NATIONAL SCIENCE FOUNDATION

The Money to Meet the President's Priorities

Money talks. But this year it's on the move at the National Science Foundation (NSF), which has turned recent actions by Congress and the priorities of a new president into an array of programs to strengthen the scientific work force, tackle pressing societal problems, and foster collaborations across disciplines.

The initiatives are made possible by the brightest budget picture in NSF's 60-year history. Some \$3 billion from the one-time stimulus package, combined with a 6.5% boost to its regular 2009 budget, has brought spending to a record \$9.5 billion this year. Its 2010 budget, excluding stimulus funds, would rise by 8.5%, to just over \$7 billion, if Congress approves President Barack Obama's request.

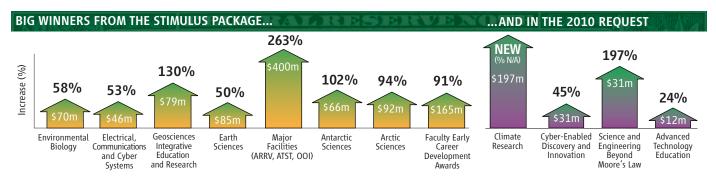
"This Administration has made clear its priorities in science," notes NSF Director Arden Bement Jr., "and they include all the things we're doing." In particular, that translates into an increase of \$197 million in 2010 for all manner of climate research, plus \$20 million over 2 years for climate change education; \$31 million more for research on improved silicon technology to push beyond Moore's Law; \$12 million more for technology training at community colleges; \$50 million for high-speed networks in low-intensity research states; and \$92 million for novel ways to fund out-of-the-box research ideas.

Although Congress passed the stimulus package in February and the 2009 budget in March, it was only last week that NSF

revealed in detail how that money will be allocated, along with the specifics of its 2010 request. That additional information fleshes out why research gets an 11% increase, education only 1.5%, and funding for major new facilities drops 23%.

For example, Obama has promised to triple the number of NSF's prestigious graduate research fellowships by 2013. But after getting a 20% boost in 2009, NSF has asked for only a 6% increase in 2010, to \$122 million. Why so low? The answer is the \$45 million in stimulus funding that Bement allocated to the program. That influx will allow NSF to grow this year's class by roughly one-third and make good progress toward Obama's goal of 3000 new awardees.

The faculty early career development



Digging for Fresh Ideas in the Sandpit

Does the idea of writing a grant proposal that's been all but approved before it's even sent in sound appealing? Then play in the sandpit.

That's what 30 scientists did this spring, meeting outside Washington, D.C., for 5 days of intense discussion about synthetic biology under the auspices of the U.S. National Science Foundation (NSF) and the U.K. Engineering and Physical Sciences Research Council. But instead of simply discussing where the burgeoning field is headed and then waiting for a possible funding solicitation down the road, the scientists—equally split between the United States and the United Kingdom and drawn from sev-

the United Kingdom and drawn from several disciplines—assembled into 10 teams and came up with specific research proposals.

That's when the

That's when the fun began, at least for some participants. Each team presented its idea to the larger

group, received instant feedback, made revisions, and presented it again—six times in all. By the end of the week, officials from the two government agencies—each of which had agreed to put up \$5 million to fund the best ideas—verbally signed off on five of the 10 proposals. The two agencies also split the \$200,000 cost of the workshop, held in Warrenton, Virginia.

The exercise, conceived in 2004 by the U.K. research council and labeled a sandpit (the British term for sandbox), is the latest attempt

Fuel Cell System

Synthetic Muscle

Water works. This "cyberplasm" will try to mimic the undulations of the lamprey.

by governments to fund so-called transformative research. Joanne Tornow of NSF's biology directorate told the participants—chosen from among 170 applicants—that she and her U.K. counterpart, Paula Duxbury, "didn't want to hear anything that had more than a 10% chance of succeeding." The week began with team-building exercises designed to help participants "strip off their preconceived notions," says Duxbury, before choosing partners and getting down to the science. "The talent in the room was just amazing," says Joseph Ayers, a

neurophysiologist at Northeastern University Marine Science Center in Nahant, Massachusetts, who had spent 15 years working on biomimetic marine robots. "You'd ask a question, and people would respond with a lecture."

Andy Ellington, a self-

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(CAREER) program is an even more dramatic example of the interplay between stimulus funding and NSF's regular budget. Despite strong interest from both Congress and the White House, NSF requested only enough money in 2010 to restore the program to its 2008 level of \$203 million. However, those numbers do not include a whopping \$165 million increase for the program this year, using stimulus money spread across all six of the foundation's research directorates.

Some priorities come courtesy of Congress. As part of the stimulus package, legislators designated \$60 million more for scholarships to undergraduates majoring in science and engineering. That jump will enable NSF to expand the program while holding its 2010 request flat at \$55 million.

