

What is the Future for the Physical and Mathematical Sciences?

Congressman George E. Brown, Jr.

The following is the text of a speech presented by Congressman George E. Brown, Jr. (D-California) at the annual meeting of the American Association for the Advancement of Science on February 17, 1995, in Atlanta, Georgia.

I am honored to once again be invited to participate in a symposium on the future of science by the American Association for the Advancement of Science (AAAS). I do not know if you have asked me here out of habit, given my frequent pronouncements on the subject at AAAS meetings, or out of pity, given my somewhat diminished status following the recent elections. I will take a more optimistic view and assume that you have asked me here because you think I have something useful to say, a point of view that we will leave to the commentators to judge.

As I reviewed the many speeches and articles that I have offered over the past several years on the health of science, I am struck by how often I have pleaded with the scientific community to pay attention to the changes taking place in the world and to the need to become more closely linked with social goals and needs. Given the results in November, I should have been giving these same speeches to the Democratic Party.

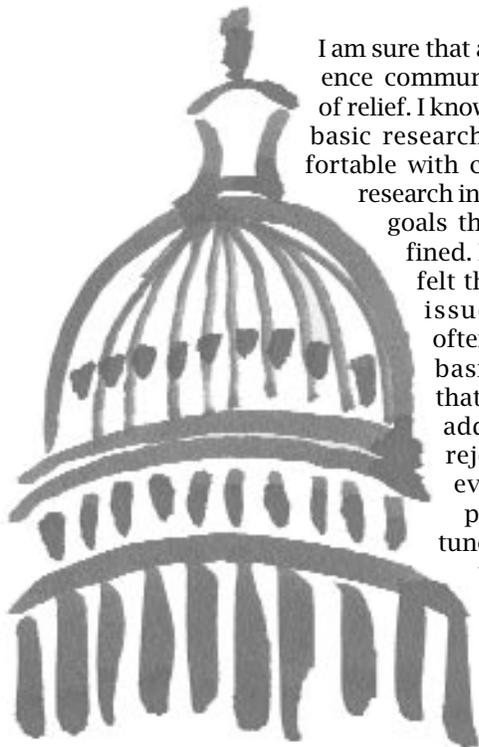
Unlike the Democratic Party, the scientific community has been responding to these changing times with studies, symposia, white papers, and the series of dialogues sponsored by the National Research Council's Commission on Physical Sciences, Mathematics, and Applications, "The Changing Environment for the Physical and Mathematical Sciences". This last series of meet-

ings, led by Rad Byerly, Norm Metzger, Al Teich, and Dick Zare, has led up to this session.

What I would like to do this morning is to briefly address some of the same science policy issues I have addressed before but to put them in the current political context.

Put in temporal context, my comments today trace back to the keynote address that I made to the American Association for the Advancement of Science three years ago. This was followed by a June 1992 report from the then Science, Space, and Technology Committee on the health of research. Lest the science and technology community fail to take note of these actions, I proceeded to provide a Chinese water torture of articles and speeches on the subject of the need for the community to reassess its place in society and begin to redefine itself and its relationship to society.

Now, some three years later, the social and political context to which you were adapting has changed. After Senator Mikulski, Dr. Jack Gibbons, and I urged, each in our different ways, that the science and technology community link your activities to a new set of national needs, the leadership of the new Republican-led Congress signaled their desire to see funding priorities shift back to favor basic research. Early indications are that they want to return to the Reagan-era tilt toward basic research and away from applied and developmental research, except in the defense area, with outright hostility toward government-industry technology development programs for civilian purposes.



I am sure that among some in the science community there is a feeling of relief. I know well that many in the basic research fields were uncomfortable with calls to evaluate their research in light of national goals, goals that are not clearly defined. I also know that many felt that I was pushing this issue too hard and too often and was abandoning basic research—a view that is incorrect, I might add. Before you quietly rejoice over drinks this evening about the apparent turn of good fortune brought by the elections, let me make a few observations.

First, this apparent shift away from a broad definition of research that reaches “downstream” to technology development actually poses a greater threat to the basic research community than the current situation. The reason I say this is because if early trends continue, basic research will become isolated, and this will be more true in the physical and mathematical sciences, with fewer dollars and fewer publicly funded applied research programs to help address calls for increased accountability from a results-oriented political system. In the end, basic research will still have to justify its existence to the public and its elected representatives but will have to do it largely on its own, at least if the reductions in federal funding for applied research and development occur on the scale that many fear. Of course, each scientific discipline will face slightly different conditions, depending upon its sources of economic support in the public and private sector.

