

PERSPECTIVES

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The Challenge for the Obama Administration Science Team

President Obama's choices for top government science positions have made a strong statement about the importance of science and technology (S&T) in our society. In choosing Nobel prize-winning physicist Stephen Chu for Secretary of Energy, marine biologist Jane Lubchenco to run the National Oceanic and Atmospheric Administration (NOAA), and physicist and energy and arms control expert John Holdren to be his science advisor, Obama has assembled a team with not only impeccable technical credentials but considerable policy and administrative savvy as well.

Yet the ability of science policy leaders to contribute to the nation will not depend on technical expertise, or even effective advocacy on behalf of S&T in the new administration. Far more important will be the team's capacity to ensure that our scientific enterprise improves our environment, enhances our energy security, prepares us for global health risks, and—perhaps most important—brings new insights to the complex challenges associated with maintaining and improving the quality of life across this crowded planet.

President Obama was elected on the promise of change, and in science policy, effective change means, above all, breaching the firewall between science and policy that compromises the nation's ability to turn new knowledge into social benefit. Failure to acknowledge the critical interactions between science and policy has contributed to a scientific enterprise whose capacity to generate knowledge is matched by its inability to make that knowledge useful or usable. Consider, as but one example, that scientists have been able

to deliver skillful predictions of the paths and effects of hurricanes while having virtually no impact on the nation's hurricane preparedness, as we saw in 2005 when Hurricane Katrina forever changed our perceptions of extreme weather events. Or that 15 years and \$30 billion of research on the climate system are matched by no discernible progress in preparing for or preventing climate change. Or that our marvelous biomedical research capacity, funded at \$30 billion per year, is matched by a health care system whose cost, inequity, and performance rank near the bottom among affluent nations.

So even as we applaud our new national science policy leaders, we should also encourage the Obama administration to make the necessary transition from a campaign posture focused on countering political interference in science to a governing posture that connects the \$150 billion U.S. public investment in S&T to our most urgent problems.

One key obstacle to strengthening this connection is a culture that values "pure" research above other types, as if some invisible hand will steer scientists' curiosity toward socially useful inquiries. There is no such hand. We invest in the research necessary to refine hurricane forecasts, yet we neglect to develop new knowledge to support populations living in vulnerable areas. We spend 20 years refining our fundamental understanding of Earth's climate while disinvesting in energy technology research. We spend billions each year on the molecular genetic causes of cancer while generally neglecting research on the behavior that can enhance cancer prevention. Overall, we act as if the intellectual goals of scien-

tists are automatically and inevitably aligned with our most important goals as a society. They are not.

This is not about basic versus applied research; both are crucial, and in many cases the boundary between them is so fuzzy as to be meaningless. Rather, it is about the capacity of our research institutions to create knowledge that is as socially useful as it is scientifically meritorious, in areas as broad and complex as social justice, poverty alleviation, access to clean water, sustainable land use, and technological innovation. This challenge is therefore about institutional design; about designing knowledge-producing enterprises that understand and respond to their constituents. Any corporation that imitated our federal science effort, spewing out wonderful products without regard to consumer needs or preferences, would deservedly go bankrupt. Yet we continue to support a public scientific enterprise whose chief measures of productivity—for example, the hundreds of thousands of disciplinary peer-reviewed papers churned out each year—have little if any connection to the public values they allegedly support.

How can we steer the vast capacity of our scientific enterprise toward better meeting the goals and values that justify the confidence and investment of the public? By increasing the level and quality of interaction between our institutions of science and the diverse constituents who have a stake in the outcomes of science; by changing the ethos of research from insular to engaged, from elitist to communitarian; by giving the scientific workforce incentives to broaden the way it selects problems and defines excellence.

We do not need to start from zero. We can tap as exemplary models some promising efforts that align research with the outcomes we would most like to see. For example, the agricultural sciences have a long history of building institutions that bring scientists and users together in the service of food security, productivity, and affordability, from the extension services and experiment stations first developed in the 19th century to the distributed research centers of the Consultative Group on International Agricultural Research that helped create the Green Revolution.

We can learn from the experiences of federal agencies such as the National Institute of Standards and Technology, whose effectiveness depends on its ability to interact with and learn from its complex network of constituents, mostly in the private sector. At NOAA, several innovative (and poorly funded) programs, such as the Regional Integrated Sciences and Assessment, bring scientists together with environ-

mental managers to craft research agendas that are relevant to the needs of decisionmakers in areas such as the management of water supplies and fisheries. A radical expansion of this participatory approach is necessary if we are to avoid endless repetitions of the Katrina debacle. In another realm, the National Nanotechnology Initiative includes a vibrant research network coordinated across 23 agencies aimed at applying social science research to signal emerging risks and help guide nanoscale research and innovation toward socially desirable outcomes. Although funded far too modestly, this effort shows that fundamental scientific research can be fully integrated with research on societal, ethical, environmental, and economic concerns from the outset, rather than assuming that the invisible hand of scientific inquiry will automatically lead to the maximal social benefit. This type of integrated approach should be implemented across all areas of frontier research.

The nation's science policy leaders can lead the way here by tying R&D funds to institutional innovation of this sort. For example, universities, the site of much of the fundamental research sponsored by the federal government, should become much more aggressive and effective contributors to the solution of social problems. As a university president, I am only too well aware that the tenure process is still largely driven by counting grants, publications, and citations—a weak proxy for social value, and I would say even for scientific excellence. At my institution we try to encourage new modes of scientific success, but until the ability to attract federal funds is decoupled from outmoded notions of productivity and excellence, a process that must be led by the funding institutions themselves, this will be an uphill battle.

The success of President Obama's new science team should be measured by its ability to break down the historical disconnect between science and policy. Our scientific enterprise excels at creating knowledge, but it continues to embrace the myth that new knowledge, emerging from the stubbornly disciplinary channels of today's scientific programs, automatically and serendipitously turns into social benefit. A new administration facing a host of enormous challenges to human welfare can best unleash the power of S&T by rejecting this myth and building a government-wide knowledge-creating enterprise that strengthens the linkages between research and social need.

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