

Puerto Rico's fiscal woes threaten its scientific future

Cash-strapped physics departments in the island's main university system cannot hire new researchers to replace the ones that retire or migrate.

As Puerto Rico teeters on the brink of financial default, its scientific community is bracing for the worst. On 1 December, before a US Senate committee, Governor Alejandro García Padilla declared that the US territory has “no cash left” to pay down its \$72 billion debt or fund its public institutions.

The fiscal and economic growth plan unveiled by the governor last year could cripple the 11-campus University of Puerto Rico system. If enacted, the UPR's government subsidy, which currently funds two-thirds of the university's budget, would be reduced from \$834 million in 2016 to \$634 million by 2020.

An approved long-term austerity plan, which could reflect input from the Puerto Rico legislature, voters, the island's creditors, and Congress, appears months away. Still, fears of what's to come are leading some UPR scientists to leave the island, which has created a brain drain that the government can't afford to plug.

“A major humanitarian crisis”

Economists trace the downturn to the phase-out in 2006 of a 30-year federal tax exemption that had attracted manufacturing companies to Puerto Rico. Since then, jobs—and people—have left in droves: In the past decade, according to a report by the Pew Research Center, an average of 48 000 Puerto Ricans per year migrated to the US mainland, five times the migration rate of the previous two decades.

Unlike US states, Puerto Rico cannot file for federal bankruptcy protection, and, by law, the island's government is required to make the debt payment on its general obligation bonds before it pays public workers. The Obama administration is pushing to allow Puerto Rico bankruptcy protection, which would require action by Congress.

In a 9 September speech, Governor García Padilla said Puerto Rico will face



REGINA RODRIGUEZ MANZANET

AT THE FENCE of the University of Puerto Rico—Río Piedras in San Juan, students gathered for a concert marking the end of a two-month strike. The strike, in 2010, was called in response to a proposal by then governor Luis Fortuño to cut UPR's funding and increase tuition. “This was no typical strike,” says Gerardo Morell, a physics professor at UPR—Río Piedras and senior scientist at the university's Institute for Functional Nanomaterials. “We were locked out of the university and our labs.” Budget cuts are on the table again.

“a major humanitarian crisis” if creditors are unwilling to restructure the debt. “It will force us to choose between paying a creditor, a teacher, a policeman, or a nurse.”

“We are the lucky ones”

Already feeling the pinch are two of the island's largest physics departments—on the UPR campuses in Río Piedras and Humacao. Río Piedras is a subdivision of San Juan, the capital city, on the northeast coast, and Humacao is about 50 km away, near the southeast coast. Because of budget cuts, “we're left with essentially no capacity to make projections or plans for more than some basic necessities,” says UPR—Río Piedras department chair José Nieves.

According to Nieves, within five to seven years the Río Piedras department could lose more than half of its 16 permanent faculty members to retirement alone. Those that remain are “overloaded with teaching and other related academic activities,” he says. The impact of further cuts will make it “impossible to replace retiring or migrating faculty [and will mean] no visitors program and no operational budget for the maintenance of the teaching labs and related facilities,” he adds.

The physics department at UPR—Humacao is down to 12 full-time faculty members, having lost 4 professors to retirement and migration in the past 10 years. “We are losing out on external research funding because we don't have

enough faculty to apply,” says UPR–Humacao physics professor Idalia Ramos. The last permanent hire was in 2008.

Ramos also is program director for the NSF-funded Partnership for Research and Education in Materials (PREM) between the University of Pennsylvania and three UPR campuses, led by UPR–Humacao. The partnership fosters research collaborations on nanoelectronics and materials modeling and expands research opportunities for Puerto Rican students. Ramos says of PREM participants, “We are the lucky ones, because our NSF grant was just renewed.”

Loss of critical mass

Private universities and research institutions are somewhat shielded from the direct blow of cuts to the island’s education budget. “Certainly we don’t have the same financial pressures as UPR,” says Jonathan Friedman, a professor at the private Metropolitan University (UMET). Friedman, a physicist, also directs the new Puerto Rico Photonics Institute, based at UMET and funded primarily by a \$2.5 million grant from the US Department of Labor. “What’s hurting everybody is the exodus of people, especially young talent, from the island,” he says.

One such talent is Carlos Rinaldi, a University of Florida biomedical and chemical engineering professor and Puerto Rico native. Rinaldi taught at the west-coast UPR–Mayagüez campus, the system’s engineering hub, from 2002 until he left for Florida in 2012. He was also a founding research scientist at the UPR-based, NSF-funded Institute for Functional Nanomaterials.

Rinaldi says he left Puerto Rico primarily to seek better living conditions for his family. He is critical of the poor financial support UPR faculty receive. The base pay is much lower than on the US mainland for an engineering professor, he says, and “my startup package was zero dollars.”

Many of the people leaving are the well-funded and well-published ones, says Rinaldi. “There are still good people [at UPR], but a lot of critical mass has been lost in science and engineering. It will take decades to rebuild.”

Daniel Altschuler, a physics professor at UPR–Río Piedras and a former director of the Arecibo Observatory, sees a negative long-term impact of the hiring



ELEMENTARY AND MIDDLE SCHOOL STUDENTS at a rural school in Yabucoa, Puerto Rico, participate in hands-on science demonstrations organized by students and faculty at the University of Puerto Rico–Humacao. More than 150 public schools have been closed in the past five years as the government tries to deal with a rapidly declining population and no money to fund its public programs.

freeze. Puerto Rican scientists have access to federal funding, so research won’t suffer much in the short term, he says. But he adds that the inability to hire new faculty is its own crisis. “In science, you need new PhDs and new ideas or you’ll stagnate.”

Ciencia Puerto Rico

For Nitza Santiago, a Puerto Rico native and UPR–Humacao graduate, the economic crisis has solidified her decision not to return after she completes her PhD in atmospheric science at North Carolina A&T State University. Her desire to pursue nonacademic research also plays a role. “There are more opportunities on the mainland geared towards what I would like to do once I graduate,” she says.

David Ernst says he hopes Puerto Rico hasn’t gotten so bad that researchers have no choice but to leave. The Vanderbilt University professor and cofounder of the National Society of Hispanic Physicists says he spent time in Mexico in the early 1970s helping to build up that country’s physics program. After the peso collapsed in the late 1970s, “I spent a lot of time helping many friends on the

faculties in Mexico find positions in the US and Europe,” he says. “What I learned is that it takes time, money, luck, and a lot of common sense to build science in a developing country, but a bad downturn in the economy can quickly undo all the effort.”

Giovanna Guerrero is executive director of Ciencia Puerto Rico, a virtual network of more than 7000 Puerto Rican scientists, Puerto Rican emigrants, and people otherwise committed to advancing science on the island. “The fact that many scientists choose to stay connected through networks like Ciencia Puerto Rico indicates there’s a larger scientific workforce that is willing to return or to help if the opportunity presents itself,” she says.

The government has taken a few initiatives to mitigate the negative effects on science, says Guerrero. She cites the Puerto Rico Science, Technology and Research Trust, an autonomous organization established in 2004 to promote investment in R&D on the island. Last year the trust awarded more than \$2 million in grants to support research in such areas as energy, aerospace, and biotechnology.

Jermy N. A. Matthews