our interest to devise and enforce such rules, and it is very foolish to refuse to negotiate about the use of space. We believe that if the majority of US citizens were aware of our nation's position, they would want a more balanced policy—but they are not aware of it. It is our duty to raise questions, pose issues, encourage people to think about them, and suggest constructive answers. That is what the Academy's project on space policy is all about.

The Humanities Indicators Project

Francis Oakley

In 1998 the Academy launched its Initiative for the Humanities and Culture. Let me start by describing that program in general, and then go on to focus on the aspect of the enterprise in which I am most deeply involved.

The initiative consists of several distinct but interrelated undertakings, all of them responsive to that quintessentially humanist injunction to "know thyself." First, the Academy is leading a sustained effort to create an improved system for gathering empirical data about the humanities and, with that in view, has created an informal consortium that

Francis Oakley (Williams College)

includes many of the nation's leading organizations in the humanities and in higher education. Second, the Academy is sponsoring a series of research studies about the evolution of the humanities disciplines, the institutional settings that provide support for the humanities, and the influence of cultural diversity on the development of the humanities in the United States. Two volumes are now being prepared: one edited by Academy President Patricia Meyer Spacks (University of Virginia), the other by David Hollinger (UC Berkeley). Third, although it is not formally part of the humanities initiative, the Academy's newly created Visiting Scholars Program has special significance for the humanities because fellowship opportunities for postdoctoral fellows and junior faculty in the humanities are comparatively scarce.

Having been involved in the humanities initiative since its inception, I want now to focus on its response to the lack of reliable sustained data of the sort that can facilitate meaningful comparisons among disciplines, institutional sectors, and moments in time. Stephen Raudenbush (University of Michigan) and I cochair the Academy's leadership group on data development. One of the Academy's greatest strengths is its ability to involve in this effort Fellows who are preeminent social scientists, as well as others from classes with an interest in the humanities. Our working group, the Humanities Indicators Consortium, includes economist Robert Solow (MIT), former US Census Bureau director Kenneth Prewitt, and Columbia University provost Jonathan Cole, as well as representatives from leading scholarly organizations and federal agencies with an interest in data collection, such as the National Science Foundation, the National Endowment for the Humanities, the American Council of Learned Societies (which I currently serve as president), the Association of American Universities, and the National Humanities Alliance. Together, we hope to shape a cost-effective research strategy that will minimize duplication of efforts and bring much-needed coordination to data collection.

Data collection may seem something of a dry topic, perhaps, until one pauses to ask why it is, after all, that those of us in the humanities seem to find it so very hard to convey to others the significance of what we do, its importance for national well-being, or even the status and current condition of the humanistic endeavor to which we bring so passionate a commitment. This problem, in all its complexity, cannot be resolved by any single or simple mode of approach. Part of the problem, I sense, is that we ourselves do not always understand what we do, or why we do it, or why it is as important as we instinctively take it to be. At least part of the reason for that failure of understanding is that even when we try to comprehend what we are doing—by placing it in a larger context, for example, or by viewing it from a broader or a comparative perspective—we find that we lack the supportive and interpretive tools provided by the systematic gathering, organization, analysis, and dissemination of the type of pertinent data long available to those whose task it is to interpret the natural sciences not only to the larger public but also to themselves. In the humanities, such data are either lacking or, if collected, are inconsistently assembled, hard of access, poorly disseminated, inadequately analyzed, unwittingly ignored, and routinely underutilized.

Early in our discussions, a number of Academy Fellows contrasted the lack of reliable empirical data in the humanities with the wealth of resources available in the sciences and engineering. More than a quarter-century ago, some members of the initiative's steering committee had participated in the creation of the *Science and Engineering Indicators (SEI),* and they proposed that we take its statistical profile of American science as our model. The *SEI* has grown into a robust set of data indeed; updated every two years, its datasets provide information on enrollments, the workforce, and research and development, as well as on regional, racial, and gender differences in educational and career patterns.

It is one of our misfortunes in the humanities that we have nothing at all comparable. We don't even

know if the state of the humanities is better or worse than it was, say, fifty years ago. How could we? We do have gross figures, at least for the years since the late 1960s, about the number of degrees awarded in arts and sciences subjects nationally, but we simply don't know, for example, whether or not there's been a decline in the numbers of undergraduates taking individual courses in humanistic subjects, nor do we really know if there is any truth to claims that colleges and universities are abandoning requirements that students take courses in Western civilization. One targeted study has suggested, surprisingly and counterintuitively, that the overall percentage of institutions requiring students to take a course in the history of Western civilization has risen to almost 50 percent over the past quarter century. We confront, in effect, a situation in which educational policymakers lack crucial information about roughly half of the disciplines that form the core of liberal arts education.

The need for basic empirical data is particularly urgent now, when new economic, curricular, and ideological pressures threaten support for the humanities. In recent years, foundations, scholarly associations, and individuals have issued reports offering often pessimistic assessments of the health of the humanities and the quality of research and teaching in individual disciplines. Not all of those reports rest on secure factual or statistical bases, least of all the more polemical studies that assert a decline in the amount and quality of teaching in the humanities. Neither the critics themselves nor the characteristically wounded (if occasionally truculent) respondents have shown much interest in the pertinent statistical data, even when they are available. Instead we get a species of disheveled anecdotalism, and a free-fire zone is created for eye-catching and sensationalist claims, matched all too often by analytically flaccid and apoplectically sloppy responses. Clearly, this is not good enough. And it is here that the Academy's project on humanities indicators comes into play.

Earlier this year, the Academy issued an Occasional Paper on the problems of databases in the human-

ities. Entitled *Making the Humanities Count: The Importance of Data,* the report includes a detailed examination of existing databases in the humanities, with particular attention to their utility for answering the kinds of questions routinely addressed by the *Science and Engineering Indicators*. In it we concluded that existing humanities data sources are limited in usefulness because of inconsistent measurement techniques, small sample sizes, and a failure to update these materials regularly. In sum, we have found that neither policymakers nor professionals in the humanities are well served by existing data collection efforts. We hope to solve these problems of coordination and planning as part of the Academy's ambitious effort to improve data collection.

This initiative is still in its infancy, but we are already seeing some positive results. The Rockefeller and Hewlett Foundations, among others, have provided support for our work. In addition, membership organizations representing the humanities are beginning to work together to make data collection a platform on which we can build.

It is, I believe, one of the Academy's glories that its purview extends to so broad a range of intellectual endeavor. It embraces the full gamut of disciplines, and its mission, accordingly, is to try to serve all of them. W. E. B. Du Bois once observed (he was talking about the Housatonic River) that we will be judged by what we neglect. By embarking on its humanities initiative, the Academy, with all its manifold obligations, will not be judged for having neglected the humanistic disciplines. I celebrate that fact.

The Changing Relationship Between Congress and the Court

Robert C. Post

The Academy is launching a study of the contemporary relationship between Congress and the federal judiciary. At issue are questions of great importance for the future of democratic governance in this country. The steering committee consists of

Robert C. Post (Boalt Hall School of Law, UC Berkeley)

Jesse Choper (UC Berkeley), Abner Mikva (University of Chicago Law School), Linda Greenhouse *(New York Times),* Nelson Polsby (UC Berkeley), and myself. This diverse committee will, we hope, develop an interdisciplinary approach to analyzing and, hopefully, ameliorating the severe tensions that now afflict the relationship between the legislative and judicial branches of the federal government.

To understand these tensions, I must ask you to remember your high-school civics class, in which you no doubt learned that the government of the United States had only limited powers. The founders of our country created a federal government that had *only* the powers given to it by the Constitution. State governments, by contrast, were believed by the founders to hold plenary power, meaning that state governments could exercise any power except that which had been taken away and given to the federal government. This distinction between federal and state power persisted until the twentieth century. It made a certain amount of sense in the context of a nation that was highly decentralized. But although the federal government left a rather small footprint on the life of the nation in the eighteenth century, its role grew increasingly important as the country grew economically more integrated throughout the nineteenth century. Regulation of the single national market created by the expansion of the great rail-

road lines—a market that far transcended the boundaries of individual states—increasingly came to be seen as a federal responsibility.

Nevertheless, the United States Supreme Court, true to the original understanding of the founders, continued to review congressional statutes to determine whether they were consistent with limited powers granted to the federal government by the Constitution. Even as late as 1918, for example, the Court was prepared to strike down a congressional statute prohibiting the transportation of the products of child labor in interstate commerce. The Court argued that the federal government had not been given the power to regulate local conditions of manufacturing. Only the states could regulate these conditions.

The emergency spawned by the Great Depression smashed this conceptual distinction between federal and state power. The lesson of the Depression was that the nation was a single, integrated economic entity, so that the national dimensions of the crisis could not be addressed unless Congress were free to regulate economic transactions that had previously been deemed to lie within the exclusive domain of state power. At first the Supreme Court sought to maintain the old boundaries between federal and state power, striking down New Deal statutes that regulated manufacturing within the states. This caused a constitutional crisis, in which Franklin Roosevelt threatened to pack the US Supreme Court with new and sympathetic justices. Eventually, the crisis was resolved when Justice Owen Roberts switched his vote, leading to the famous quip by T. R. Powell about "the switch in time that saved nine." As a result of the crisis, the Supreme Court abandoned its efforts to police the boundaries of federal power. Instead it defined its role as reviewing otherwise valid exercises of federal power to see if they were consistent with constitutional rights.

