MATHEMATICS FUNDING

NSF Initiative Gives Field a Chance to Show Relevance

Congress has given the National Science Foundation a green light to boost funding of mathematics research—in service to the nation

Wavelets used to be merely curios of the mathematical realm, visually boring wiggles even to those who find mathematical functions aesthetically pleasing. But their ability to represent shapes and patterns compactly—from storing fingerprint data on suspected terrorists to preparing targets for a missile strike against enemy forces—has suddenly made them very popular in some pretty important places.

To Philippe Tondeur, head of mathematical sciences at the National Science Foundation (NSF), the use of wavelets to shore up the country's post 11 September defenses is just one reason why he and NSF are pushing for a dramatic increase in federal funding for mathematics. Last year, NSF director Rita Colwell began a campaign to quadruple the agency's $121 million math budget over the next 5 years. Although the economic and budgetary climate has deteriorated rapidly since then, Congress recently signaled that it was in her corner by instructing NSF to place a "high priority on mathematics research." For 2002 that's likely to mean $30 million more for the discipline. More importantly, however, the language—which was part of an appropriations bill—gives NSF the green light to shore up America's mathematical infrastructure. "Look at the language! They pay special attention to mathematics," says Tondeur, with a touch of wonder in his voice. "We have instructions to build the budget."

Congress and the White House were initially concerned that Colwell's 5-year scheme seemed a bit too unfocused. But months of dialogue won them over to the idea that increasing funding for mathematics is a cost-effective means of spurring scientific discovery in all fields—and it is also vitally important to national security. "It's a ubiquitous tool to advance all areas," says one congressional staffer. "[Members] are interested in emphasizing areas—and math is one of them—that are enabling disciplines."

Although the budget numbers are still a bit fuzzy, the plans are concrete. One major step will be the creation of up to four mathematical institutes in addition to the ones that NSF already funds in Los Angeles, Berkeley, and Minneapolis. "An institute acts as a catalyst for bringing people together," says Russel Caflisch, a mathematician at the University of California, Los Angeles. "It also serves a good purpose in training young mathematicians." A contest to determine the first new institute is already well under way, with the winner to be named in March.

David Eisenbud, director of the Mathematical Sciences Research Institute in Berkeley, is particularly keen to see a rise in the size of individual research grants, now a median $35,000 a year for 3 years. "In mathematics, individual research is much more significant than in other sciences," he says. Tondeur agrees that the current level is "discouraging." He hopes to hike it by 10% or so and make some grants last for up to 5 years.

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Behind the math. NSF's Philippe Tondeur, with a "Costa surface" sculpted by mathematician Helaman Ferguson, believes math can be beautiful as well as practical.

The initiative will also allow Tondeur to fund more Focused Research Group grants, typically $150,000 to $300,000 over 3 years. The grants are geared toward attacking cross-disciplinary problems that span, say, mathematics and biology, or mathematics and computer science. For example, one grant this year is funding an attempt to use topology, the abstract study of shapes in space, to give scientists a new tool to handle hard-to-understand research sets. "It's a new vehicle that I had to scrounge funds for," says Tondeur, who promises a "significant expansion" of the program.

Another beneficiary will be the Vertically Integrated Grants for Research and Education in the Mathematical Sciences (VIGRE) program. The grants, typically $500,000 a year for 3 years with a possible 2-year extension, are intended to bolster the educational pipeline through mentorships, fellowships, traineeships, and research opportunities. "I was one of the early skeptics about VIGRE," says Eisenbud, because of its focus on education. "But it has had an excellent and tonic effect" on mathematicians in universities, which use the block grants to reshape their curricula and revitalize their departments.

Mathematicians hope that the initiative's visibility, along with the increased funding, will help them alter the perception that the field is too difficult for the public to understand. "Not only do we have a language barrier, but [we also have] a level of technicality way above what you see in physics," says Andrea Bertozzi, a mathematician at Duke University in Durham, North Carolina. "It's difficult to convince people that what you do is important, so you have to show why it is useful." Eisenbud and others say they are pleased that Congress has finally responded to their plight: "People were telling NSF for years that math was underfunded."

Colwell says that mathematics funding is "more important than ever" in light of the threat to national security. Tondeur volunteers a large list of mathematics research projects funded by NSF that are "key areas" for addressing homeland security. In addition to wavelets for face and target recognition, there is number theory and algebra for cryptography and differential equations for helping modelers calculate the spread of an infectious organism. If the mathematics initiative is successful, Tondeur predicts, that list will grow quite a bit longer.

–CHARLES SEIFE