

# Science endures as conditions in Greece worsen

Worry, resignation, and optimism mix among Greek scientists as they deal with salary cuts, ever-changing laws, and pervasive uncertainty.

**Y**ou need fresh blood. This is a long-term catastrophe," says Leonidas Resvanis, a high-energy physicist at the University of Athens. For scientists in Greece, the country's financial meltdown has exacerbated preexisting problems and created new ones. Money for research was already both tight and irregular, but now it's not clear when or if it will be disbursed at all. The community is worried that the best scientists will leave and that recruiting people is becoming impossible.

Greece is, of course, striving to reduce its spending and debt according to guidelines from the troika of the International Monetary Fund, the European Central Bank, and the European Commission. But the country's scientists fear that applying the prescribed measures across the board, without regard to quality or productivity, damages science. As Giorgos Tsironis, a physicist at

the University of Crete and at the Foundation for Research and Technology–Hellas (FORTH), puts it, "If the remedy is successful, but the patient dies, it's not a very good remedy."

"The ambience really worries me," says Resvanis. "To produce, you have to be in a creative atmosphere. People in Greece don't know what will come above the horizon tomorrow. They are scared. When you have to make a choice, you take the conservative approach, and this is not how science moves forward."

## Relying on Europe

Greece gets about €3 billion (\$4 billion) per year in European structural funds—money collected from value-added tax throughout the European Union for use in poorer regions. Roughly €150 million of that, earmarked for research, is administered by the Greek government. Since

structural funding began more than 20 years ago, the country has assigned its national research budget to go mainly toward projects funded by the European money. In 2011 the European Commission lowered from 25% to 5% the percentage that Greece is required to match, making it easier in some cases for researchers to get funding.

The other main source of research funding in Greece is competitive grants through the European Union. Greek scientists manage to win a lot of European Union grants, says Achilleas Mitsos, an economics professor who served as director general of the European Commission's research directorate and until last year was secretary general for research in Greece's education ministry. "Since that money and the structural funds have not been reduced, you would imagine that in terms of funding, research is not suffering a lot. But things are not like that, unfortunately."

The European money is to some extent shielding research from the financial crisis. But soft money is not a dependable source of funding, it does not allow for long-term planning, and it rarely covers fixed costs, such as equipment maintenance, salaries, water, and electricity. Such fixed costs are covered by the Greek government, and money for them has been repeatedly slashed. Greece invests only about 0.5% of its gross national product in research. Membership fees for international scientific organizations such as CERN, the European Space Agency, and the European Molecular Biology Laboratory, which total about €30 million a year, take up a sizable portion of the Greek research budget and are being paid.

## Ubiquitous cuts

Not surprisingly, anything that requires money from the Greek government is feeling the squeeze. Salaries for faculty at Greece's research centers and two dozen or so universities have been cut by up to 30% in the past two years, and another 10%–15% cut is expected this summer. New hires are officially allowed at a rate of 1 per 5–10 vacancies. For months libraries have been unable to pay for journal access. Facilities are doing without technicians.

Resvanis, who heads plans to build an underwater neutrino detector in the Mediterranean Sea, says that about



Participants at the first Greek–Turkish conference on statistical mechanics and dynamical systems in 2008 stand in front of the library ruins in the ancient Greek city of Ephesus. Greece is not cohosting the conference this year because of the country's financial crisis.

\$1 million he had “accumulated” for running the project “evaporated” a year and half ago. [The government] took it away to supplement salaries. You cannot say no to that.” Still, the project remains an “oasis,” he says. Plans for the detector have increased from 1 km<sup>3</sup> to 10 km<sup>3</sup>, with a €240 million price tag. The Greek government is so far standing by its commitment of €50 million, of which it must provide only 5%; the rest will come from structural funds. The partner countries are Italy—which will also pay out of structural funds—France, Germany, the Netherlands, and Romania.

Scientists have sometimes had luck getting small grants from sources such as the Onassis and Latsis Foundations. Last year, Stavros Baloyannis, a neurologist, managed to launch a new institute to study Alzheimer’s, aging, and degenerative disorders. “I have an electron microscope, light microscopes, a PCR [polymerase chain reaction instrument] for genetics, and I have organized equipment for neuropathology and neurochemistry,” he says. Most of the institute’s funding is from the Greek Orthodox Church. Even so, Baloyannis spends money from his own pockets on research. And charitable organizations are saying they no longer have money for science because of more pressing demands, says Astero Provata, a researcher at one of the National Center for Scientific Research (“Demokritos”) institutes in Athens. She and colleagues have been denied their requests for a few thousand euros to cover expenses for a conference on genomic complexity in Brussels later this year.