Second, anyone in basic research who feels that they can stand up to an American public that is engaging in current levels of political channel-surfing has my best wishes. Nearly one half of the House of Representatives has served one term or less and this sudden, large turnout of experienced representatives reflects an American public that is fed up with its institutions and its representatives and wants change now. Your trying to stand alone explaining the mystery and beauty of fundamental physics to this population and why it should have more public support is a town hall meeting that I do not want to attend.

Third, even if a utopian return to the cloistered halls of basic research resulted from this polit-

ical change, the basic research community would find that the cloister is smaller than the one they left. The magnitude of cuts that are looming boggles the mind. I recently expressed my disappointment at President Clinton’s research and development (R&D) budget, which proposes essentially flat funding for fiscal year 1996. And his budget cuts do not reduce the annual federal deficit but only maintain it at current levels, adding another trillion dollars to the national debt over the next five years and paying for a \$56 billion tax cut over the same period. The Republicans intend not only to balance the budget but also to offset a tax cut that has been conservatively estimated to cost \$200 billion over the next five years. This will require about a trillion dollars more in cuts than the president is proposing. What this will mean to federal R&D funding is anyone’s guess. My own prediction is a 25 percent cut in total R&D funding over the next five years, with some areas suffering even more.

In the end, it is folly to think that any publicly funded endeavor can escape public scrutiny in the current political climate. Putting on my partisan hat, it is even more naive, given present politics, to think that research, basic or applied, will not be linked to the conservative Republican social and political agenda. For example, environmental research discovers environmental problems that might lead to regulation. Global warming would be a good example. Biological research may lead to the discovery of additional endangered species or even endangered ecosystems, leading to the “taking” of private property by the government to protect these species and ecosystems. Enough examples of these linkages exist to convince me that our R&D system will be increasingly linked to real-world debates and issues. The only problem is that someone else is defining your goals, and you do not yet have your own, more appropriate set of goals against which your work can be honestly evaluated.

This leaves you in the worst situation: under fiscal attack without benefit of goals and performance standards that you have defined, being judged by inappropriate measures designed by an ill-informed society. And, unlike public television, you don’t even have Big Bird to help you defend yourselves before Congress! So it seems elemental to me that the need to link your work to true national needs which you have had a part in defining is more important than ever.

Now at this point I could elaborate on the need for the science community to define a new mission or to set new goals given the changes in the world. I could and have cited the pressing need for this change due to the end of the Cold War. I could and have cited the massive changes that have begun to take place in our lives due to the

utilization of science and technology, changes which have begun to affect our definition of self. I could describe the dawning of the era of mobile international capital and a stationary work force, a situation that will result in the emergence of new high technology centers in the developing world and an internationalization of science that makes national boundaries meaningless. Instead, let me try to motivate you with a more personal interest: self-preservation.

I cannot really begin to describe the magnitude of federal funding cuts that will affect research and development activities, especially at research universities. But I fear that they will be deep and broad. These politically driven changes reflect the other broad changes—end of the Cold War, etc.—that I have described in the past and indicate that we have crossed over a threshold, undergone a phase change, if you will. What this means to me is that the equation that has described the cyclical nature of political and social trends may have changed. Simply waiting for the cycle of support for science to come around again will not work because the cycle is broken. We now have to push harder than ever to make our own way through this period of readjustment and may have to make basic adjustments of our own, if indeed the basic social equation has been rewritten by global events.

Remember that a strong federal government is a fairly recent phenomenon. With the Great Depression, the federal government expanded and created new areas of activity or took some over from the states. Then with World War II, the government expanded more, as any government does during wartime. But with the Cold War, we entered a period of continuing centralization of power and programs that continued, largely unabated, until the Soviet Union dissolved.

Likewise, our extensive higher-education system is also a fairly recent event. During World War II, science and technology played a large role and was well supported. After the war, the G.I. bill of rights brought large numbers of people into universities. The outlays of the military-industrial complex during the Cold War continued the expansion in higher-education. Now, the justification for such a large higher-education sys-

tem can no longer be found in our national military security concerns. Just as we are rethinking our justification for a large central government, the higher-education community, as well as the science and technology community, must rethink its situation.

And given that those of us in government and higher education are facing what seems to be a threshold event, we should step back and discard our commonly held perceptions of ourselves. Large government and a large higher-education system are both relatively recent occurrences. What we are facing may be so different that even our lexicon no longer applies. What we are trying to do in politics is to think “outside of the box” of our recent experience and expectations, and I urge you to do the same.

