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March 27, 2011

As Budgets Tighten, Big Science Gets a New Opportunity to Make Its Case

Laura Segall for The Chronicle

Zhi Guo, a graduate student at Arizona State U., works with a laser in a laboratory in the university's Biodesign Institute, which takes on real-world problems.

Enlarge Image

By Paul Basken

Research universities face a long list of seemingly intractable problems.

Faculty too often work in subject-specific silos. Taxpayer-supported basic science doesn't get converted by industry into useful products and jobs. The vagaries of federal financing play havoc with laboratory projects and staffing. And now, making it even worse for some universities, Congress is cutting off budgetary "earmarks" reserved for many big-picture projects.

One possible solution—known as interdisciplinary science, or "team science"—is ripe for a surge in growth. An early sign: a new group of campus-based grant experts, known as the National Organization of Research Development Professionals, has ballooned from 32 to 232 members in the past two years, with what its leadership sees as a focus on promoting interdisciplinary science.

Universities are putting an emphasis on shared projects, says the group's president, Holly Falk-Krzesinski, part of the research-support staff at Northwestern University. The universities see it as "the strategic positioning of research development," she says.

Those supporting the change of direction include T. Taylor Eighmy, vice president for research at Texas Tech University, who can often be found visiting Washington to learn which federal agencies have big projects in the works. He has used tips from professors working on temporary assignments in government offices to give him a head start in applying for multimillion-dollar awards that require large teams of researchers.

Neal W. Woodbury, a professor of chemistry and biochemistry at Arizona State University, uses team tactics to push forward commercial innovation in solar-based energy.

Enlarge Image 

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Neal Woodbury (right), a professor at Arizona State, spent six months preparing a proposal for a large U.S. Energy Department grant program. Although the proposal was unsuccessful, pursuing it, he says, has been helpful in identifying new avenues of research for his team, which works to develop techniques by which the methods plants use to convert solar power into energy could be adapted for commercial applications.

And groups of researchers and clinicians led by Teresa K. Woodruff, of Northwestern, are improving the ability of young women to become pregnant after cancer

treatments. "We couldn't have gotten where we are today by doing ordinary science," says Ms. Woodruff, a professor of obstetrics and gynecology.

The shift toward team science is in line with the Obama administration's priorities. The White House last year called for strategies to solve the "grand challenges" of the 21st century in areas such as health care and energy. Changes at individual agencies include the Energy Department's creation of multimillion-dollar, university-based innovation hubs, and the Agriculture Department's decision to emphasize competitive grants through its new National Institute of Food and Agriculture.

One of the clearest advantages of the new focus, at a time when Congress is under severe pressure to cut the federal budget, is the opportunity it offers to present lawmakers and voters with an understandable rationale for research spending, given that team science typically encompasses the scientific process from basic discoveries through commercial production. Basic research can be difficult to explain, says Jacob E. Levin, assistant vice chancellor for research development at the University of California at Irvine. "But to say, 'We're sequencing the human genome' or 'We're trying to find a vaccine for AIDS'—this is something easy to wrap your head around."

Yet for all the apparent advantages of team science and the new momentum behind it, there remain questions of commitment among both universities and government, with each side calling for more effort from the other.

Government officials say universities need to make fundamental changes in tenure and other faculty rules if they really want to promote interdisciplinary cooperation. Thomas A. Kalil, deputy director for policy at the White House Office of Science and Technology Policy, wants universities to be more open to collaborations with industry, more flexible on granting faculty leave for outside projects, and better attuned to the needs of local economies.

University officials are "trying to rework the traditional stovepipes, because of the importance that plays in advancing science," says Tobin L. Smith, vice president for

policy at the Association of American Universities, referring to the tendency of researchers to work only with those in their own academic disciplines.

But without a significant change in financial incentives from government, he says, they are finding it difficult. "I argue that any time you give money, you get people thinking in different ways," Mr. Smith says. And if universities "have to pull together teams, they'll do it."

Teamwork Brings Advantages

Team science is not a new concept. The Manhattan Project, one of the best-known examples, came together nearly 70 years ago. But the idea of large-scale research projects has gained new momentum in the past decade, following the success of the Human Genome Project in 2000.

