

## Opening Remarks

George Rupp  
Jonathan Cole

RUPP: My name is George Rupp. I'm delighted to welcome you to this third and final conference in the series commemorating the 50th anniversary of Vannevar Bush's *Science: The Endless Frontier*. Many of you who attended the first two conferences will know that those sessions focused on the history of Bush's policy design and on the impact of that policy design for American research and development.

Today, the focus shifts to the future, to an examination of what science and technology can or should be in the coming years. As we begin this look ahead, I'd like to take just a few minutes to underscore a point that we probably all agree on but that seems to me ominous nonetheless. The point is that developments in the relationship between government and universities, changes that are underway right now, threaten to undermine what has been a remarkably successful interaction since the close of World War II, in the sense the first two sessions of this conference celebrated.

The changes can be characterized as a transition from a confident partnership intent on seizing opportunities to a stagnant or declining enterprise with a focus on downsizing or cost shifting. That is admittedly a somber way of characterizing the transition, but I think it's not an inaccurate one. This transition is of course not confined to research. Government support for student aid and medical education and health care reflects the same pattern. In each case, costs are shifted from the government to non-government partners.

As we all know, the post-war recognition of the value of the government/university partnership resulted in growing funding for research and a research establishment preeminent in the world. But the years bore as well the seeds of a dilemma, bred by the very success of this partnership. Together with the new ideas and the new applications of those ideas came a rapid increase in the number of trained scientists who now seek support and an expectation that government support would continue to increase indefinitely.

The leveling of research funding in recent years and dire forecasts of significant declines in the coming years are the clearest indicators of the change in the government/university relationship that I've described. But other less obvious forces are also at work here. Pressures to reduce indirect cost recovery and increasingly prevalent instances of cost sharing by universities have the effect of shifting costs from the government to the institutions that perform research.

Whatever our views on the advisability or feasibility of cutting government spending, shifting costs to other institutions is not reducing expenditures. It is instead – to use the rhetoric of the cost cutters against their own approach – a form of unfunded mandate. And it has the effect of undermining partners in the research enterprise.

What can we do? How can we work together to mitigate the impacts of this changing environment in government/university relations and to re-establish an effective public sense of

research as a means of seizing and realizing opportunities as it was during the decades following World War II?

First, we must re-double efforts to articulate the importance (BREAK IN TAPE)

RUPP: ... in the pursuit of knowledge and in the education of scientists and engineers. Individual universities, consortia of universities, and coalitions of universities, scientists, and industrial leaders are hard at work at this admittedly difficult task.

Second, we can and should resist the insidious progression of the shifting of costs from government to universities and other research institutions. Decision makers must be made to understand that those shifts cannot be expected to occur without substantial negative impact on the research effort itself and on the institutions that perform research. Cost shifting is not cost cutting.

Third, we at universities must re-think the ways we seek to enhance our academic and research programs. For decades, such enhancement has been presumed to be pursued through growth by the addition of faculty and research staff and research programs. That much change. It must change to a strategy of enhancement through consolidation and integration. A strategy of drawing together and building upon already developed strengths instead of simply adding new programs.

At most universities, these strengths are now fragmented and dispersed. This isolation and insulation of individual scientists and departments must change. Happily, the need to link disparate elements of the university coincides with an increasing recognition of the importance of interdisciplinary collaborations in the conduct of research. More and more, important research issues lie at the boundaries of established disciplines or even at the area between them and require the efforts and expertise of groups of scientists from multiple disciplines.

Two brief examples of recent initiatives here at Columbia illustrate this point. The study of neurobiology and behavior now involves research efforts, many of them collaborative, of more than 40 faculty members in ten different departments on both this campus and our health sciences campus. A new university-wide Ph.D. program ties together the various elements of this field. That's one example.

Another example is our emerging initiative to engage global and environmental issues more effectively. To that end, we're in the process of establishing the Columbia Earth Institute. This Earth Institute will connect research efforts in the Lamont Doherty Earth Observatory, the Center for Environmental Research and Conservation, which itself already pulls together multiple research efforts both on this campus and in other New York institutions, the Geology Department, which we're now renaming the Department of Earth and Environmental Sciences, the School of International and Public Affairs, and the Business School.

Now in both of these instances – the brain and behavior and the Earth Institute – we are drawing together widely dispersed strengths to address issues that can be investigated more effectively if we overcome tendencies towards separation and duplication. We cannot but be apprehensive as

the magnificent research enterprise built in this country over the last several decades is threatened. We all know that this enterprise faces substantial changes in the coming years. The focus of this meeting is on those changes.

What will they be? What should they be? How do we get there from here? I think you will agree that the organizers have gathered a group of speakers and panelists who by virtue of their experience and expertise can shed light on these and other pressing questions that confront us all. I am therefore delighted to welcome you and I look forward with you to a stimulating and productive conference. Thank you for coming.