The stimulus package also added \$400 million to NSF's major facilities account, which typically contains a half-dozen big projects in various stages of construction. Bement has divvied the money among three projects—the Alaska Region Research Vessel (ARRV), the Advanced Technology Solar Telescope, and the Ocean Observatories Initiative—that have been in the pipeline for years but were held out of the 2009 request for various reasons. Bement says the \$148 million for ARRV should be enough to finish the ship, so nothing is being requested for it in the 2010 construction budget. One big facility still

awaiting a green light from NSF is the National Ecological Observatory Network, first proposed a decade ago but still awaiting approval of its final design.

Bement promises that the bolus of new funding will enable NSF to be more innovative, and he's asking each of the foundation's 46 divisions to spend \$2 million next year on innovative research ideas chosen outside the normal grants-making procedures. "We hope to stretch the culture of what's acceptable," explains Jim Collins, head of the biology directorate, which this spring sponsored a weeklong workshop in synthetic biology that featured real-time peer review (see sidebar). "We don't want to put too many boundaries on people."

One effort to break down disciplinary boundaries is already under way, as 17 program managers from the biology and geosciences directorates are being formed into an "integrated global system science" team. "The phrase 'earth system science' has been around since the 1970s," says geosciences chief Timothy Killeen. "But it didn't bring in the human dimension of these processes." NSF has already set aside money for proposals in three areas that will funnel into this new "node"—emerging topics in biogeochemical cycles, multiscale modeling, and environment, economics, and society. "It's not enough to talk the talk," says Killeen. "We also have to walk the walk."

-JEFFREY MERVIS

described evolutionary engineer at the University of Texas, Austin, admits that it took him a while to embrace the sandpit approach: "It was like nothing I've ever done before." He says the most important lesson he learned "is shutting the heck up ... and letting others put their ideas forward." Ellington says that the sandpit approach "is more like Twitter" than the usual process of "writing a grant proposal, submitting it, and then 6 months later getting back three pages of detailed comments. ... But we probably got just as many incisive comments and a lot fewer nonincisive comments."

Some participants never warmed to the task, however. "I did not expect an environment in which scientists competed against one another [in real time and often late into the night] for a limited pool of funds," wrote one prominent scientist in an anonymous evaluation submitted at the end of the week. The exercise evoked "Darwinian selection for limited resources in a pleasant natural environment (Airlie House), where the least successful individuals die a slow

and agonizing death. ... It was one of the most unpleasant weeks of my life."

The prospective winners—no decisions will be final until July—have taken on big challenges within this sprawling field. Ellington and four other scientists hope to create genetically altered polymers, in effect, artificial versions of amino acids and their related genes. Ayers is part of a four-person team that is building a "cyberplasm," a device possessing an integrated system of fuel cells, activators, muscles, and sensors that will move through the water like a lamprey. A third team hopes to produce synthetic taxol, a cancer-fighting drug, in large amounts and at low cost, building on the success of team member Jay Keasling of the Joint BioEnergy Institute at the University of California, Berkeley, with the antimalarial drug artemisinin. There's even a project to address ethical and societal issues, in hopes of avoiding the controversy that has bedeviled the related field of genetically modified crops.

-J.D.M.

ScienceInsider

From the *Science* Policy Blog

News about the impact of the U.S. stimulus funding package on researchers, the ongoing battle against swine flu, and the impact of California's financial troubles on the state's universities were among the headlines on Science Insider last week.

The competition for **Grand Opportunities (GO) grants at NIH**, which start at \$1 million and use stimulus money, has drawn 2400 letters of intent, in contrast with the 20,000 applications submitted for the smaller Challenge Grants. NIH officials expect **success rates** for the GO grants to be **as high as 10%**. Meanwhile, NIH plans to fund more than 30% of the 1600 scientists who have applied to expand an existing grant. In other NIH news, the agency has announced **a \$120 million, 5-year plan** to set up a drug-development service center that will focus on **rare and neglected diseases**.

The U.S. Centers for Disease Control and Prevention (CDC) last week sought to reassure the public that **a vaccine for swine flu** would be ready by late fall, in time to combat a possible comeback by the H1N1 virus. CDC's statement came after a World Health Organization working group estimated that it could be December before authorities are able to start immunizing people.

Last week's resounding defeat of ballot measures aimed at helping California's finances darkens the outlook for **the University of California (UC)**. UC had already instituted hiring and salary freezes and raised student fees by 9.3%. The university now faces a possible \$322 million budget reduction, which could lead to further fee increases, larger classes, and pay cuts.

The tough economic climate will force more than a quarter of medical charities in the United Kingdom to cut funding by anywhere between 10% and 40%, according to a survey released this week by the country's Association of Medical Research Charities.

To keep up with science policy news daily, visit http://blogs.sciencemag.org/scienceinsider/.