Because the crisis of the New Deal was resolved in this fashion, most of us have come of age in a world in which the federal government effectively has plenary power to address what it perceives to

be national needs. After 1937 the Supreme Court refused to strike down federal statutes on the grounds that Congress didn't have the power to enact them. This regime of constitutional law, which has been called the New Deal Settlement, came to an abrupt end in 1995, when five justices, appointed by Republican presidents determined to revive the values of federalism, coalesced into a powerful voting bloc capable of determining the direction of the Court. In the 1995 case *United States* v. *Lopez*, the Court struck down the Gun-Free School Zones Act of 1990, on the ground that the act was beyond the power of Congress. Since that time, the Court has indicated that it is serious about striking down congressional statutes that are beyond the boundaries of federal power. For example, the Court has invalidated important provisions of the Violence Against Women Act, and it has narrowly interpreted the reach of federal criminal and environmental laws in ways that are explicitly designed to sidestep ultimate questions of constitutional power.

From the perspective of those of us who study constitutional law, these decisions constitute a profound revolution of potentially immense significance. They signify that the national legislature no longer has the constitutional power to address what it deems to be national needs. The Court, rather than the Congress, will determine the reach of national authority. This shift is enormously consequential, and it underlies the great tension that now permeates the relationship between Congress and the Supreme Court.

It is not, however, the only source of that tension. I will quickly mention three other causes of the relationship's deterioration. First, there is a growing dispute between the Court and Congress about which branch has authority to interpret the Constitution. Section 5 of the Fourteenth Amendment gives Congress the power "to enforce, by appropriate legislation, the provisions of this article." The provisions of the Fourteenth Amendment that Congress is thus empowered to enforce include the right to due process of law and the

right to equal protection of the law. In a recent series of cases, however, the Supreme Court has invalidated federal legislation enacted pursuant to Section 5, on the ground that Congress's interpretation of these rights conflicts with the interpretations of the Court. The Court has, in effect, asserted a monopoly on the power to interpret the Constitution.

This claim of exclusive interpretive authority is of great significance. It alters over a century of contrary practice. It basically transforms our Constitution into what Franklin Roosevelt once called a "lawyer's contract," as distinct from a "layman's charter" of rights. Acting on this claim of exclusive interpretive authority, the Court has struck down as unconstitutional provisions of numerous statutes, including the Violence Against Women Act, the Religious Freedom Restoration Act, the Age Discrimination in Employment Act, the Americans with Disability Act, and the Patent and Plant Variety Protection Remedy Clarification Act. The Court has found that these statutes violate constitutional principles of separation of powers because they reflect Congress's effort independently to interpret the Constitution, an effort that infringes on the Court's preemptive "duty to say what the law is."

In striking down these statutes, the Court has exercised its power of judicial review, which authorizes the Court to check what it perceives to be congressional actions that overstep constitutional limits. But this check is countered by the many constitutional means given to Congress to check what it regards as judicial overreaching. There are numerous such mechanisms, which range from determining the scope and range of judicial jurisdiction to the setting of judicial salaries. By far the most important avenue of congressional influence, however, is the confirmation process, which is a second additional source of tension in the relationship between Congress and the judicial branch.

The Senate can ultimately control the complexion of the federal judiciary because it must approve the

appointment of all Article III federal judges. Although the appointment process for Supreme Court justices was highly contentious throughout most of the nineteenth century, levels of disputation have reached new heights since the unsuccessful nomination of Robert Bork in 1987. At the heart of these debates are ideological contests about the constitutional identity of the nation. We will see whether competing visions of constitutional structure begin to influence the confirmation process. As of now, however, the Senate seems incapable of conceptualizing its role as monitoring the constitutional ideology of nominees; it has instead displaced these concerns to issues of individual character, or to the question of whether a candidate is within "the mainstream," whatever that may mean. The rules of engagement in the confirmation process remain highly murky and obscure, despite the increasing importance of that process. Moreover, nominations to the lower federal bench have become infected with the same ideological polarization as have nominations to the Supreme Court. This is a recent development of great significance.

The third source of tension involves the more mundane but ultimately more important process of statutory interpretation. Congress regulates the country by passing laws. These laws are not self-enforcing; they must be interpreted and applied by courts. In the past few years, the basic principles of statutory interpretation have become highly controversial. Some justices contend that courts ought never to review legislative history when seeking to interpret statutes, whereas others deliberately look to all available forms of information that might help a court understand the meaning of legislation. It has therefore become unclear what pieces of information, in addition to the actual text of a statute, will actually count as authoritative indicia of legislative intent and meaning. The smooth cooperation of Court and Congress is correspondingly undermined, and law enforcement throughout the United States is undercut.

So, to put the matter bluntly, the relationship between the Court and Congress has become ex-

tremely problematic in the past decade. This is an unsettling development to anyone who cares about the effective operation of the federal government. Some Fellows of the Academy believe that the Academy, as a nonpartisan witness of recent developments, with a strong independent interest in promoting principles of good governance, might facilitate a constructive dialogue that could reach across the chasm now separating Congress from the federal courts. We have accordingly launched an Academy project addressed to the current tensions between the Court and Congress. We have a two-pronged strategy.

The first prong is to convene groups of justices and judges, on the one hand, and members of Congress, on the other, for off-the-record conversations. We hope that these meetings will serve two purposes. The first is to facilitate communication between Congress and the courts that will reduce the possibility of misunderstanding and to maximize cooperative efforts to confront common problems. We had our first meeting last year in the Library of Congress, and it produced a frank and stimulating discussion. We hope to be able to institutionalize these conversations. The second point of these meetings is to develop an agenda for future scholarly research. If disagreements between Congress and the courts can in any respect be diminished by impartial and interdisciplinary scholarship, the Academy stands ready to sponsor such research.

The second prong of the project's strategy is to produce scholarship relevant to ameliorating the current tension between Congress and the judiciary. We are now pursuing two inquiries. The first concerns the nomination process for the federal appellate courts. The headlines now are full of confirmation battles regarding judges nominated to the US Courts of Appeals, including Michael McConnell and Miguel Estrada. This is a new historical phenomenon. There is a real question, however, as to whether the ideological orientation of Court of Appeals judges can affect the ultimate shape and direction of the law. Appellate court

judges argue that their work is so bound and supervised by the Supreme Court that there is relatively little room for the exercise of judicial discretion. But is this true? Law professors and political scientists tend to think that the composition of intermediate federal courts makes a great deal of difference. Lobbyists and special interest groups clearly believe that this is the case. There is thus disagreement about the empirical facts of the matter. We hope to be able to study the influence of ideology on decision-making in the US Courts of Appeals. The outcome of this work is relevant to the confirmation process of appellate federal judges.

The other scholarly inquiry that we are pursuing concerns the question of statutory interpretation. There are many different, competing theories of how a court should interpret a statute, and often these theories lead to different conclusions about the operative meaning of federal legislation. We intend to identify controversial cases that turn on questions of statutory interpretation and then to examine carefully the history of the relevant statutes. We will compare this history to the assumptions underlying different theories of judicial interpretation. We will, so to speak, put these theories to empirical tests. Although this work will not definitively settle the jurisprudential questions involved in statutory interpretation, because these questions often have strongly normative components, our study should nevertheless illuminate these questions. We hope that it might provide a solid foundation for more efficient cooperation between Congress and the judiciary. We expect that as future meetings occur between members of the judiciary and members of Congress, additional scholarly inquiries will be placed on the Academy's agenda.

Universal Basic and Secondary Education

David Bloom

Joel Cohen (Columbia and Rockefeller Universities) and I cochair the Academy's project on Uni-

David Bloom (Harvard School of Public Health)

versal Basic and Secondary Education (UBASE), an extremely ambitious undertaking focused on the rationale, means, and consequences of providing quality basic and secondary education to all the world's children.

The starting point for the UBASE project is that huge numbers of school-age children in developing countries are not currently enrolled in school. The deficits, concentrated in South Asia and sub-Saharan Africa, are especially pronounced among girls. Although access to primary school has increased sharply in recent decades, the same cannot be said of secondary school. In addition, the quality of the education offered at both the primary and secondary levels leaves much to be desired, judging by careful examination of a wide range of inputs, outputs, and practices of educational systems throughout most developing countries.

None of these observations is novel. Back in 1990, representatives of 155 countries gathered in Thailand, took note of a qualitatively similar picture, and pledged that they would achieve universal primary education by the year 2000. But today, in 2002, the world is still a long way from achieving that goal. And now the world has graciously given itself a fifteen-year extension for the achievement of universal basic and secondary education, as reflected in the Millennium Development Goals of

the United Nations, which are taking shape as the central imperative and unifying theme of all efforts at international development.