The advantages can be quite clear. When Ms. Woodruff formed her Oncofertility Consortium, five years ago, with a $21-million grant from the National Institutes of Health, young women diagnosed with cancer were routinely advised that treatments such as radiation or chemotherapy could leave them sterile. Now most cancer patients of childbearing age have options for preserving their fertility, such as having eggs or an ovary removed before they undergo treatment.

Ms. Woodruff credits the success to her network of 66 sites—at universities and clinics—where teams interact. Researchers explain treatment options to the clinics, and the clinics give researchers data based on treatment and observations of actual patients.

The consortium also draws on the services of other specialists, including bioethicists, lawyers, and communications scholars, to inform and advise patients.

"Our horizons were fairly flat" when the researchers were working individually, Ms. Woodruff says. "What team science does is it elevates the horizon to how this work can actually be placed into the context of helping an intractable problem."

Team science also gives universities an arguably healthier alternative to replace budgetary earmarks, which Congress is now promising to ban. Some 500 universities collected more than $2.2-billion in earmarks in 2008, mostly for scientific research, according to a 2008 Chronicle analysis. The emergence of large federal research grants helps university researchers "think strategically, and I think that's a good thing for universities to be doing as opposed to just going up to the Hill and asking for an earmark," says Mr. Smith.

Universities are warming to the challenge. Texas Tech collected nearly $12-million in earmarks in 2008, according to the survey, but it now tries to tackle science by listening to agency needs rather than lobbying lawmakers.

"Earmarks have had their place and purpose here and at many institutions," says Mr. Eighmy, the university's research head. "But we have to be much more competitive about how we go after things, and this is one way that we're doing that."

Texas Tech's new approach saw it joining with General Dynamics to win a turbine contract. The university recently missed out on a $25-million Agriculture Department initiative, but it is still pursuing 40 other projects.

Costs and Benefits

Even the losses can be positive. Mr. Woodbury, of Arizona State, spent six months pursuing one of the Energy Department's $120-million innovation-hub grants. His team lost, but now he has the experience of consulting with and learning from professors with expertise in subjects of which he previously had no knowledge. And preparing the grant proposal is helpful in developing a series of smaller proposals and strategies that set the direction of his work, which involves copying and commercializing methods that plants use to convert solar power into energy.

Larger universities have some advantages. Mr. Eighmy acknowledges that he has organizational capacities at Texas Tech that he never had at his previous institution, the University of New Hampshire.

Minority-serving institutions in particular could be harmed by an emphasis on big science, says Lorelle L. Espinosa, director of policy and strategic initiatives at the Institute for Higher Education Policy. "They literally don't have the staff" to handle the necessary paperwork, she says.

On the other hand, even major research universities need partners, which gives faculty members at smaller institutions a chance to be included. Researchers at smaller universities often bring "a lot more collegial attitude" and are more willing to share equipment and space, says Mr. Levin, of Irvine, who will take over in June as president of the National Organization of Research Development Professionals.

The NIH, the nation's single largest source of money for academic research, has fresh evidence of how change can upset those accustomed to the established order. When it announced plans this year to create a new "translational research" center that would help step up the kind of research needed to develop drugs from university research discoveries, it faced protests from university scientists worried that the change would mean less money for basic research.

The NIH has, in fact, already said it has no plans to continue the Interdisciplinary Research Consortia program that Ms. Woodruff used to start her oncofertility project at Northwestern. And Mr. Levin has expressed concern that if the NIH created the proposed center, the agency's existing interdisciplinary initiatives might be "pushed or compelled to become even more translational and pharmaceutical-focused."

While the government highlights its promotion of big-science projects in areas such as cancer and energy, it more quietly cuts them in areas such as particle physics and space exploration.

Mr. Kalil, of the White House science office, is on leave from the University of California at Berkeley, where he was special assistant to the chancellor for science and technology, promoting multidisciplinary-research initiatives. Yet at the White House, he says, he does not "have an a priori view that big science is better than

support for individual" researchers. The answer, he says, depends on the nature of the scientific question.

Big science, he says, is seen in the administration "as a means to an end, rather than an end in itself."