

Greetings and Introductions

Provost Jonathan Cole

COLE: Good morning. I'm Jonathan Cole, Provost and Dean of Faculties at Columbia. It is truly a great pleasure for me to welcome you to Columbia University and to the first of our three-part conference entitled "Science, the Endless Frontier 1945-1995: Learning from the Past, Designing for the Future."

Science and technology policy would appear to be in a state of crisis. There are many indicators that a crisis does exist in the partnership between the federal government and the American research universities, that the terms of the partnership are increasingly being questioned and re-examined. If it should turn out that this is not, in fact, the case, so many knowledgeable and informed members of the academic and scientific community believe that it is so, that the perception of crisis is real in its consequences.

It is probably not a matter of hyperbole to suggest that we are witnessing a number of fundamental changes in the relationship between the federal government and the scientific and technology research community. There are apt to be material changes in the national system as innovation proceeds in the years ahead. To many observers, this moment of crisis appears ironical, after all, each of us is aware of the extraordinary half-century of scientific and technological growth and achievement that we have witnessed in the United States.

This 50 years of exceptional growth in knowledge in terms of its diversity, sheer volume, and unquestionable quality is perhaps unmatched since the glorious period of scientific and technological development in 17th Century England. It happens that the past half-century of America's emergence as the pre-eminent nation in the development of science and technology coincides with the period since the publication of *Science: The Endless Frontier*.

Even if Vannevar Bush is as much a symbol of this period of dramatic progress as its putative architect, it seems fitting that in the 50th anniversary year of the publication of *Science: The Endless Frontier*, we celebrate the work and the period: reflect on the origins of the Bush paradigm for scientific excellence, take stock of where we currently are in the relationship between science and government, consider whether we are in a period of crisis, and do some serious work on the future shape of the national system of scientific and technological innovation.

Historically, Columbia has played a formidable role in the development and elaboration of post-war science policy. It also has been a major beneficiary of that policy. In examining our own history, I thought it fitting for Columbia to host the major working conference to address critical issues of American science policy.

To that end, roughly a year ago I brought together a group of Columbia faculty deeply interested in these issues, with the goal of formulating plans for this conference. The members of the conference planning committee are listed at the end of your agenda for today's meeting.

Professors Richard Nelson and Michael Crow, and an extraordinarily able graduate student, Chris Tucker, who spent scores of hours developing ideas for the conference series, merit special recognition. They consulted with some extraordinary colleagues from around the nation. Together we developed the central themes for this series.

Now the intent of this conference is more than a celebration of Vannevar Bush or a celebration of the 50th anniversary of the publication of Bush's pioneering report. It is our intent to have this series serve as a forum for the thought analysis of the current and historic policy environment and as a forum for the presentation of new concepts regarding the design of a new science and technology policy model.

We are, of course, aware of the ongoing debates in Washington regarding science and technology policy matters. While cognizant of these debates, which are apt to become still more intense with the recent changes in Congress and the possible prospect of an implemented "Contract With America," we intend for these meetings to be driven by analytical rigor and concept development.

The support of science by the federal government should concern us and we must, I believe, work to educate members of Congress about the returns on the public's investment in science and technology. We must make the effort to prevent damage to the organization of productive science and technologies at our universities and national laboratories.

But we should not mistake symptoms of crisis for its causes. We must concern ourselves with both the origins of the Bush model and how it facilitated the growth of knowledge, and the causes of stress and breakdown of some features of the model.

By design, therefore, these meetings are intended to serve not as another forum for debating the latest Washington policy option or issue, but rather as a forum for historic analysis and new concept development. That is why we have brought together this extraordinary group of knowledgeable experts, the speakers, panelists and active audience participants.

In terms of structure of support for scientific and technological innovation, where have we come from, where are we today, and where are we going?

This meeting will provide analysis and context for the two meetings to follow. We believe that a formal historical analysis of Vannevar Bush, his path-finding report, and the science policy that later evolved is in order.

The second conference in May 1995 will focus on reviewing the institutions for research that grew out of the Bush model, how the national system of innovation has evolved, and what the fundamental issues facing each group in the system are.

The last of the three conferences, to be held in the fall of 1995, will be two days in length and will focus on designing options for the future. We hope that each of you will be able to participate in all three of these meetings.

Many of you know that we are not alone in celebrating the half-century since the publication of *Science: The Endless Frontier*. Other sessions on the subject have been organized by the American Association for the Advancement of Science and Sigma Xi. The National Academy of Sciences is also undertaking a project associated with the Vannevar Bush model for the support of science in the public interest.

For now, let us return at least momentarily to the November 17th, 1944, letter from President Roosevelt to Vannevar Bush. Roosevelt asked Bush to answer four questions.

One, "What can be done, consistent with military security and with the prior approval of the military authorities, to make known to the world as soon as possible, the contributions which have been made during our war effort to scientific knowledge?"

Two, "With particular reference to the war of science against disease, what can be done now to organize a program for continuing in the future the work which has been done in medicine and related sciences?"

Three, "What can the government do now and in the future to aid research activities by public and private organizations?"

And fourth, "Can an effective program be proposed for discovering and developing scientific talent in American youth so that the continuing future of scientific research in this country may be assured on a level comparable to what has been done during the war?"

Vannevar Bush answered these questions in his report, aided by many members of the scientific community who joined committees to consider each question. From the debate that followed the publication of the report, came the evolution of the National Science Foundation and a national system of innovation that linked the federal government with research and graduate Ph.D. education at research universities.

The model and its implementation led to the unprecedented partnership between the people of a nation, their elected representatives, and the producers of scientific and technical knowledge and human capital.

After 50 years, however, serious questions confront us in light of the erosion of some terms of the partnership. How can the partnership between research universities and the federal government be redefined and new sources of research support be acquired without entering in Faustian bargains?

When all is said and done about changes in the Bush paradigm, the federal government must and will continue to be the basic supporter of basic research in the nation and at universities. But it is not apt to invest on the same terms that existed during the period of extraordinary growth and knowledge over the past 50 years.

Consequently, the dilemmas facing research universities in particular are nothing less than how to sustain the world's most creative science and technology enterprise without the rate of increases in federal support that would appear to be needed to do so.

But these dilemmas are not simply about new resources, they are about the types of changes the university scientific community will have to undergo and the bargains it will have to strike in the effort to preserve and expand the research enterprise while ensuring continued quality. The drama in the situation lies in the nature of the bargains. What is being given up, at what cost, to achieve what goals?

In the post-Cold War era, the military rationale for government investments in science – which we undoubtedly will hear more about today – has to be replaced with a new rationale, one that builds more from the social and economic benefits for continued investments in American science and technology.

At today's session, we will analyze the original report and its consequences for science and technology over the past 50 years. The initial discussion will be placed in historical and political context and analyzed by distinguished members of the community of scientists and science policy analysts.

Now since this day's work is intended to produce substantial discussion and interaction, I want to apologize in advance for spending minimal time on the introductions of our speakers. Suffice it to say, that our speakers, respondents, and members of the audience were invited because each has produced an extraordinary record of achievement.