Even projects that have been approved to get structural funds sit waiting for the money. Tassos Bountis, a physicist at the University of Patras, leads one such project, on mathematical modeling of complex systems in biomedicine, physics, and the technology of materials. The project is supposed to get €500 000, and is one of 200 projects waiting for promised funding. Bountis is optimistic that the money will come through soon because, he says, “we know the money is there. And politicians are being scrutinized now. They realize they can’t get away with channeling the money to something else.”

### “Unexpected discontinuities”

Superimposed on the tight funding are constantly changing rules. A set of university reforms enacted last year has yet to be implemented because of opposition within the university hierarchy and by students. In February scientists were surprised by an announcement that the



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*Journal of American Chemical Society, March 2011*

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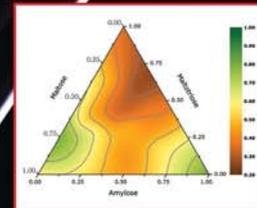
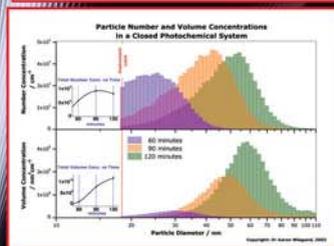
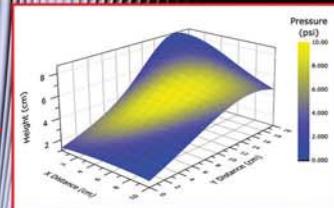
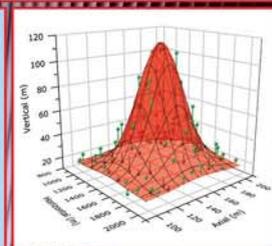
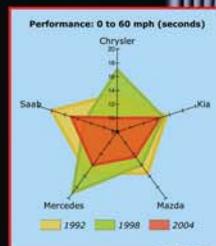
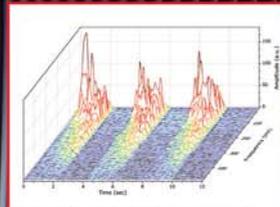
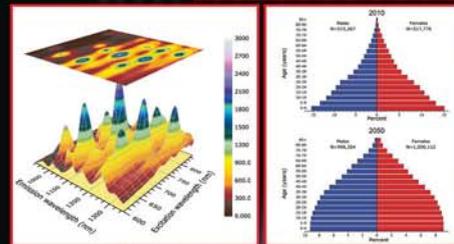
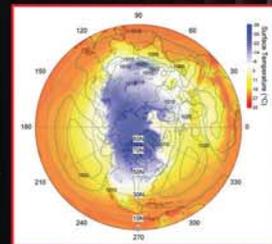
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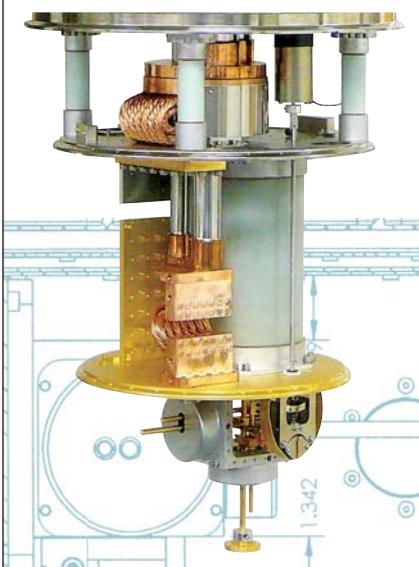
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**A laser technique for cleaning statues** is applied here to a caryatid from the Acropolis. The technique, developed by scientists at the FORTH Institute of Electronic Structure and Lasers in Crete, involves the simultaneous emission of two wavelengths and preserves the surface.

country's 56 public research institutes would be merged to 31. The idea is to share resources, but researchers are skeptical. The mergers are "an exercise in linguistics and window dressing with no substantial effect on budgets or anything else," says Ion Siotis, a high-energy physicist and former director of Demokritos and of the National Hellenic Research Foundation. "This exercise will allow our ministry to tell the troika that Greece is reducing the number of public bodies and thus saving on public expenditure. It is all a big joke."