For example, higher education has gotten to be a large endeavor. How large? How about larger than the automobile, aircraft, textile, construction machinery, mining machinery, toy and sporting goods, household video and audio, and refrigeration and heating equipment industries combined in terms of direct employment! In 1989 higher education in this country employed nearly 2.5 million people, 1.5 million of whom were

professional staff. Now what use can we make of this new perspective?

We have been arguing that our college and university system is needed to take us into the high technology realm expected in the twenty-first century. Maybe we should argue that cutting federal support for R&D and higher-education funding has a direct impact on 1995 employment. It also will increase tuition costs to the middle class and have other direct fiscal impact. This approach is not a permanent fix to what ails us, but it may buy time and soften the blow of some of the cuts to come. If it works for the auto industry, with a mere 218,000 workers, it ought to work for higher education and the research community that resides there. Their jobs are worth saving too.

Likewise when you step back and look at where the budgetary pressures are coming from, you observe that they come largely from our inability to solve nagging social problems. Escalating medical costs, many of which are due to

*Before you
quietly rejoice
over drinks this
evening about
the apparent
turn of good
fortune
brought by the
elections, let me
make
a few
observations.*

preventable diseases, crime and incarceration costs, alcoholism and other addiction costs, and a host of other social problems are putting pressure on the budget and thus on federal research funding.

Perhaps the way to save research funding for the physical and mathematical sciences is to invest in social science research that can help us solve some of these expensive social problems. Until this situation changes we will all pay, some of us through increased hospital bills or more expensive goods, and some of us, such as the R&D community, will pay as federal research funding is cut to reduce the deficit and pay for these social ills.

Now many of you may think that these are screwy ideas, and perhaps they are. But they are just illustrative of the kind of thinking that is needed if, as I suspect, we are facing major changes in the way we Americans view all social institutions, including higher-education institutions. The reality is that federal dollars that used to be spent on high-energy physics research facilities will now be going to high-security correctional facilities. If this is going to change, we are going to have to think “outside of the box” and do it soon.

We are also going to have to think honestly. We can no longer deny the excess capacity, or more correctly, unfocused capacity in our higher-education system. Our graduate degree-granting institutions can no longer support the Ph.D.s they are graduating. A clear indication of this is the fact that 40 percent of college faculty members today are part-time employees, up from 22 percent in the early 1970s. This army of gypsy professors illustrates both the financial pressure on higher-education institutions and the excess of Ph.D.s for whom their higher-education training directs them solely toward employment in—higher-education.

We must address this situation somehow. I do not have the answers, but commend to you the paper, “Scientific Elites and Scientific Illiterates”, presented by David Goodstein in February 1993 at the Sigma Xi forum, “Ethics, Values, and the Promise of Science”. This paper and others that have started to appear in recent months illustrate some thinking that needs examining in the midst of our current crisis.

For example, we need to reassess the role of the Ph.D. in society. In the current political and

fiscal climate, do we want to replicate university researchers and college professors at a rate above the replacement rate? Does research and high technology development demand Ph.D.s, or can technically adept masters- and undergraduate- degreed students fill some of the roles that the vast army of underpaid and underemployed postdocs currently perform?

Stepping back again, I think that Congress and the nation can and do expect more from the research community than we see currently. At the very least we expect you to exercise a modicum of common sense. And common sense dictates that we make good on our promises of societal benefit where those benefits are no longer the more obvious ones of national military security. Common sense dictates that we envision a new definition of security as I mentioned before, based on a healthy,

growing, and sustainable economy; an improved global environment; and—most important—a just and equitable society, first in our own country and then in an increasingly interdependent global community.

Our challenge for the twenty-first century must be no less than building a new human culture— more democratic; providing for more autonomous, self-directed growth for individuals and social institutions; less bureaucratic and more sensitive to complex signals of all kinds, including market signals, that can guide us to new levels of understanding ourselves and the universe which nurtures us.

Guiding us in this work should be basic principles of justice and harmony. Lest you think that I could get through a speech without some philosophical inspiration, I would turn to some of the thinking of Mohandas Gandhi, a hero of mine since the 1930s. Gandhi urged us to avoid the seven social sins which he described as politics without principle, wealth without work, commerce without morality, pleasure without conscience, education without character, science without humanity, and worship without sacrifice. To fail at this will put scientists, and all of us as individuals and as a society, adrift without guidance in a time of major change.

More concretely, if the scientific community cannot reconnect with basic social values, you will find yourselves in a role as central to policy making as a Democrat in Washington, a status I wouldn't wish on anyone.

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