The UBASE project may not be novel in terms of the stylized facts that motivate it, but it is somewhat novel in several other respects. Its novelty has to do with its focus on both primary and secondary education, its attention to educational quality as well as educational access, and its recognition that fresh thinking is needed if we are to pick up the pace of educational development. It also has to do with the future orientation of the project—in other words, the need to plan for tomorrow's world, not yesterday's. Finally, the UBASE project recognizes that the issues under study are inherently complex. The complexity extends beyond the bounds of any single discipline and necessitates disciplinary rigor as well as interdisciplinary cooperation.

Getting one's arms around UBASE is a rather daunting task, if only for the great breadth of the concept. Our project attempts to deal with this issue by adopting an approach that deconstructs the challenge of UBASE into seven main components. The first component focuses on basic education facts, and the nature and quality of the data that underpin these facts. The second looks at the concept of universal education from the standpoint of its intellectual and programmatic history, and also covers its economic, social, political, and ethical rationales. The third component concerns the demographic, social, political, cultural, and economic consequences of achieving universal basic and secondary education. The fourth examines the goals of primary and secondary education in widely different settings and how we assess progress toward attainment of those goals. The fifth component focuses on the harsh realities of the field, on problems of implementation, and on the use of technology in delivering more and better education. The sixth takes up the politics of educational reform, in recognition of the fact that such reform is not simply a technical exercise but also a political challenge. Finally, the seventh component deals with the cost

of UBASE and the distribution of that cost among different possible payers.

Each of these components is built around a study team that comes together periodically for intensive discussion and review of background syntheses crafted by the team's leader(s). In order to promote the overall coherence of the project, Joel Cohen and I, as well as most of the study team leaders, participate in all the meetings of all the study teams. These teams typically consist of eight to ten individuals from North America and beyond, reflecting a range of disciplines and various degrees of research experience in education and international development. The project is still at an early stage, but several dozen scholars have already participated as study team members or as distinguished project advisers. Several dozen more could be described as avid consumers of our products. I would also note that the Academy is proving to be an ideal sponsor for the UBASE project because of its independence, its academic standards, and its extraordinary convening power—not to mention that it offers a superb meeting venue.

All the UBASE project papers and related materials will be accessible on the Academy's website. We intend to publish the papers as a volume, or perhaps as a special issue of *Daedalus*. During the third year of the project, Joel and I plan to craft a monograph on UBASE, using the background reports of the study teams as key building blocks.

The UBASE project is supported by a generous three-year grant from the Hewlett Foundation, along with several grants from individual donors and foundations.

Notwithstanding the breadth and complexity of the UBASE project, we do have some humility with respect to our goals. For example, we are not at this point taking up the deep question of whether the world's limited resources would be better devoted to education or to other aspects and indicators of development, such as improved health, governance, and infrastructure. Nor are we endeavoring to deliver a detailed plan for achieving universal basic

and secondary education. We think there is as much contribution to be made in formulating the right questions as in answering them. We aspire to inform and stimulate the global dialogue on education with some new frameworks, ideas, examples, and evidence. We hope to inspire a new cadre of researchers to focus on this area. Advocacy efforts do not fall within the purview of our project.

We welcome your thoughts on these efforts, as well as your participation in what we hope is a worthy endeavor. As Franklin D. Roosevelt once said, in neat anticipation of the spirit of the UBASE project, "We cannot always build the future for our youth, but we can build our youth for the future."

Visiting Scholars Program

James Carroll

As you have gathered from the preceding project reports, the Academy is something of a movable feast. It's a network that defines itself loosely across the nation and the world, yet there is a strong incarnational center: the House of the Academy in Cambridge. Those of you who are here for the first time, as well as those who visit often, are aware of its

Historian James Carroll

generous hospitality, defined by its commitment to interdisciplinarity, to service, and to intellectual, artistic, and professional distinction. I am privileged to speak about one of the Academy's newest initiatives, its Visiting Scholars Program (VSP), which represents yet another commitment: to foster research by scholars who show promise of becoming leaders in their fields.

As chair of the program, I joined the Academy's Officers in welcoming the inaugural group of seven postdoctoral fellows and junior faculty in September. They were chosen by a distinguished group of Academy Fellows who reviewed over a hundred applications. Already accomplished in their own right, they represent a range of disciplines and are engaged in inquiries that are closely related to the Academy's ongoing projects and studies. To give you a sense of the variety of their topics and approaches, I would like to tell you about their specific research projects.

We have three junior faculty members. Eric Bettinger of Case Western Reserve is examining the impact of school vouchers in Colombia, South America—an investigation that will contribute to the Academy project on universal basic and secondary education. In the area of security studies, Page Fortna of Columbia University is investigating the concrete effects of peacekeeping in international civil wars and exploring what difference peacekeepers make in the aftermath of conflict. In the humanities, a cultural biography of F. O. Mathiessen, the Harvard scholar of American literature, is the research focus of Jay Grossman of Northwestern University.

Among our postdoctoral fellows, historian David Greenberg of Columbia University is examining the role of ideology in the confirmation of Supreme Court justices—a study linked to the Academy project on Congress and the Court. Another historian, Andrew Jewett of the University of California, Berkeley, is analyzing a group of scientists, social scientists, philosophers, and writers who believed that science could strengthen demo-

cratic government in America during the first half of the twentieth century.

Two postdoctoral scholars in twentieth-century literature are also at the Academy this year. In a reinterpretation of American modernism, Joseph Entin of Yale University is considering how writers, artists, journalists, social scientists, and doctors interpreted the lives of immigrants, African Americans, and the underclass. Anne-Marie Mikkelsen of the University of California, Irvine, is carrying out research on a group of American poets whose emphasis on social, political, and economic inequality was a reflection of their own marginal status in society.

Associate scholar Andy Zelleke, a J.D. from Harvard Law School and doctoral candidate at Harvard Business School, is completing a study of governance and leadership structures in British and American business organizations, in association with the Academy's project on corporate responsibility.

In the spring, senior scholar and Academy Fellow David Hollinger of the University of California, Berkeley, will visit the VSP to develop a history of the effects of twentieth-century demographic and social changes on the humanities. My own research on the history of the Pentagon further extends the Academy's studies of American government and business institutions.

Taken together, the participants in the VSP mirror the Academy as a community. Just as our Fellows conduct their independent research and enrich the Academy by their contributions to its program, so the Visiting Scholars carry out their own studies, interact with each other as a closely knit group, and participate in such Academy activities as project conferences and workshops, as well as Stated Meetings and informal gatherings at the House. The VSP is a new embodiment of the Academy's historic mission to foster and advance knowledge.

Education Reform: A Report Card

Marshall S. Smith, Program Director for Education, William and Flora Hewlett Foundation, and Professor of Education, Stanford University

Commentary: ***Jerome Bruner,*** University Professor, New York University

The following presentation was given at the 1858th Stated Meeting, held at the House of the Academy in Cambridge on April 10, 2002. At the event, the Academy honored Frederick Mosteller (Harvard University) and Howard Hiatt (Harvard Medical School) for their work in placing the health and welfare of children on the Academy's agenda. Richard Light (Harvard) spoke about Mosteller's distinguished career in educational research, and Jerome Kagan (Harvard) cited Hiatt's many accomplishments as director of the Academy's Initiatives for Children Program. A summary of the tribute appeared in the Summer 2002 *Bulletin* (pp. 9–13).

Marshall S. Smith

Two years ago, I ended a seven-year stint as undersecretary of the US Department of Education. Tonight I would like to talk a little bit about quantitative studies—how I thought about them in the government and what I think might be done to improve them. I'll start with some history, going back forty years or so; then I'll talk a little bit about my sense of our progress. I will close with a brief report card on reform, as interpreted through the words of John Adams.

Forty years ago, in the 1960s, various activities in education were influenced by empirical studies. I will not argue that empirical studies drove such developments as the passage of Head Start and Title I. Lots of other things that went on in the sixties—including the civil rights movement and other social movements of those times—were far more impor-

Speaker Marshall S. Smith (William and Flora Hewlett Foundation; Stanford University)

tant than quantitative studies. Nevertheless, important quantitative studies were carried out, and they were part of the mix. A famous study of the effects of preschools, conducted in Ypsilanti, Michigan, contributed to (and was certainly cited during) the passage of Head Start. Among the researchers who were influential in that era, none exceeded Jerome Bruner. His landmark book *The Process of Education* (1960) was a crucial factor in the generation of a range of educational programs and experiments in the 1960s, including Title I and Head Start. During the early 1960s, I believe, Jerry was also a member of the President's Advisory Panel of Education.

Title I—the federally funded supplemental reading program for at-risk first-graders—changed the nature of evaluation in this country. A new federal provision—a Robert Kennedy amendment—required that every Title I project in the 14,000 local education agencies in the country had to be evaluated. The few words in that provision heightened thinking about evaluation in a major way.

In my own first research experience outside of the university, in the summer of 1965, I was on a team that helped to evaluate the Title I program in Boston. We spent most of that summer arguing about whether we should be measuring only outcomes—only student achievement—or whether

we should also be measuring some of the background variables and intervention processes that affected achievement. That argument continues, thirty-five years later. I think we know quite a bit more about it now than we did before, though people on both sides are still as passionate.