For example, the eight Demokritos institutes have been recast as five, including the merging of three Athens institutes to form the Institute of Advanced Materials, Physicochemical Processes, Nanotechnology, and Microsystems. The government is creating a few mega-institutes, and next to them there will be nano-institutes, says Georgios Papavasiliou, director of the now subsumed Institute for Advanced Materials. Merging research centers is necessary, he says, "but not in a hurry. There is no plan behind this merging." The mergers, he adds, were done independently of an imminent law intended to restructure and streamline the research system.

In Greece, says Costas Fotakis, president of the seven research institutes that make up FORTH, "we are witnessing a violent financial restructuring which deeply affects the society and the scientific landscape. It is causing some unexpected discontinuities." Fotakis and others are particularly upset about the cuts applied across all scientific ac-

tivities "without preserving existing islands of excellence." Treating everyone the same, he says, "works against those who do exceptionally good work."

Such horizontal cuts are in keeping with Greece's tradition of not linking performance with funding for education and research, says Lefteris Economou, retired president of FORTH. The best scientists survive by getting money from the European Union, he says, "but this does not promote competition within the Greek system. If everyone thinks their salary is guaranteed, more and more start not producing." What's more, he notes, most Greek researchers get their PhDs in other countries and then come back. He says many of them end their careers after a postdoc. "They have high enthusiasm in the beginning, but they receive almost no funding from the Greek government, and they see others who are deadwood treated the same way they are. In the long run this does not promote high performance."

Michael Kokkoris says that he, "like all young scientists in Greece, got no startup package" when he returned from the US to become an assistant professor in experimental nuclear physics at the National Technical University of Athens. "The whole core of research is in constant jeopardy. The fact that we have learned to produce with little should not hide the need for structural reforms"—and for more money.

On top of such long-term problems with Greece's research system, the crisis creates "a general paralysis of machinery. This paralysis is choking everything," says Siotis. Another problem, he

says, is that “our politicians believe research should have a short-term financial return. Our effort is to change this unrealistic attitude that leads to enormous waste of resources through the funding of ‘monkey projects’ that ultimately do not deliver.”

### Human capital

More than the salary cuts, more than the changing laws and merging centers, more than the uncertainty and having to make do with little money, scientists in Greece are worried about keeping their community vibrant. “Greek scientists have always gone outside to study and work,” says Provata. “The difference now is that students who are finishing their bachelor’s degrees in physics don’t even consider the possibility of staying in Greece. They are all asking for help to get out. And the ones who are outside the country and have gained experience do not consider the possibility of returning.” Says Kokkoris, “I love my country, I do not want to leave. The level of our students is high. It is decadent to be forced to send all these young minds abroad. But what can I tell them about the future?”

The University of Crete and FORTH were created about 30 years ago by Greek scientists who returned from years abroad. Says Fotakis, “We have managed to act as a pole of attraction for prominent scientists and talented young researchers. Now we are in danger of losing them, or some of them. It’s not only a financial problem, it’s a political problem.” One of the main dangers of the crisis, he says, “is that we have a repetition of brain drain. Human capital—not just researchers, but technicians and administrators, too—[is] more important than the actual infrastructure.”

Until last fall, the Demokritos institutes were collectively able to offer scholarships for 100 PhD students, thanks to Greek national money. “If the blood is students, then the flesh is postdocs,” says Papavasiliou. “Funding for postdocs hasn’t stopped yet, but I am afraid we will not have them for long. Things are getting worse.”

Many scientists say they are counting on the structural funds to tide them over. But Economou says he is “hoping for a miracle. It has to come soon if a culture of scientific excellence in Greece is to survive.”

Toni Feder

## Computer games take their place in the science classroom

A 2011 National Research Council report found emerging but inconclusive evidence that educational science-based games improve learning.

When senior NASA officials came looking for someone to lead the development of a computer game that would teach science and engineering concepts, Daniel Laughlin, a project manager for the agency’s educa-

tion division, says he hesitated to admit he was an avid gamer. Back then, in 2003, video games were considered frivolous and not an “adult” hobby.

Attitudes have changed, says Laughlin, who took the job that resulted



**Cracking science puzzles** takes on a whole new meaning in the virtual world. In a soon-to-be-released online game (left), players help each other solve biology and math quests. In **SURGE EPIGAME** (right), players propel a spaceship using their knowledge of Newtonian mechanics.

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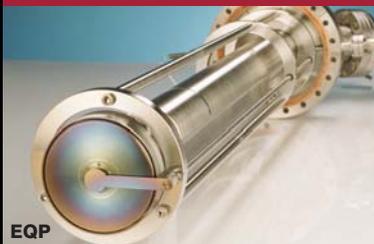
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