The European Union's Framework research program this year hopes to admit 10 central and eastern European states. For the new recruits, playing in the big league has a price, and a prize worth playing for

Eastern Europe's Research Gamble

PRAGUE, WARSAW, AND BUCHAREST—Nearly a decade after the fall of the Berlin Wall, the former communist countries of central and eastern Europe are still waiting impatiently outside the door of the European Union (EU), eager to join the club. But early this year, scientists in as many as 10 of those countries will get a taste of life on the inside: for the first time, becoming full participants in the EU's new flagship research program, Framework 5. For cash-strapped nations from the Baltic to the Black Sea, the chance to join the Framework represents a major opportunity. But it also constitutes a high-stakes gamble: Governments will pay for participation up front and hope that their researchers win back the cost of admission in grants.

EXPANDING EU

As the European Union today launches its single currency, its thoughts also turn to expansion, particularly into the post-communist countries of central and eastern Europe. *Science* assesses what it will mean for their researchers to be admitted to the club.

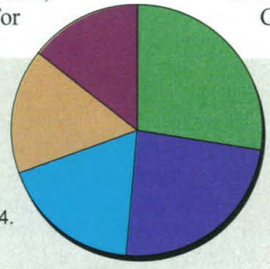
▶ EXPANSION
SLOVENIA
CZECH/SLOVAK
U.S. AID

It's a serious wager. After initial subsidies end, Framework 5 subscriptions will consume as much as a tenth of the already-meager national research budgets of some countries. And the competition for grants will be intense: The post-communist region's researchers will be up against teams from research powerhouses such as Germany, France, and the United Kingdom. "The challenge is for our scientists to bring their research—and their grant applications—to a high international level," says Andrzej Wiszniewski, a former university rector in Wroclaw who is now the minister-level chairman of Poland's KBN granting agency.

The chance for Polish and other scientists to test their mettle against international competitors is the result of a major expansion of the Framework program. Nineteen countries participated in Framework 4, which ended last month: 15 EU members plus four that joined as associates. The $17.6 billion Framework 5—which begins its 4-year run next month—is expected to encompass 31 countries, including 10 from post-communist Europe. Parliaments in a few of these countries could still block entry, but Brussels expects firm commitments by the time of Framework 5's formal kickoff in late February. Although researchers from some of these aspiring associates took part in previous Framework programs, they were admitted only on a project-by-project basis. Now, they will be able to form their own collaborations, with at least one partner from an EU country, and apply to Brussels for grants.

For most of these countries, however, the cost of associate membership in Framework 5 is just the ante in a higher-stakes game: the political maneuvering to become full EU members in the next round of expansion, probably between 2003 and 2007. For favored countries such as Poland and Hungary, which have earned high marks for their economic and scientific restructuring, eventual EU membership offers the prospect of playing for serious money: the EU's "structural funds." Intended to beef up infrastructure in regions with low per-capita income, structural funds include substantial sums for R&D projects, such as new laboratories and computer networks. For new member nations, the amounts of money they expect to receive from the structural funds would dwarf what their scientists win in Framework 5 grants.

Although science represents only a small factor in the negotiations to join the EU, associate membership in Framework 5 is a crucial first step in that process. Hence, officials in countries across the region are putting in countless hours trying to bring their research structures up to EU standards, as well as scraping together the annual fees required to join Framework. They see participation in Framework 5—and, later, joining the EU itself—as the best hope for scientists in post-communist Europe to climb out of the depression of the past decade. "We have no alternative: We must join the EU and take part in its research frameworks," says Rudolf Zahradnik, a physical chemist who is president of the Czech Academy of Sciences.



Framework 5 Program
The European Union's main research, technology, and development program

Duration: 4 years, 1999–2002

Budget: $17.6 billion, an increase of 4.6% in real terms over Framework 4.

Main Categories for Research:

- Quality of Life and the Management of Living Resources, including food, health, the "cell factory," and sustainable agriculture.
- User-Friendly Information Society, including information technology, multimedia, and electronic commerce.
- Competitive and Sustainable Growth, including production processes, transport, and aeronautics.
- Energy, Environment, and Sustainable Development, including water management, climate change, biodiversity, cultural heritage, renewable energy, and energy efficiency.
- Special programs, including EURATOM nuclear research, international cooperation, the Joint Research Centre, business programs, and "socio-economic knowledge base" research.

SOURCE: EUROPEAN COMMISSION

At what cost?

With so much at stake, many scientists in central and eastern Europe are nervous. Over the past 6 months, *Science* has interviewed more than 60 researchers and science administrators, from Gdansk on Poland's north coast to Bucharest in southern Romania, and a clear pattern has emerged: The region's science administrators are more enthusiastic about joining Framework 5 than are the scientists themselves. In Hungary, Pal Venetianer, a molecular biologist at the Biological Research Center in Szeged, supports Framework but worries that "if we are not successful in grant applications, the result will be a net loss for Hungarian R&D." In Ljubljana, Dragan D. Mihailovic, a physicist at the Jozef Stefan Institute, says Slovenian science did well under the project-by-project participation in Framework 4, but "I'm not

at all sure that we will be able to get back, in research grants, the sums that Slovenia's government will pay."