Many of you are familiar with James Coleman's report on *Equality of Educational Opportunity,* issued by the government in 1966. The findings of that report and subsequent reports building on Coleman's survey, especially *Racial Isolation in the Public Schools,* were instrumental in stimulating a large-scale social experiment: the widespread busing of students to achieve racial integration in US public schools. The consequences of that experiment, and of early evaluations of both Head Start and Title I—many of which were slightly negative—began to change a lot of people's thinking about what kinds of investments the country should be making in education, as well as in other areas.

I recall a phone call I got in 1969 or 1970 from Pat Moynihan, then domestic policy adviser for President Nixon. During his first stint at Harvard, from 1966 to 1969, Pat had been influenced by the Coleman report to believe that perhaps education didn't quite have the effect he once thought it had. Also, Head Start evaluations had led him to think that Head Start didn't quite have the intended effect. During the call, I was in my kitchen in Cambridge with two very young children, while he was in his office in the White House.

Pat had been advocating in the government for the negative income tax. He asked me whether I would rather put $1,000 into a family to cover one year of Head Start for one of its children or put $1,000 into that family to buy food, clothing, and shelter by means of a negative income tax. I conveniently ducked the question by saying I'd do both. But the question was an important one because it signaled an orientation toward thinking about what kinds of interventions would have the greatest effect—an orientation that was possible only because there had been empirical studies of at least some of the various domestic interventions.

Later on, in the 1970s, methods were developed for synthesizing the results of quantitative studies. Richard Light and Paul Smith started that off with a little article in the *Harvard Educational Review.* Gene Glass came up with the concept of meta-analysis, which advanced research synthesis dramatically. During the 1970s, we in education began to look at qualitative studies more—and in some ways, qualitative studies began to drive out empirical studies for the next fifteen years.

This was a phenomenon of some importance. We lost some of the momentum around empirical studies, I believe—but at the same time, we gained some real insights into theories of intervention and into the ways and processes of classrooms, schools, and other organizations. So on the one hand, our field drew a sharp distinction between qualitative and quantitative that should never be drawn, in my view. This led to an almost ideological battle in the field of education. But if you look carefully down the middle on this one, you will find that those qualitative studies provided valuable insights that allowed people to begin to piece together the findings of research on how students learn and how teachers teach, and to apply those findings to situations that were more complex. Those insights gained us a great deal.

Then came the 1980s. Many of you will remember the 1983 government report titled *A Nation at Risk,* which relied on international quantitative data to assess education policy. Increasing attention also was focused on national assessments and test scores. Great growth occurred in cognitive science, yielding useful theories on how people learn. The eighties also brought the class-size experiment—a massive randomized field trial that has had an enormous effect on policy over time.

As we moved through the 1990s and into the new millennium, almost every state in the nation adopted a framework of standards-based school reform. The intent of the reforms is to bring resources, policies, and assessments into alignment with standards that specify clear and explicit goals for student learning. The assessments are used for accountability

purposes. This is a package that has bipartisan support. It started with strong support by the Clinton administration and is now being supported by the current administration.

An increased emphasis on accountability, reflected in the standards-based reforms, has also influenced other parts of our society. Accountability based on quantitatively measurable outcomes has moved both the government and the private sector to become much more sensitive to the kinds of effects that can be measured. In many areas, including education, that has sometimes led to a narrowing of the kinds of outcomes people worry about, which may be a negative byproduct of the policy. We seem to value what we measure, rather than rigorously measure what we value. Consequently, if we assess only things that are easy or inexpensive to measure, we may end up placing value on the wrong things. This happens too often in education. Nonetheless, measures focus people's attention. The emphasis on empirically based accountability has created coherence out of incoherence in many instances, not least in the government.

The positivist belief in the value of empirical and verifiable findings has also increased attention to the empirical evaluation of education policies and practices. This—unfortunately, in my view—has resulted in a rash of dramatic statements about randomized field trials being the "gold standard" of

Left to right: Jerome Kagan and Henry Rosovsky (both, Harvard University)

research. This form of rhetoric often implies that other forms of research are inferior, rather than that they provide different kinds of data and different insights. In fact, the fascination with randomized trials seems to have been elevated to an ideological level by some. The National Research Council addresses the issues of different methodologies for different purposes in an elegant new report. On the other hand, the interest in randomized trials may be seen as a counterbalance to an equally ideological perspective of many in the late 1980s and early 1990s who regarded qualitative research as the only path to truth.

The concerns about effectiveness have not only heightened attention to methodological issues; they have also resulted in increased attention to theory. The National Research Council, for instance, has issued some excellent books on theories of learning, including how children learn to read and do mathematics.

Program evaluation has benefited from this. We are beginning to marry good and appropriate methodologies with better theory, and our evaluations are becoming more and more powerful and useful for policy development. Anthony Petrosino's work at the Academy on theory and evaluation is becoming very influential. We better understand the challenges of implementation. We are also seeing improvements in synthesizing the results of prior research. The inception of the Campbell Collaboration in the late 1990s was a formal way of beginning to approach the synthesis problem.

Of course, technology is changing many of the rules right now. It is changing our ways of modeling and our ways of organizing data. It is changing our access to data in dramatic ways. In the humanities and arts areas, the opportunities for new forms of research and analysis are extraordinary. Through technology, we are now able to do things we couldn't even dream of doing before.

At least four of the major events or findings in these areas can be traced back to Fred Mosteller. There are surely many other links with which I am not

familiar; I will note just four of his important contributions in areas that I have mentioned. He played a very significant role in interpreting the Coleman report; gave extraordinary legitimacy to the class-size study; fostered strides in synthetic analysis, both as Richard Light's mentor and as a supporter of the Campbell Collaboration; and made major contributions through his work on the National Assessment of Educational Progress in the early days.

In 1957 I took a course with Fred. Ever since, I've carried a Mosteller quote in the back of my mind, and I looked it up the other day in the 1953 edition of the *Handbook of Social Psychology.* What I found just goes to show that Fred hasn't changed his beliefs about the importance of carefully planned, theoretically driven research designs. Mosteller and Bush wrote, "In no circumstances do we think that sophisticated analytical devices should replace clean design and careful execution, unless very unusual economic considerations arise." Clear thinking should prevail.

Now, let me ask a rhetorical question: If we know so much about all of this, why don't we have better policy? Other countries appear to have strong linkages between improved knowledge and improvement in their schools. Back in the fifties, the National Science Foundation developed a set of very exciting and rigorous math and science courses in response to the challenge represented by *Sputnik.* For a good while during the sixties, lots of schools in the United States adopted those courses, and some actually still use them. In general, though, they began to die out around 1969 or 1970. Yet they were used in other countries for far longer. Materials based on US research are picked up and used by other countries fairly regularly. Yet in the United States, the curriculum materials developed through NSF investments in the 1950s and 1960s lasted only a while, and materials developed in the 1990s have been largely unused—some having been bought and then shelved by publishers that did not want them competing with their own textbooks.

Ellen Lagemann (Harvard Graduate School of Education) and Thomas Payzant (Boston Public Schools)

But the publishers are not the only culprits. The governance system can also be part of the problem. In the United States, we have an amazingly complex policy environment. California alone, for example, has seven different state agencies that influence the development and implementation of education policy. The elected state school officer and state governor are both Democrats, but they don't talk to each other, because they're battling over the turf. A variety of other groups out there are also in the fray. California has term limits, so there is almost no legislative memory. And the legislators seem to evaluate the quality of their term on the basis of the amount and number of legislative items passed rather than the effectiveness and coherence of the laws. This is not just a problem in California; state and federal legislators have the same disease. California also has government by public proposition, which means that anybody with a lot of money can put anything they please on the ballot. Consequently, a cacophony of chaotic provisions is placed into law, and that makes effective governance almost impossible.

On the other hand, as I learned during my years with the government, policymakers actually do listen. I was in the Clinton administration for seven years, in a policymaking role, and I don't think there was any major issue where quantitative re-

search didn't enter into the picture. There's no reason to think that it made a telling contribution, but people thought about it, worried about it, and looked at it. In some instances, research—for example, the Tennessee study of class size—really tipped the balance because it changed people's views in the Office of Management and Budget, the president's office, and Congress.

Generally, however, the effect sizes in research studies are small. If effect sizes are small, and if multiple studies are done, we are likely to get a distribution of effects that covers zero and goes into negative territory. As a consequence, anybody who wants to argue any position can base the argument on empirical research.

Let me spend a couple of minutes on a report card on education reform, just to give you some sense of where I think we stand today. I'm not going to relate it back too much to empirical research—just a little bit. It's a complicated picture. We have a set of standards-based reforms now that are in their early adolescence—nine, ten, eleven years old at best. In California, they're only three or four years old. So nationwide, these reforms are going through tremendous growing pains.

Although there are still many debates over the reforms, I believe they have begun to have some effect over time. Math scores on the National Assessment of Educational Progress have risen significantly in the fourth and eighth grades—by over a grade level—in the past six or seven years. That's quite a bit of progress. And that's not just for white students; it's also for African American, Hispanic, and Asian students.

