European Commission Prods EU to Unify Research Base

Europe's physicists wait with a mix of optimism and skepticism to see how FP6 will affect their science.

Hands-off management, bold political ambition, and fewer, bigger grants are the signatures of the Sixth Framework Programme (FP6), the blueprint for European science funding for the years 2003–06. In the new program, the traditional framework goal of fostering cross-border connections among Europe's scientists is magnified. And, in a departure from the EC's infamous micromanagement style, scientists can look forward to less bureaucracy and more autonomy.

With a budget of €17.5 billion (roughly $17.2 billion), FP6 got a 17% boost over the previous framework program. Framework funding still makes up only 5–6% of Europe's total public investment in R&D; the rest comes from various national bodies. But the EC aims to use FP6 to mold Europe's scattered research enterprise into "the most successful and competitive knowledge-based economy in the world," as European Commissioner for Research Philippe Busquin envisions for his European Research Area (ERA).

"Europe is becoming increasingly less technologically competitive," says Peter Kind, who heads the EC's task force on new funding mechanisms within FP6. In 1997, the European Union had only 5.1 researchers per 1000 employed people, compared with 8.9 in Japan and 8.1 in the US. And in 1999, the percentage of the EU's gross domestic product invested in research was less than 2%, which prompted the EC, the EU's executive arm, to set as a goal an increase to 3% by 2010. Hard numbers aside, says Kind, Europe is trailing in competitiveness "because of the intense fragmentation of research. There is a great deal of duplication, an absence of critical mass, and too much research that doesn't achieve the scale it needs to be competitive at a world level. This needs to be addressed."

Selected sciences

As the financial arm of Busquin's political vision, FP6 will seek to get the most bang for its euro by concentrating on seven broad themes: genomics and biotechnology for health, information technologies, nanotechnology and multifunctional materials, aeronautics and space, food quality and safety, sustainable development, and public outreach. "If you go through all of our priorities, physics is everywhere," says Kind. "Nowadays, genomics has a large amount of physics. Information society technologies are nearly all physics-based. Sustainable energy and global change have some physics. And of course nanoscience and aeronautics." In FP6's "bottom-up" funding lines, such as for infrastructure, "physics has a strong presence," he adds.

The seven themes will get roughly two-thirds of the FP6 budget. The money will be distributed chiefly through two new mechanisms, or "instruments." One, called integrated projects, is applications oriented and will involve researchers in both academia and industry. An integrated project might have 10–15 partner groups and get around €15 million—or about 10 times the money and twice the number of research groups as similar projects in the Fifth Framework Programme, which ends this year. The other instrument, networks of excellence, aims to knit together not only individual researchers but institutions. "If we are to create centers of excellence equal to research centers in the States," says Kind, "each member of the network has to agree to mutual specialization, so they work in an integrated way as if they were a single virtual center, even though they are dispersed." A network of excellence is expected to involve up to 500 researchers and have funding in the tens of millions of euros. People in the 15 EU member and 17 associated countries can apply for FP6 funding.

"The idea is to offer money as a real incentive to overcome organizational, human, and cultural barriers," says Kind. "In the past, what we have thundered was good research. These extra dimensions—structuring, integrating, shaping—may have existed, but they were not a fundamental aspect of the program. We will only fund projects in these two new instruments if they meet this and, of course, if they have the necessary ambition to be supported at the [European] Community level."

EUROPEAN COMMISSION

PHILIPPE BUSQUIN, European Commissioner for Research, aims to make European research more competitive. The Sixth Framework Programme was crafted as part of that goal.

Wait and see

Will bigger collaborations make better science? Many scientists are leery about both the megacollaborations and the narrow scientific focus in FP6. They worry that the large collaborations will be unwieldy, promote growth of established groups, and stifle creativity. Perhaps even more, they fear that money from national agencies will increasingly follow FP6's lead, leaving many research areas in the cold. "Putting a huge amount of money on very focused areas of research may create imbalances that can, in the long run, actually handicap the development of research," says Jean-Pierre Bourguignon, director of the Institut des Hautes Etudes Scientifiques (IHES) near Paris.

At this stage, scientists still have only a fuzzy sense of how the new collaborations will work. The idea, says Maria Allegrini, a physicist at the University of Pisa and a member of the European Physical Society's executive committee, "is that different groups working in, for example, quantum optics, quantum information, and advanced optical technologies should have a common program. They should try to put their resources together to get excellent results—in this case to improve the rate of information transfer and security." At the EPS, she adds, "we like the spirit of FP6. We

have great expectations of it. But we have to wait and see how this new tool works in practice."

All participating FP6 countries agreed to the seven priority themes. By definition, such a consensus "means the end product is slightly conservative," says Enric Banda, secretary general of the European Science Foundation. "It's very difficult for someone doing non-mainstream science to get funding from the EC. They mentioned the possibility of taking risks, but I'm not sure we will get there this time." The broad consensus, coupled with grantees having to raise matching funding and the strings that dictate wide collaboration, are intended to give FP6 leverage.