COLE: Thank you, George, for launching us. I want to thank the approximately 30 speakers and 300 participants for joining us in this third part of our conference series, “Science The Endless Frontier, 1945-1995.” For many of you, I know this is really the occasion for a reunion, and we like that and we hope that the conversations among you will shed light on the issues at hand.

Let me speak very briefly about the context in which we have placed this third session and indeed all of the sessions of this conference.

About three years ago, as the 50th anniversary of the publication of Vannevar Bush's *Science: The Endless Frontier* approached, a number of us interested in science policy at Columbia and other institutions across the country thought that it would be appropriate to hold a series of conferences that attempted to do really three basic things.

First was to consider in analytic terms the origins of the extraordinary work that helped to shape the discourse and the policy that has produced some of the most glorious scientific and technological achievements certainly since the 17th Century in England, probably in all of human history. What were the origins of the Bush report? What were the debates shaping it? What were the causes of the formulation of the elaborated role of the federal government in shaping the future of science and technology in America? What aspects of the report were implemented? What was changed as a result of debate and Congressional action?

We were fortunate to have at that first meeting on December 9, 1994, some individuals, such as Harvey Brooks, I.B. Cohen, and Bill Golden, who participated actually in the birth of the Bush model for national innovation. Some of them are here today.

The second conference held here on June 9, 1995, had the explicit aim to think analytically and collaboratively about the historical achievements and failures of American science and technology as it has operated within the framework of the Bush manifesto over the past half-century. To analyze the strains that have developed in the alliance or partnership between the federal government and research universities and to identify the causes of what have been perceived widely as a crisis over the terms of that partnership.

Third, we come to this very rich and full two-day conference. From the outset, we believed and said that this conference would pose the most difficult set of questions and problems for an extraordinary group of presenters, panelists, and active conference participants.

This third set of sessions is intended to be more prescriptive. We are now looking forward and trying to formulate ideas about how problems in the current national system of innovation can be solved. We are trying to look toward the next half-century and, within the context of a very changed world from that which confronted Bush and his colleagues, develop ideas for the next phase of science policy in the United States.

We have asked a truly distinguished group of individuals to present their ideas for the future of science and technology policy as it relates to specific areas of the institutional landscape. Unfortunately, many of the political leaders who had hoped to participate today had to withdraw even quite recently. The elections must be getting near.

This specific set of issues that we face today and tomorrow relate of course to the most fundamental global question and that is, is there a need for a major or radical shift in the national system of innovation? Is the Bush framework truly exhausted? Are the social, economic, and political conditions of globalization and internationalization without a well-defined military threat so different from the context in which Bush worked that the system needs fundamental restructuring?

In short, is the system really broken in fundamental ways in the sense that continuing along the current path will lead to the loss of America's preeminent position in the development of science and technology? Or, are we really discussing tinkering with the Bush model in light of significantly new conditions? But tinkering that does not require fundamental changes in the values or structures that were designed and built 50 years ago.

Beyond these issues, we ought to be addressing the question of mechanisms. If the system is at substantial risk, or if it simply needs a far less dramatic tune-up with a few new design features, what are the political, social, and scientific mechanisms required for achieving those changes?

Beyond these global matters of science policy, there are other issues that need to be addressed: the public perception of the value of science, the nature of discovery and the linkage between science, technology, and social welfare. The level of scientific illiteracy in the United States has reached alarming proportions. It needs to be addressed or the field will be ripe for the growth of very strong anti-science movements. So we have much to do.

We are under no illusion that the outcome of this conference series will be Bush II, but we do hope that the analysis and discussion over the next two days will set the stage for some concrete proposals for changes that may be needed in the national system of innovation.

I want to thank those of you who have agreed to make presentations and those who will be responding to those presentations. We do very much appreciate you joining us here at Columbia. We realize how busy you are and take your presence here at Columbia today as indicative of your sense of the importance of the subject that we are discussing. We thank you for your concern and your interest.

*Science The Endless Frontier 1945-1995*  
*Learning from the Past, Designing for the Future*  
Part III – September 20-21, 1996

I also want to thank the nearly 300 members of the audience, who I trust will become active discussants following our panel presentations. Many of the most interesting moments of the first two sessions by the way came during the give-and-take in the periods of discussion.

Finally, I want to give special thanks to my three collaborators in the formulation of the conference series – to Professor Richard Nelson and Vice Provost Michael Crow, who will share the task of introducing our speakers, and to an extraordinary graduate student, Chris Tucker, who played a very active role in generating ideas for this conference and in seeing that they came to pass.

We're delighted that Columbia University, which has benefited greatly from the partnership between the federal government and the research university and has in some significant ways contributed to the achievements of science and technology that are the consequences of that enlightened policy, can host these conferences. Now to our busy program

Following the format established in the first two conferences, we'll keep the introductions of the speakers to a bare minimum since you have materials that give you longer descriptions of their many accomplishments. It is now my great pleasure to turn the podium over to Professor Richard Nelson who will introduce our first set of speakers. Thank you and welcome.