We have individual states that do very well in the international studies. It is a difficult thing for us, as a country, to be compared with Singapore, or even with Holland, or Denmark, or Norway. One might think that Minnesota, for example, would compare more closely with Norway or Sweden than would the entire United States—or that some fairly small, well-off area of the United States might compare more closely with Singapore than would the whole

United States. When we do look at places that are well off and compare them with Singapore, our students do pretty well. They don't quite reach the level that the students in Singapore do, but they are competitive. When we look at how Minnesota does, compared with the Scandinavian countries, it actually does very well.

Some states have shown significant gains in many regards over the past few years. Texas, North Carolina, and Connecticut—all states that have pushed these standards-based reforms hard—show good gains in reading and mathematics. As for Massachusetts, we'll see—there's a big debate here. Virginia, Maryland, and other states have shown substantial gains. Nonetheless, we have a long way to go, especially for our least advantaged.

Many think that US education reform is taking us much too far in the direction of testing and assessment. Others think that perhaps we are not pushing hard enough. I was pleased to find support for my own views on the reforms in David McCullough's book *John Adams,* which I read on my plane trip here. I was struck by two quotes from Adams on education because they fit with my assessment of where we stand right now.

Here's one of them, written about 220 years ago: "A memorable change must be made in the system of education, and knowledge must become so general as to raise the lower ranks of society nearer to the higher."

I would venture to say that the lower ranks of society today are almost as low on the education totem pole as they were 220 years ago. We haven't changed that particular phenomenon in our society. We still have people at the bottom, and we can predict who they are, by and large. We know where they live. We know what the problems of their schools are—and we haven't done enough about it. So our reforms haven't done very well on that particular dimension.

The second quote that impressed me was from a letter John Adams wrote to John Quincy Adams at

around the same time. John Quincy had just been denied admission to Harvard, despite having demonstrated his extraordinary abilities. He'd been told that he would have to complete several months of tutoring in Greek with the Reverend Shaw in Haverhill in order to go to Harvard.

Apparently, Adams was a bit concerned that John Quincy would study too hard and get too involved in his Greek. He wrote to him, "The smell of the midnight lamp is very unwholesome. Never defraud yourself of sleep, nor your walk. You need not be in a hurry." What was essential, Adams advised, was an inquisitive mind. John Quincy must get to know the most exceptional scholars and question them closely: "Ask them about their tutors, manner of teaching. Observe what books lie on their tables. Ask them about the late War, or fall into questions of Literature, Science, or what will you."

There is a message of caution for us in Adams's prophetic words. We may be losing, in our passion for increasing achievement test scores in mathematics, reading, and science, the breadth of knowledge and understanding that needs to be developed in all students if they are to be productive citizens of our increasingly complex society.

Jerome Bruner

I want to comment first on what I see as some of the deep wisdom in Mike's analyses, emphasizing some things that he didn't have a chance to discuss in detail. Then, after that, I want to offer a slightly different perspective with regard to where we Americans stand internationally in the World Education League. In doing so, I want to use a lesson I learned from Fred Mosteller, who has been my friend and mentor for many, many years, starting back at Princeton in another century. Fred likes to say, "In comparing performance scores, don't just pay attention to the means. Look at the variance too." Well, that's what I want to do: look at variability. I'll turn to that presently.

Left to right: Commentator Jerome Bruner (New York University), Marshall S. Smith, and Vice President Louis Cabot (Cabot-Wellington LLC)

But let me look first at some of the lessons that Mike set forth in his talk. The first was that there has to be a good fit between what a program for educational improvement is seeking to improve, and how it goes about assessing its results. In assessing a program, to put his point briefly, you can't just use any old standardized test. The assessment test needs to fit the objectives of your attempted intervention. There are no all-purpose assessment procedures that fit all needs. Adequate assessment has to be relevant to the theory behind the intervention program you are evaluating. You can't fly blind—but that, in effect, is what you end up doing if you don't design your assessment to fit the objectives of your intervention.

I remember this classic problem from the early days of the Physical Science Study Committee (PSSC), one of the first curriculum reform efforts of the 1960s, directed by Jerrold Zacharias and Franny Friedman at MIT. A lot of people urged them to evaluate the PSSC curriculum effort with the standardized physics tests available at the time. Zacharias replied boldly, "Hell no, we're not teaching that kind of physics." So PSSC developed new assessment procedures (with the help of the Educational Testing Service) geared to their own instructional objectives and to their own ideas about what it meant to understand physics. It was a real step forward.

Indeed, every educational intervention program has some underlying theory that shapes it, implic-

itly or explicitly, and the more explicit it is, the better the evaluation will be. Even when the theory is "simply" that small classes get better results than large ones, as in Fred Mosteller's now famously successful Tennessee Study, there is an underlying theory that is not as simple as it seems. If you mindlessly attempt to replicate it, as they did in the state of California, the chaos is unbelievable. First of all, the way in which you set up small classes has to have some mind for who's teaching. Teaching small classes requires skills in communicating.

So, what of California's replication? They didn't have enough teachers available, so they began hiring teachers willy-nilly—and got more than the usual proportion of weak and inexperienced ones. Small classes also require more classrooms, not just corridors or hastily remodeled closets and bathrooms. It's not surprising that "reduced class size" didn't bear fruit in California.

But there's more to it than that. We don't fully know why smaller classes work better, given the right conditions; we haven't thought through the question. Is it that smaller classes lead to a different strategy on the part of the teacher, to different discourse patterns? Do they change the teacher-pupil authority relationship? We need a lot more theory to proceed wisely.

Let me give an example. I have been studying the famous preschools in Reggio Emilia in Italy. Here's a surprising finding: when a teacher asks a child something, she waits for an answer. If the child has some difficulty answering, the teacher typically asks the other children in the class to help little Giovanna or Giuseppe figure out an answer, and a discussion starts. The context changes: knowledge seeking becomes communal. I've seen some astonishing scenes there. I've even started using this approach teaching graduate students. I'm still trying to think through the theory behind it, and even making a little progress. As Mike has been trying to tell us, people need to think about what they have in mind with their interventions. Then they'll be able to evaluate properly.

Now I want to move on to Fred Mosteller's admonition about attending to variance. I'd like to look at it from the point of view of American performance on the tests now being widely used for comparing adult "literacy" in the nineteen most well-off countries in the world, including top-ranking America. These tests, devised by the Office of Economic Cooperation and Development, are thoughtfully designed and carefully translated into the different languages required. There are three subtests: one for ability to recognize prose, as in news stories and the like; another for "document literacy," or the ability to understand order forms, tables, and so on; and a third for "quantitative literacy," or knowing how to perform such tasks as balancing a checkbook and figuring a tip. Let's take a look at some findings from these tests.

First of all, as everybody knows, America doesn't do well on international tests. For example, among those nineteen well-off countries, we're ninth on the prose score, fourteenth on the document score, and thirteenth on quantitative—twelfth among nineteen on the composite score. You'd think, given our riches, we'd do better than that.

But where we undoubtedly lead the world is in variability, or dispersion. American standard deviations on all the tests are just about at the top. For example, on the prose test, we rank first in the size of our standard deviation; on the document test and on the quantitative test, we rank second. We lead the world in the standard deviation of composite scores—the most diverse country in the well-off world.

If you look at the test-score difference between the top tenth percentile and the lowest tenth percentile in each country, again we lead the pack. Our lowest percentile is way, way down; our top tenth is way, way up. America seems to have a gift for fostering maldistribution or inequality. No country in the civilized world can match us in terms of the maldistribution of wealth, the gap between rich and poor. And it seems, too, that none can match the gap we create between our most literate and

least literate countrymen. Ours is a diversity of inequality.

What about the history of all this? Are we getting better or worse in literacy, in comparison with other well-to-do nations? We can estimate this by looking at different age groups, and what comes out is not encouraging. Our youngest Americans—ages sixteen to twenty-five—rank fourteenth out of nineteen in the world on the composite literacy score. The age group twenty-six to thirty-five ranks eleventh. With the group that is thirty-six to forty-five years old, we go to fifth place. And the two oldest groups, ages forty-six to fifty-five and fifty-six to sixty-five, are second and third in the world ranking. So either America is falling behind, or the rest of the world is surging ahead, in literacy.

How much of this has to do with immigration? Our native-born Americans ranked tenth out of the seventeen countries on which there were immigration figures. Our foreign-born ranked sixteenth out of those seventeen countries. Our own past history suggests that when immigrants get segregated in caste conditions, as in our inner-city slums, second-generation "immigrants" continue to lag behind or even get pushed down further. So immigration is an issue, alright, though not an enormous one numerically.

I suspect, though, that the ones who are falling furthest behind world standards are poor blacks and poor second-generation Latinos. Yet there is an irony in this decline, for we know from intensive studies that with improved teacher expertise and classroom conditions, these groups can be greatly helped. If we in America are willing to do something about it, plenty can be done. But not much is being done. So our world position remains parlous—not to mention the conditions that such inequalities produce here in the United States.