Officials at the EU science directorate in Brussels offer no guarantees, but say they have fashioned the new Framework—especially its fee structure—to ease the financial burden on central European countries. Each associate member is expected to pay an annual subscription based on the relative size of its gross domestic product (GDP). But when post-communist nations said they could not afford the fees, the EU allowed new associates to begin by paying only 40% of their fee the first year, 60% the second, and 80% the third before paying the full amount in Framework 5's final year. They can also use grants from an EU aid program to pay up to one-third of their Framework fees. Says Ranier Gerold, an EU research directorate official who until recently supervised science programs for the region, "We realize that financing is a problem, and we have done what we can to help."

Those measures have made initial membership more palatable. For example, Estonian officials estimate that their first-year payment will represent only 4% of their government's research budget. But once the initial subsidies run out, Framework fees are likely to spur some tough decision making. Says Stanislovas Zurauskas of the Lithuanian science ministry: "Framework will open up new opportunities for us, but it presents a challenge to the nation's R&D system."

In many post-communist countries, research is so underfunded that any additional expenses may well cause problems. R&D spending as a percentage of GDP is well below 1% in most post-communist countries, where research systems—along with their economies as a whole—have endured harsh reforms this decade to make the difficult transition from discarded socialist models to leaner, competitive free-market approaches. While R&D budgets are finally on the rise again in Hungary and a few other countries, economic problems have crippled research budgets elsewhere. Bulgaria's prime minister, Ivan Kostov, concedes that "science financing is a serious problem" for many post-communist nations. But, he says, "It is precisely because we consider science and education a national priority that we are launching a large-scale reform," which is likely to include Framework associate membership.

Even relatively prosperous Poland faces strains. Some scientists—angered by the Finance Ministry's efforts to reduce basic-research funding—formed a "Save Polish Science" committee last summer that helped convince the government to at least preserve, and perhaps increase, the level of R&D spending. A leader of that effort, physicist and former Warsaw University rector Andrzej-Kajetan Wroblewski, says "scientists are aware that the 'regular' science budget will be reduced" as a result of Framework fees. "But joining the 5th Framework seems to be a necessity. Poland simply can't stay away from it if we ever want to join the EU."

"We have no alternative: We must join the EU and take part in its research frameworks."
—Rudolf Zahradnik

In Romania, researchers were disheartened last year when the government cut its contribution to the nation's already-anemic research budget to about 0.2% of GDP. But many scientists are determined to bite the bullet in order to reap the benefits of wider European research networking. "It will be costly, but it is a price which we have to pay," says Ionel Haiduc, a chemist who is vice president of the Romanian Academy. "We have to be involved to avoid isolation." Elmars Grens, a molecular biologist who is a member of Latvia's science council, takes a similar view. Joining Framework, he says, is "the only way to preserve international collaboration and make sure that good science survives."

Some researchers relish the challenge ahead. "I'm optimistic that Hungarian scientists will be talented enough to get back in grants what our government contributes in fees," says Norbert Kroo, a solid-state physicist who recently became Hungary's deputy education minister for science policy. In Slovakia, computer scientist Ivan Trebaticky, the Education Ministry's head of scientific cooperation, says, "It's now up to our scientists to show that Slovakia can get as much out of Framework 5 as the government put in."

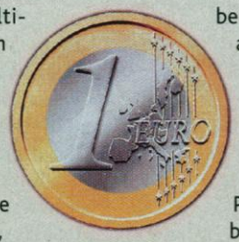
Many basic researchers fear, however, that they may not be competing on a level playing field: While their national R&D budgets are heavily weighted toward basic research, Framework 5 is more oriented toward applied research. "The Framework looks as if it is mainly an industrial-research program," complains physicist Robert Blinc, vice president of the Slovenian Academy. In response, EU officials say Frameworks are by definition oriented mainly towards applied research—addressing EU priorities—but they also include some basic-science projects. "There are basic-science aspects to this program," says Finnish physicist Jorma Routti, the top civil servant at the EU's research directorate. But he adds that "it makes no sense to duplicate science-driven research conducted at the national level."

An EU-commissioned report by the consulting firm Coopers & Lybrand found that in most post-communist countries there is an overemphasis on basic science, while industrial research is underdeveloped. The report recommended major efforts toward a more balanced mix. Hungary, for one, has pursued that course, fostering the creation of several major industrial R&D centers. And some central Eu-

CREDIT: (BOTTOM) R. KOENIG

Will the Euro Help Grants Flow?

BRUSSELS—Managers of national research programs in Europe have traditionally kept a close watch on international money markets. If their nation's currency weakened, the costs of participating in multinational European projects could suddenly go through the roof, prompting cuts in domestic projects. For most members of the European Union (EU), such gyrations are about to become a lesser concern. Today, 11 of the 15 EU countries take a major step toward adoption of a single European currency, the Euro. The long-term result, many researchers predict, will be more international mobility among scientists and more reliable budgeting for cross-border collaborations.



Unifying force? The new Euro coin.