"It is clear that Europe has to focus its research resources in important areas to be competitive, and that FP6 will inevitably more strongly integrate over national borders," says Lars Borjesson, deputy secretary general for Sweden's science and technology research council. "But some researchers would rather like to see 1000 flowers bloom." Some national agencies and institutes are also chafing, he adds. "They would like to decide for themselves what's to be done in their own country. Now they have to look more over the borders." In addition, the fraction of research money that Sweden and other countries contribute to the EC, and the ERA in particular, is rising, says Borjesson. "This will affect the national research priorities—which is of course a cornerstone of FP6." Once the networks of excellence are established, adds Gérard Mégie, president of France's National Center for Scientific Research (CNRS), "after four or five years, national research organisms will have to take over and fund their continuation. That is the strategic idea of Busquin."

France and the CNRS, says Mégie, "are ready to think in terms of networks of excellence and integrated projects, and to bring ideas and expertise together. It will help us decide which labs to push in the international projects, what we can support at the top levels of research." Given that FP6 doesn't cover all areas of research, he adds, "it will be important for us to detect the areas which are not funded. We have a responsibility to deal with all disciplines in fundamental research, and not all are funded in the thematic programs of FP6."

The new funding mechanisms and the overarching goal of unifying European science may be debated, but FP6 has clearly caught researchers' attention: In June, scientists submitted more than 15 000 miniproposals in response to a call for expressions of interest. The EC intends to use them to whittle down the areas to be funded within the seven priority themes. Asking the community for input on what research to fund, says Bourguignon, "may well turn out to be a major innovation. One now has to see whether the Commission will look at [the proposals] with an open mind."

RESEARCHERS FROM ACROSS EUROPE gained access to the lasers at the Laboratoire d'Optique Appliquée in Palaiseau, France, thanks to funding from the Fifth Framework Programme.

New infrastructure money

More than anything else, however, it's FP6's support for scientific infrastructure that physicists seem to be excited about. In keeping with FP6's broad goals, the EC wants to enhance the internationality of facilities—from libraries to special habitats to the European Space Agency. In contrast to the networks of excellence and integrated projects, this money is open to all fields. And the EC has broadened its infrastructure net to include not only such things as bringing scientists to facilities, but also feasibility designs, construction, and networking among facilities. FP6's infrastructure programs are set to get €455 million, plus €300 million that is earmarked for Grid networking development.

Now, instead of grants going to individual neutron sources, for example, about a dozen facilities will have to apply for joint funding. "Everything in the FP6 goes toward big," says Robert McGreevy, who heads diffraction and muons at ISIS, the spallation neutron source at the Rutherford Appleton Laboratory near Oxford, UK, and chairs a network on neutron and muon beam sources—one of two dozen or so discipline-specific groups that interface with the EC. "In return for [our] taking on some management responsibility, what [the EC] offers is more flexibility," he says. The arrangement, adds Kurt Clausen, a neutron physicist at Risø National Laboratory in Roskilde, Denmark, "takes national labs and makes them more European. It lets the community itself make sure funding is used efficiently and on topics we are most interested in. It forces the community to sit down and make priorities."

The infrastructure money is the big new thing, agrees the University of Cambridge's Gerry Gilmore, who chairs a network that looks out for optical and infrared astronomy in FP6. "It funds technological development. It will allow you to build new telescopes and pay for people to use them. Before, this money was tiny—now it's even possible to do design studies for a future telescope." The design money could also aid CERN and other high-energy labs in planning a next-generation particle accelerator, neutron users in getting started on a European spallation source, and so on. This money serves a unifying role, says Gilmore. "When you have 15 to 20 economies, you are always having a bad year somewhere. That's where the EU can step in and say, 'We'll give you seed corn.' This solves the problem of countries being out of phase or having a veto. FP6 is establishing a way in which people can agree on Europe-wide priorities."

Flexibility and autonomy

Cutting across nearly all FP6 funding avenues is a retreat by the EC from heavy-handed management. As with the networks of large facilities, administrative duties will be shifted to grantees in networks of excellence and integrated projects. Says the EC's Kind, "We want to move our monitoring away from knowing what exactly they spend all their money on and focus instead on the output."

The move could go a long way toward reversing the EC's reputation as a bureaucratic nightmare. Says Bourguignon, "Each time I wanted to invite someone [to the IHES], even for one week, I had to get permission. That's crazy. The person in charge of us is good, but is managing 65 contracts. Why should they know better than I who should come?" Others tell of losing postdocs to US offers due to

delays, or of being put off by the hassle of applying for EC money. Indeed, says Bourguignon, "the situation got to such a point that, according to a study conducted by the French government, the best labs were ignoring European funding because it was not flexible enough and the bureaucracy was too heavy."