If we follow Mike's wisdom, we can begin to turn the tide, though we will have to take measures beyond the usual educational ones—for instance, assuring a more equitable distribution of wealth. After all, we know that the sense of helplessness

and despair produced by poverty is the worst block against improved school performance. On that basis, school reform without concomitant economic reform is simply not sufficient.

So, to return to Mike's message, we should indeed look more deeply and more theoretically at the causes of good and poor school performance, and propose reforms that take into account what it is that makes American society so prone to inequality—what it is that puts us in top position for variability in national literacy.

Science as a Window into Wine History

Carole P. Meredith, Professor of Viticulture and Enology, University of California, Davis

The 1863rd Stated Meeting was hosted by the Academy's Western Center in Napa, California, on November 2, 2002. The meeting included tours of the Robert Mondavi Winery and COPIA: The American Center for Food, Wine & the Arts. President Patricia Meyer Spacks (University of Virginia), Western Center Vice President John Hogness (University of Washington), and Executive Officer Leslie Berlowitz welcomed Fellows and guests, as well as several newly elected members from the Western region.

Speaker Carole P. Meredith was introduced by Academy Fellow Walter Fitch, a professor in the Department of Ecology and Evolutionary Biology at UC Irvine. Meredith, a specialist in the DNA and genealogy of grapes, brings her insights as a wine maker to her work in academia. Her remarks follow.

My husband and I live in the hills on the west side of the Napa Valley. We have a vineyard, and we make wine under our own label, Lagier Meredith—a combination of our last names. Once we began growing grapes and making wine on our own, I developed a real understanding of the interests of my constituents—the grape growers and wine makers of California. Now that I also get my hands dirty, I think I do my job at the university a lot better.

Over the past ten years, my lab has been looking into the history of some of the classic wine grapes of the world. At first we thought we were simply working on variety identification. There are thousands of wine grape varieties in the world, and even more names that they go by. We thought we were developing a method to resolve some of the problems that result from using more than one name for the same wine grape. This becomes a technical

Speaker Carole P. Meredith (UC Davis)

issue, because people can't talk to each other if they don't know they're talking about the same grape variety. It also becomes an economic and regulatory issue with regard to wine labeling and the regulations of various governments about how beverages must be identified. We started out to use DNA typing simply as a method for objectively and irrefutably identifying grape varieties in order to reconcile some of the many problems and mistakes that exist around the world.

It rapidly became clear to us that this technology could also be a powerful tool for understanding genetic relationships among some of the classic wine grapes in the world and thereby resolving questions about their origins. I'm going to discuss our findings on four varieties: two classic grapes, Cabernet Sauvignon and Chardonnay, and two that are particularly important in California, Petite Sirah and Zinfandel. I will start with the Cabernet Sauvignon story, which represents the beginning of our work in this field, thanks to a serendipitous discovery.

First, however, it's important to explain how grapes are propagated, because that is key to understanding how a classic grape variety that is growing today in the Napa Valley—or in France or Australia or South Africa—is essentially unchanged from the first vine of that variety, which arose many centuries

ago. All the classic wine grapes are very, very old. They have been maintained by vegetative propagation, which means by using cuttings or buds, as you would with geraniums. Although some small genetic changes have taken place in the classic vines throughout history, they are essentially unchanged from the very first vines of those varieties.

All vines propagated by cuttings or buds from a preexisting vine are essentially clones. The first vine of a given variety is the only one that grew from a seed. That seed was the result of a sexual event that took place between two parents. In the case of grapevines, the two parents are always completely different genetically. Except for the propagation part—the cuttings and buds—this is completely analogous to human reproduction. Each person shares a lot of genetic material with both parents yet is completely dissimilar from each of them genetically. It's exactly the same with a grape variety. All the individual plants of that variety are genetically almost identical to each other, but they share only half their genetic information with each of the two parents that gave rise to the first vine of that variety. That's a key point to keep in mind.

Cultivated grape varieties can originate in a number of different ways. The very first cultivated grapes that existed were selections of wild vines. Bear in mind that all crops, including grapes, are derived from wild plants; they are not simply the products of human efforts.

Along the Napa River and the creeks in that area, grapevines with bright yellow leaves climb up the trees. They are *Vitis californica*—a wild vine, not cultivated. The wine grapes are all *Vitis vinifera*—a species native to Europe and western Asia. The first grape varieties were simply individual wild vines with fruit that people found attractive and eventually learned how to propagate. We cannot really learn anything about varieties that were selections from wild vines, because the wild genotypes that gave rise to those grapes no longer exist.

Another way that grape varieties can originate is by natural cross-pollination—either between wild

vines and the earliest of the cultivated varieties, or between the cultivated varieties themselves. All of the work that I'm going to talk about today takes advantage of what we can learn about these natural cross-pollinations. Over the past 160 years or so, modern grape breeders have performed controlled cross-pollinations between selected parents to develop new varieties. None of the classic wine grapes, however, have originated from a controlled cross; they are all so old as to predate deliberate cross-pollination between any kinds of plants, which did not begin until the eighteenth century.

To identify the genetic origins of a grapevine, we take a sample of that vine and chemically purify the DNA from the other components. We then target specific small segments of the DNA that we have previously identified as existing in multiple forms (called "alleles"), and we use a process called polymerase chain reaction (PCR) to make millions of copies of those small segments (called "markers"). We can then compare the alleles at a particular marker site in one variety with the alleles at that same site in another variety to establish whether they are the same or different. We follow this procedure for each marker we are analyzing. This is completely analogous to human DNA profiling. If

Left to right: George Olah (University of Southern California) and Gabor Somorjai (UC Berkeley)

you understand at all how human DNA profiling is performed in order to analyze genetic relationships among humans, then you won't have any trouble understanding what we do with grapes.

We look at the DNA profile of the variety we are curious about, along with the profiles of a pair of putative parent varieties. If we are indeed examining the actual parents, the progeny variety should share, at each marker site, one allele with one parent and one allele with the other parent. We analyze a large number of marker sites in order to deduce whether or not there is a probable parental relationship between two varieties and a third variety that we postulate to be the offspring.

Cabernet Sauvignon, as you probably know, is the most important red wine grape of the Bordeaux region of France. Wines labeled "Bordeaux" are typically made predominantly from Cabernet Sauvignon, along with Merlot and sometimes several other varieties. Cabernet Sauvignon, which is considered by many to be the most important and highest-quality red wine variety in the world, is widely grown in California and the New World countries. Because the name Sauvignon is derived from the old French word *sauvage,* meaning "wild," many people have speculated that Cabernet Sauvignon is a selection from a wild vine. We now know that it is not. Others have speculated that the Romans brought Cabernet Sauvignon into France from Albania, but we now know that was not the case. Still others have suggested that it was brought from Spain, but it wasn't. What we learned back in 1996 (this was our lab's first discovery, and it came as a big surprise) was that Cabernet Sauvignon is the offspring of Cabernet Franc, a red wine variety, and Sauvignon blanc, a white wine variety.

We went on to find that it's quite common for dark wine grapes to have one white parent. The color form is simply a dominant trait in the case of Cabernet Sauvignon. This was a discovery of a former graduate student of mine, John Bowers, who grew up in the Napa Valley in a family that has been involved with wine grapes for a long time. We were developing a database of the most important

wine grape varieties so that whenever we came across an unknown, we'd be able to identify it by matching the DNA profiles. At the time, we had only about fifty varieties in our database. One day John realized that his data showed that Cabernet Sauvignon shared half of its alleles with Cabernet Franc and half with Sauvignon blanc, which strongly suggested that those two varieties could be the parents of Cabernet Sauvignon. We then used some statistical methods that are used in human genetics to answer various questions: For each allele found in the offspring, how common is it in the whole population of grape varieties? What is the chance that Cabernet Sauvignon could share half of its alleles with Cabernet Franc and half with Sauvignon blanc simply by chance? What is the chance that Cabernet Sauvignon would have those alleles if those two varieties really were the parents? What we found, by fairly straightforward statistical analysis, is that it is vastly more likely that Cabernet Franc and Sauvignon blanc really are the parents of Cabernet Sauvignon.

This was the first time anyone had identified the origins of a classic wine grape. Up until then, wine writers had been free to speculate whatever they wanted about a variety's origins. There was never any way to examine their hypotheses until we realized that modern genetics gives us a way to learn about historical events that took place centuries or even millennia ago. By combining our new information with what we could glean from the French wine literature, we were able to deduce that Cabernet Sauvignon resulted from a natural cross in Bordeaux before 1700, because the first mention of Cabernet Sauvignon as being distinct from Cabernet Franc, with which it actually shares some physical characteristics, was made in the early 1700s.

Realizing that we had a powerful tool on our hands for learning about important wine grapes, we became more deliberate in our investigations. Another variety we have studied, Petite Sirah, has been grown in California for a very long time. It has never been a major grape, but it has had some

The garden at COPIA: The American Center for Food, Wine & the Arts (Napa, CA)

strong proponents. For a long time people thought that perhaps Petite Sirah was a form of Syrah, the noble grape of the Rhône valley in France. We knew that was probably not the case, because they were morphologically different, and so we began to investigate the origins of Petite Sirah. We obtained samples of some varieties that we thought would be relevant, including Peloursin and Durif, both from the south of France. We found that almost all of the Petite Sirah in California matched the DNA profile of Durif at every marker. Occasionally, however, we came across some Petite Sirah that matched the profile of Peloursin. When we investigated a bit further, we saw that Peloursin, although completely distinct from Durif, shares one allele with Durif at every marker, which suggested that Peloursin has a parental relationship with Durif.