In the first phase, exchange rates between the Euro and the currencies of the participating members will be permanently fixed. While national currencies will remain legal tender, foreign exchange and some bank transactions will be done in Euros. Euro notes and coins will be phased in gradually after 2001, until their use becomes mandatory on 1 July 2002.

The president of Germany's Max Planck Society, Hubert Markl—a biologist who has appeared in ads that back the Euro—regards the currency as "a stabilizing element for the development of European research." Says Markl: "It makes it easier to move scientists in EU nations, and it should strengthen our ability to find more synergies in European research, especially in 'big science' projects." Peter Day, a solid-state chemist and former director of the Institute Laue-Langevin in Grenoble who is now at the Royal Institution in London, also sees potential budgeting advantages. "No national research council now knows exactly how many French francs or Deutschemarks and so on they have to set aside" for membership in international projects, observes Day.

Ernst-Ludwig Winnacker, a biochemist who heads Germany's DFG granting agency, agrees that the introduction of the Euro will speed scientific integration and cooperation: "Once the Euro is in common use—and a scientist in Munich is paid in the same currency as a researcher in Paris—some psychological barriers will disappear, and we'll see even more international cooperation." Jorma Routti, a Finnish physicist who heads the EU's research directorate, foresees mainly indirect advantages for science: "The common currency will strengthen the interaction of Europe's scientific and financial spheres to provide more opportunity for launching high-tech companies."

These predictions will, however, be of little comfort to researchers in the United Kingdom, Denmark, Sweden, and Greece—the four EU countries that opted not to join the Euro. "I deal with a European contract at the moment," says Bob Cernik, assistant director for physical science at Britain's Daresbury Laboratory. "We are paid in ecu [the prototype for the Euro] and, ... as a consequence of [the strength of the pound], I lost something in the region of [$425,000] from [the project] budget because of currency fluctuations." From a personal point of view, Cernik says: "If we were part of the Euro, that, of course, would make planning easier." Cernik and his colleagues will continue to keep a close eye on the money markets. **–R.K.**

With reporting by Alexander Hellemans.

ropean officials argue that joining Framework 5 will nudge their national programs in a similar direction. Polish Prime Minister Jerzy Buzek, a former chemical engineering researcher, told *Science*: "I am absolutely convinced that applied science in Poland will help determine our economic growth and our potential for joining the EU."

Membership in sight

Like Buzek, many central European science officials view participation in Framework 5 as a stepping stone to full membership in the EU club. Associate membership in Framework 5 "will improve our strategic orientation toward the EU," says Slovenia's foreign minister Boris Frlec, a chemist. Judging from the experiences of scientists whose nations have joined the EU over the past decade—notably, Ireland, Spain, and Portugal—membership comes with substantial benefits, especially the chance to compete for structural funds. "For Spain, EU structural funds have been of tremendous value to improving the state of research," says Rafael Rodriguez, a materials scientist with the Spanish Council for Scientific Research.

Lajos Nyiri, the former president of Hungary's OMFB R&D agency, argues that there are many other hidden scientific benefits of EU membership, such as increasing research collaborations, opening up new markets that will heighten the business demand for R&D, and making the nation more attractive to international investors. "We studied what happened in Ireland and Portugal and found great benefits for science and technology there," he says. Indeed, the next expansion round could create a new de facto demarcation across central Europe—separating the "haves" from the "have nots." Last year, the EU tapped five central European states as the most likely candidates for membership: Poland, Hungary, the Czech Republic (see p. 25), Estonia, and Slovenia (see p. 25). But the nations excluded from the next expansion round may take many more years to get into the elite club.

EASTERN EUROPE'S VITAL STATISTICS

Country	R&D spending as % of GDP (1994–95)	Citation Impact (cites/paper 1993–97)
Bulgaria	0.60	1.52
Czech Republic	1.15	1.57
Estonia	0.63	2.29
Hungary	0.89	2.64
Latvia	0.52	1.59
Lithuania	0.48	2.27
Poland	0.84	2.11
Romania	0.68	1.30
Slovak Republic	1.01	1.17
Slovenia	1.61	2.19
EU Average	1.84	n/a
U.S.A.	2.64	5.36

Whether the EU opts to expand quickly, or slowly, into post-communist Europe, nearly everyone agrees that it will be decades before the level of science in the region will match that of the west. Even the former East Germany still lags behind the west—despite massive efforts to bolster its research base. Hubert Markl, president of Germany's Max Planck Society, says that "countries like Poland and Hungary have been making tremendous efforts to improve their research. But, depending on economic developments, it may take 20 or 30 years before a full equilibrium is reached."

When Slovak immunologist Michael Novak did research at Cambridge University in 1989, a British colleague predicted that the first 10 years after the Iron Curtain's fall would be the worst for central Europe's scientists, and "it might take 20 to 30 years for scientists here to fully regain their former prominence." Says Novak, who now directs the Slovak Academy's Institute of Neuroimmunology in Bratislava: "I didn't believe him, but now I see that it may well take another 20 years before this region's scientists reach the same position as researchers in the west." **–ROBERT KOENIG**

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