Increased flexibility and autonomy are key improvements, agrees Bijan Saghai, who serves as a liaison to the EC for the department of nuclear, elementary particle, and astrophysics in France's Atomic Energy Commission (CEA), where he is a hadron theorist. "This will give more possibility to adapt research to updated levels, and not just finish projects suggested three years ago. [FP6] plays the role of catalyst for me. It is a new way of working and thinking. I think it will evolve whole institutions in Europe. That's more than a 5% impact. It's a cultural evolution."

TONI FEDER

OSTP Issues Blueprint for Improving US Neutron-Scattering Capabilities

There is a shortage of neutron sources available to US scientists, and while the SNS will help, demand is expected to eventually outstrip even that facility.

The demand for neutron sources in the US nearly doubled during the past decade while the availability of first-rate instruments at neutron facilities declined more than 15%. Add to that the 1999 closing of the High Flux Beam Reactor (HFBR) at Brookhaven National Laboratory, and the US science community is left at a significant disadvantage in neutron-scattering capability compared to Western Europe and Japan. That is the conclusion of a new Office of Science and Technology Policy report that calls for improving, through better instrumentation and more efficient use, the overall quality of the handful of US neutron source facilities.

In a document entitled *Report on the Status and Needs of Major Neutron Scattering Facilities and Instruments in the United States*, an interagency working group of scientists, chaired by Patrick Gallagher of the NIST Center for Neutron Research (NCNR) in Gaithersburg, Maryland, compared the efficiency of the four major neutron facilities now operating in the US and then looked at where the US will stand when the Spallation Neutron Source (SNS) goes online in 2006.

The report said that the neutron facility at NIST "is the only US facility which currently provides a broad range of world-class capability." The report noted that the anticipated completion of the SNS at Oak Ridge National Laboratory in Tennessee in 2006 "is the most significant new opportunity to provide world-leading neutron-scattering capability in the United States." But the report warned that the SNS alone "cannot provide the necessary neutron-scattering capability [to meet demand] and ways must be found to enhance the effectiveness of other sources as well."

There are four major sources for neutron scattering research in the US, of which two are reactor based and two are accelerator-based spallation neutron sources. The High Flux Isotope Reactor (HFIR) at the Oak Ridge National Laboratory and the NCNR are the reactor-based sources. The Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory in Illinois, and the Los Alamos Neutron Science Center (LANSCE) at Los Alamos National Laboratory are the two accelerator-based sources.

Brookhaven's HFBR ceased regular operations in 1997 and was permanently closed in 1999 due to a tritium leak into groundwater from a fuel storage pool. The void left by the loss of the HFBR has been filled in part by increased operations at NCNR and ongoing upgrades to HFIR. The US still lags far behind Europe, however, and the report notes that the gap won't be narrowed until the completion of the $1.4 billion SNS, scheduled to become operational in 2006. The SNS will be "the world's first advanced-design, high-power spallation neutron source," the report says. However, the full potential of the SNS will not be realized without a full instrument suite, which is not part of the current construction budget. To remedy that problem the report calls for immediately establishing "a framework for an interagency partnership to provide funding . . . to develop and operate a robust suite of instruments."

James Rhyne, a University of Missouri physicist and president of the Neutron Scattering Society of America, said that while a fully instrumented SNS is critical, "it would be unfortunate to put all of our eggs in the SNS basket." Rhyne, who termed the neutron report "outstanding and very comprehensive," said its recommendations that instruments at existing facilities be modernized are important. "NIST has a number of new and upgraded instruments, but others there and at other labs are 25 to 30 years old," he said. "We can gain a lot by modernizing instrumentation."

Data tells the story

Patricia Dehmer, the associate director for DOE's Office of Basic Energy Sciences and a member of the study's working group, said, "I think the report is very objective in that it relies heavily on an awful lot of data that we collected on the facilities and on the user base and the user demographics." The data were "very compelling and essentially told a story," she added. "And that story is that the user base is becoming increasingly heterogeneous, just like for the light sources."

Although the traditional fields of condensed matter physics, materials science, and chemistry continue to make up a large element of the research program at neutron facilities, the report says, the largest growth in neutron-scattering use over the past decade has been in fields that exploit low-Q diffraction and high-resolution spectroscopy instrumentation at high-intensity cold sources. "These include polymer science; materials science and nanomaterials; complex fluids and other areas of 'soft' condensed matter physics and biology," the study says. The use of neutron scattering for biological research, which totaled about 5% of facility use in 2000, could increase significantly as improved instruments are added to existing facilities and the SNS comes online, according to the report.

To meet the changing nature of the user base and to try to regain world-class capability in the field, the report offered four recommendations:

- Fully develop at least 85% of available beam lines with instrumentation that exceeds, or is at least competitive with, international instruments. The recommendation also calls for maximizing beam time available to a broad scientific community by using independent, peer-review programs, and increasing the scientific staff at the facilities.
- Form partnerships between the "steward" agency at each facility and other federal agencies to ensure both stable funding and wide access by researchers to the neutron sources.