We eventually determined that the French variety called Durif, which is the same as the California-grown grape known as Petite Sirah, is actually the offspring of Peloursin and true Syrah. This came as quite a surprise to people (even though the name used in California is Petite Sirah) because, having been told that Petite Sirah was definitely not the same variety as Syrah, people had begun to consider them as two completely different grapes. In fact, many regarded Petite Sirah with scorn, as if that grape were trying to pass as a relative of Syrah. When we discovered that Petite Sirah is Durif and confirmed that it is not Syrah, its detractors

thought, "Told you so. It has nothing to do with Syrah." But then, shortly thereafter, we found out that Petite Syrah is the offspring of Syrah. So now Petite Sirah has taken on an elevated status because of the recognition that it is one-half Syrah, and people are noticing the similarities. Our discovery has been rather helpful to the people who produce Petite Sirah, because it has enabled them to gain inclusion in a trade organization called the Rhône Rangers, which promotes Rhône varieties grown in California.

Having found the parents of Cabernet Sauvignon and Petite Sirah, we decided to make a deliberate search for parents of other varieties by selecting a large number of candidates on the basis of certain criteria. We enlisted the collaboration of the world's greatest living expert on French grapes, Dr. Jean-Michel Boursiquot, who at the time was a scientist and teacher in Montpellier. He was eager to participate in our project; after all, an American group had found the origin of a famous French grape, Cabernet Sauvignon, so our French colleagues were understandably interested in joining our efforts. We decided to focus on northeastern France, which is where Burgundy and Champagne are located. We chose about 300 candidates from the several thousand varieties at the French national grape variety collection in Montpellier, on the Mediterranean coast of France. Many of the varieties in that wonderful collection are no longer grown in France; they were rescued from remnant populations in vineyards destroyed by phylloxera. Some of these varieties were saved from extinction by being brought to the Montpellier site, where phylloxera cannot survive.

Mainly, we chose varieties that looked like those grown today in northeastern France, or varieties that had some historical tie to that part of France, or varieties that historical records speculated were related to varieties growing in the region. We also chose some varieties on a hunch, even though we didn't have any concrete basis for including them.

We generated DNA profiles for those 300 varieties, at a relatively limited number of markers, so that

we could quickly eliminate those that were not closely related to the grapes of northeastern France. We analyzed the remaining varieties at a larger number of markers. John Bowers developed a computer program that would search among the DNA profiles of these varieties for parental relationships. We use numbers to record DNA data, and because the data are numerical, we can analyze them with a computer program; we don't have to rely on visual comparisons of DNA bands on a gel.

Among the 300 varieties analyzed, we found 26 pairs of parents for 26 varieties. Much to our surprise, however, those parents were not 26 different pairs. We found that 16 of the varieties had the same pair of parents: Pinot, which is the classic grape of northeastern France, and Gouais blanc, a variety I had never heard of before. All of the 16 different offspring most probably resulted from completely independent cross-pollination events that occurred in different places and at different times. Many of those offspring are varieties you've never heard of; some are no longer grown today. But one of those varieties is Chardonnay, which is probably the most important white wine grape grown in the world today. Some others are Melon, a quite important variety that produces the white Muscadet wines at the mouth of the Loire; Gamay noir, the grape from which the true Beaujolais is produced; and Aligote and Auxerrois, both important white wine grapes in northeastern France today. All of the 16 varieties with the same pair of parents are grown today, or were grown, in a corner of northeastern France, the area we were targeting.

It was a great advantage to have access to a collection like the one in Montpellier. If we had simply relied on commercial vineyards, we never would have discovered some of these genetic relationships. In fact, we never would have found Gouais, one of the parents, because it is not cultivated anywhere in France today; it exists only in the collection.

You may wonder why I'm saying Pinot when there is a Pinot noir, a Pinot gris, and a Pinot blanc. It's because these are simply three different color forms of the same variety; they all have the same DNA

Edward Feigenbaum of the Membership Committee (Stanford University), with Councilor Carolyn Shoemaker (Lowell Observatory)

profile. When we found that one of the parents of the 16 offspring was a Pinot, we did not know which of the color forms of Pinot it might have been in each of the 16 cases. (We would be able to figure that out, however, if we produced and tested some progeny from each of the 16.)

Pinot is known to be a very old variety. A Roman naturalist, writing about the things that were growing in Burgundy when the Romans arrived there about 2,000 years ago, described a variety that sounds just like Pinot noir. None of the grapes that were grown in the more southern parts of Europe resemble Pinot at all; it has a distinctive leaf shape. Gouais blanc, a reliable, sturdy grape, was once widely grown in northeastern France. In fact, Pinot and Gouais were the two most widely grown varieties in that region during the Middle Ages. However, whereas Pinot was grown by the nobility and the church on the best sites, usually on the slopes, Gouais was grown only by the peasants on the flat lands where they lived. Gouais was considered so mediocre that it was banned at least twice in Burgundy for being just too ordinary.

Using some old French books, we were able to deduce the probable distribution of both Gouais and Pinot in the Middle Ages. There would have

been ample opportunity for cross-pollination events between those two varieties, with Pinot growing on the slopes and Gouais growing on the nearby flats. Presumably, lots of individual seedlings sprung up over the years in different places and at different times, each the result of a cross-pollination between Gouais and Pinot.

We know that Pinot was already in northeastern France when the Romans arrived, but Gouais was not. Gouais blanc is actually a French synonym for an eastern European grape known as Heunisch weiss. How did it get to Burgundy? There seems to be some fairly strong evidence that Gouais was brought to France by Emperor Probus of Rome. Some previous emperors had become resentful of wine production in the provinces, because it was competing with wine production in Rome; for a time, Emperor Domitian actually prohibited grape growing in the provinces. But Probus, who had a great interest in agriculture, liked the provinces, and he especially liked the Gauls. He was from Dalmatia, which is part of present-day Croatia. It is written that he gave the Gauls a gift of a grapevine from his homeland. We have no proof, but we can speculate that perhaps that vine was Gouais blanc.

Why are Pinot and Gouais the parents of so many varieties? We have never found another pair of parents with offspring of more than one variety. We think it's quite likely that Pinot and Gouais make such a great combination because they arose from completely unrelated original wild populations. It's a classic example of heterosis—of genetically dissimilar parents producing very fit and adaptable offspring.

The most recent work my lab has been doing is probably the most satisfying for me because it has become so multidimensional: it's not only about genetics and history but also about people and collaboration.

Zinfandel is a very important and widely grown wine grape from California. It is used to make a number of outstanding wines, ranging from a rośe

that is called White Zinfandel to the very robust and dark-colored red Zinfandel wines that come from grapes grown in some of the cooler California regions. For a long time, Californians thought of Zinfandel as California's own grape, because no grape in Europe goes by that name. It was rather nice to think that for once we weren't emulating Europe by using another one of its classic grapes. Here we had a wine grape of our own, and it was a pretty good one too.

Nevertheless, it was obvious that Zinfandel was a member of *Vitis vinifera,* a European species. Because there is no *Vitis vinifera* native to the New World, Zinfandel must have originated somewhere in Europe—but we didn't know where. This mystery was the subject of books and a lot of speculation. Finding the answer was not only of historical interest; it also had some practical interest because today's growers of Cabernet Sauvignon or Syrah or Chardonnay often like to plant more than one subtype of that variety.

Subtypes within a variety are called "clones." This is an unfortunate use of the word, because in wine, "clone" means something quite different from what it means in most biological contexts. The different subtypes of a variety are often adapted to slightly different conditions: they may ripen a bit earlier, or have a slightly different aroma, or have slightly larger or smaller berries. Growers and winemakers often have preferences, depending on the location of the vineyards or the kind of wine that they want to make. In California, all we had was a fairly uniform Zinfandel that had been grown here for a hundred years or so. If we wanted to get some more diversity into that variety, we had no idea where to go. If we wanted more subtypes of Chardonnay, we'd go to Burgundy. For subtypes of Cabernet Sauvignon, we'd go to Bordeaux. For subtypes of Syrah, we'd go to the Rhône. But for Zinfandel, we had no place to go.

In the 1970s, Austin Goheen, a retired colleague from UC Davis, was attending a conference in Apulia, on the heel of Italy. He tasted a local wine

with an Italian colleague and said, "This tastes like Zinfandel. Can you show me the vines?" Despite being told that the wine was nothing but an ordinary local red, Austin persisted and was shown the vines. They looked exactly like Zinfandel, and he thought that he might have finally found the home of that variety. The Italians called the grape Primitivo di Gioia. Eventually, when we did DNA comparisons, it became very clear that Primitivo and Zinfandel are simply synonyms for the same variety. But if you look into the history of Primitivo in Italy, it is referred to as an introduced grape, and it has not been grown there long at all. So Italy is not the home of Zinfandel.

The next place we became interested in was present-day Croatia, which used to be part of Yugoslavia before it separated into its component republics. The most distinguished red wine grape grown along the Dalmatian coast of Croatia, on the Adriatic Sea—as well as on many of the 1,100 islands off the coast—is Plavac Mali, long suspected to be the same as Zinfandel, or at least a relative. The Dalmatian coast is very close to the heel of Italy, so it's entirely possible that a grape grown there might have found its way to Italy.

Miljenko Grgich, a Napa Valley winemaker who is originally from what is now Croatia, had been insisting for years that Plavac Mali was the original Zinfandel. He was very excited to learn of our

Councilor Peter Stansky (Stanford University) and President Patricia Meyer Spacks (University of Virginia) at the Robert Mondavi Winery

investigation and wanted to help in any way he could. Having left the former Yugoslavia a long time ago to seek his fortune in America, he felt that establishing a viticultural connection between his new home, California, and his old home, Croatia, would make his life complete.

In 1998, after having looked at a number of samples that we already had in Davis without reaching any satisfactory conclusions, I decided to go to Croatia, where I serendipitously made contact with two scientists at the University of Zagreb, Ivan Pejic and Edi Maletic. Even more serendipitously, I was able to enlist the help of Jasenka Piljac, a native of Croatia. We had first met when she was an undergraduate in biochemistry, washing dishes in my lab to earn some extra money (her parents had moved their large family to Davis when civil war broke out in Yugoslavia). Jasenka graduated from UC Davis with fantastic grades and had just returned to Croatia when I decided to embark upon my "Zinquest." During my first trip to Croatia, she was my assistant, my translator, and my companion—an all-around great person to have at my side.

The four of us (Ivan, Edi, Jasenka, and I) traveled along the coast and to some islands, taking samples from various Plavac Mali vineyards, and then I brought them back to Davis to do the DNA analysis. My hypothesis at the time was that Plavac Mali was a genetically heterogeneous variety. We'd already looked at some samples of Plavac Mali vines maintained in Davis. They weren't the same as Zinfandel, but I thought that perhaps if we looked at a larger range of samples from the Dalmatian Coast, we would find some that were Zinfandel. What we found, though, was that all 150 samples I brought back from Croatia were the same as what we already had in Davis, and none of them was Zinfandel.

Nevertheless, we did find a striking genetic relationship: Zinfandel turned out to be one of the parents of Plavac Mali. This came as a real surprise, because Plavac Mali is considered an old Dalmatian

grape, whereas Zinfandel has been viewed as a relatively young California upstart of unknown origins. It took us quite some time to find the other parent, but we eventually found it on an island off the coast. After my 1998 visit to Croatia, when it became clear that Plavac Mali was not Zinfandel, Ivan and Edi had continued to search. Every summer they visited more vineyards on more islands and talked to the growers in an effort to find every grape that could possibly be related to Zinfandel. Eventually, they found the variety called Dobricic, which turned out to be the other parent of Plavac Mali—the missing link in the Zinfandel–Plavac Mali relationship.

Although we had not found Zinfandel in Croatia, we had found its genetic footprints. We were beginning to suspect that Zinfandel was extinct in its homeland. When phylloxera went through Europe, it destroyed a lot of vineyards, and many varieties were lost. Unlike the French, the people of the Dalmatian Coast area did not have the resources or the foresight to establish a regional grape variety collection before all was lost. The damage done by phylloxera in Croatia, followed by the ravages of the Communist government and a couple of world wars, had all contributed to driving people off the land. We began to think we would never find Zinfandel in Croatia because it had probably succumbed to one of the many factors that had depleted the genetic resources of the Croatian vineyards.

Nonetheless, Ivan and Edi kept looking, and sending samples back to us, in 1999, 2000, and 2001. Their search was focused on the Dalmatian Coast between Dubrovnik, a UNESCO World Heritage city, and Split, an old Roman settlement, as well as a number of the major islands in the region. They always included little descriptions with the samples: "This one looks a lot like Zin," or "Take a good look at this one; this has got to be Zin." We kept analyzing them. None of them was Zinfandel, but many were its relatives. We were putting pieces of the puzzle together, but we were still missing Zinfandel itself.

Left to right: David Hogness (Stanford University) and Richard Herr (UC Berkeley)

At the end of 2001, I got an e-mail from Ivan that said, "This time we've really found it. We've really got Zin." He had sent me the same sort of message several times before, so he was starting to sound like the boy who cried wolf. But by this time, Ivan had managed to equip his own lab to do some limited DNA analysis, even though it was very difficult for him to obtain the necessary chemicals. He said, "Listen, I've already looked at six markers. They match Zinfandel. We've found it. Mystery solved." I told him I wouldn't be convinced until we had analyzed more markers at Davis. He sent us the samples, and within a week or so of receiving them, we'd analyzed a lot more markers. This grape matched Zinfandel completely. In Croatia, it goes by the name Crljenak Kastelanski, which simply means "reddish grape from Kastela," a coastal town just north of Split. So far we have confirmed the presence of this grape in only one vineyard, which has several thousand vines in it. Only nine of them are Zinfandel, and the rest are about a dozen other varieties. Had we waited a few more years, we might never have found it, because vineyards get replanted, and nobody recognized that there was anything special about this particular vineyard.

Ivan and Edi are continuing to look for more examples of Zinfandel in Croatia. I was there this past August and went with them to the vineyard where Crljenak Kastelanski is growing, so I could

see the vines for myself (and have my picture taken with them!). Ivan and Edi are hopeful that they will find this variety in more vineyards, and they will continue to look. During my most recent visit, we went to some vineyards on the islands of Solta and Ciovo and found some promising candidates on Ciovo.

We've now pieced together a possible history for the grape variety known as Zinfandel here, as Primitivo in Italy, and as Crljenak Kastelanski in Croatia (hence our own name for it: ZPC). This variety was born somewhere along the Dalmatian Coast and spread widely throughout the coast and the islands. We think that some monks who emigrated from Croatia to southern Italy in the eighteenth century to escape historically documented religious persecution brought the grape with them to Italy, where it became known as Primitivo and is now widely grown. At the same time, the grape also managed to make its way to the United States, but we're not certain how. One possibility is that it was established in the Vienna grape variety collection of Emperor Franz Josef, whose Austro-Hungarian empire included present-day Croatia, and then was imported from Vienna by a nurseryman on Long Island. Also, a lot of Croatians have made their way to California, and many are growing grapes here today. It's possible that some of them may have brought the variety with them.

We think that Zinfandel (a.k.a. Crljenak Kastelanski) was once widely grown in Croatia. Disease probably killed most of the vines, but not before a chance cross-pollination took place between Crljenak Kastelanski and Dobricic, giving rise to a seedling that became Plavac Mali. It probably was not noticed that Plavac Mali supplanted Crljenak Kastelanski, because they're very similar in appearance, but Plavac Mali was much better able to resist the disease pressure that had killed off the Crljenak Kastelanski, and thus it became well established as the most important red wine grape of Croatia today.

AMERICAN ACADEMY OF ARTS AND SCIENCES

Main Office Norton's Woods
136 Irving Street
Cambridge, Massachusetts 02138
Telephone: 617-576-5000
Fax: 617-576-5050
E-mail: aaas@amacad.org
Website: http://www.amacad.org

Daedalus Telephone: 617-491-2600
Fax: 617-576-5088
E-mail: daedalus@amacad.org

Western Center 3000 Berkeley Place
University of California
Irvine, California 92697-7425
Telephone: 949-824-4553
Fax: 949-824-8022
E-mail: aaaswest@uci.edu

Midwest Center Lillie House, University of Chicago
5801 South Kenwood Avenue
Chicago, Illinois 60637
Telephone: 773-753-8162
Fax: 773-702-1115
E-mail: amacad@uchicago.edu

Bulletin Staff Alexandra Oleson, *Editor*
Carol Leach, *Associate Editor*

Cover photo © Steve Rosenthal.

FORTHCOMING STATED MEETINGS

March 12, 2003 at the House of the Academy

"A Tribute to Herman Feshbach and Victor Weisskopf" by ***Carl Kaysen*** *(MIT)*

Speaker: ***Steven Weinberg*** *(University of Texas, Austin) on "Nuclear Terror: Ambling Toward Apocalypse"*

April 10, 2003 at the Boston Athenaeum

Joint Meeting of the Academy and the Boston Athenaeum

Speaker: ***Patricia Meyer Spacks*** *(University of Virginia) on "How to Read a Diary"*

May 14, 2003 at the House of the Academy

Annual Meeting

Inaugural S. T. Lee Lecture in the Humanities

Speaker: ***Denis Donoghue*** *(New York University) on "Joyce and the Revolution of the Word"*

May 15, 2003 at the Library of Congress

Program: ***Judith Resnik*** *(Yale University) and panel on "The Independence of the Federal Judiciary"*

Save the Date: Induction Ceremony—October 11, 2003

Visit our website at **www.amacad.org** for updates to this schedule.