

mate goal," says Roberto Pastres, a marine scientist at the University of Venice, but it's easier said than done.

Just predicting how the water behaves is mind-boggling. Water flow alters the lagoon's shape by moving sediments, which then changes the flow, and so forth. Add to that feedback loop the many urban and biological influences, and the hopeful modeler faces "an impossibly complex system," says Giampaolo Di Silvio, a hydraulic engineer at the University of Padua.

Fortunately, the researchers already have enormous amounts of information, from the movement of sediments to the dis-

tribution of sea life. "The Venice lagoon is the best studied in the world," says Di Silvio. One of the big questions to be answered with the final model, of course, is how the lagoon will react to the new tidal gates. But it will also help scientists around the world study how pollutants are shuttled through marine systems and the factors that lead to oxygen-choking algal blooms. The model may also help answer fundamental questions involving biodiversity and nutrient transport in sea-land systems.

Turning Venice into a science mecca could also save it from a ruinous brain drain. "Venice is in danger of becoming a dead

city, like a museum," says Carrera. Driven away by the high waters and high prices, the population has plummeted from 150,000 in the 1950s to 64,000 today. Nearly half of the city's income now comes from the 14 million tourists who flock to Venice each year, with most of the rest coming from port traffic. "We desperately need more young people," says Campostrini, and "one way to attract them is to build up the university and high-tech sectors." Otherwise, Venice may end up being saved from the sea but abandoned by its own people.

—JOHN BOHANNON

John Bohannon is a writer in Berlin, Germany.

After Katrina

Displaced Researchers Scramble To Keep Their Science Going

Despite huge personal losses, New Orleans scientists are hurrying to recreate their labs and lives with some help from the government

Tulane University biochemist Arthur Lustig is still reeling from Hurricane Katrina. He spent 4 days hunkered down in his New Orleans lab before being evacuated by helicopter, then another miserable night in a shelter. His house was likely lost to flooding, and he's not sure whether the 20 years' worth of yeast strains he uses to study telomeres survived the power outage.

But things could be a lot worse. Showered with invitations from colleagues around the country, Lustig is now living with his wife's family in Chicago and working at Northwestern University, with lab space for his four students and one postdoc. "It's a traumatic time. But I think most of us have a positive attitude that we can get over this," Lustig says.

Thousands of scientists face similar challenges. The flooding that displaced New Orleans residents after Katrina slammed into the Gulf Coast on 29 August exiled faculty members, graduate students, and postdocs from a half-dozen institutions in New Orleans. Thanks to Internet message boards and cell phone calls, many are regrouping in temporary labs and office spaces at other universities. "People have been really wonderful. They realize [Katrina] is a huge impact on careers," says Arthur Haas, chair of biochemistry and molecular biology at the Louisiana State University (LSU) Health



Rescue mission. Staff from Tulane's gene-therapy center bring Dewars of liquid nitrogen to retrieve adult stem cells from flooded research labs.



Sciences Center in New Orleans. Scientific societies have also rushed to help, posting Web sites for those who haven't yet found spots (www.aaas.org/katrina).

For some, the disruption may be short-lived. Tulane medical school officials hope to get a handle soon on mold in air conditioning ducts, the main obstacle to reopening buildings in their now-dry part of the city. But many researchers have already enrolled their children in schools elsewhere and don't expect to return until January, when university classes resume. Although they are trying to view the forced exile as a minisabbatical,

it's hard to be too optimistic about their research. "Will it slow us up competitively? Absolutely," says Lustig.

Against all odds, researchers did what they could to preserve their research materials. In the days after the storm, researchers from Tulane and LSU ventured back by boat, truck, and helicopter with armed guards to top off the liquid nitrogen covering storage containers and retrieve samples hastily ordered by priority. Tulane gene-therapy center director Darwin Prockop organized a convoy from Baton Rouge on 10 September to salvage their National Institutes of Health (NIH)-funded adult human stem cell bank, with staff lugging 36-kg Dewars up four flights of stairs to collect racks of vials.

Tulane scientists saved transgenic mice but had to euthanize most other animals; LSU animal caretakers destroyed or lost to flooding about 8000 animals in four vivariums, says Joseph Moerschbaeher, vice chancellor for academic affairs at LSU's Health Sciences Center. Also lost at Tulane were freezers of blood and urine samples, including those from the Bogalusa (Louisiana) Heart Study, which has followed thousands of children since 1972 to tease out heart disease risk factors. "It's a national tragedy," says Paul Whelton, Tulane senior vice president for health sciences.

Other scientists fear that mold has destroyed animal and plant collections built up over decades. Tulane ecologist Lee Dyer sneaked back and put desiccant and mold killer in drawers containing preserved insects. University of New Orleans (UNO) butterfly expert Phil DeVries and his wife, systematist Carla Penz, fear a severe toll on 30 years' work: preserved butterflies, hundreds of photographs, as well as rare identification books and countless field notebooks. Physical scientists, for their

Katrina Leaves Behind a Pile of Scientific Questions

Amid the cleanup in Katrina's wake, scientists are rushing into the field to gather data before they disappear. It's a sobering exercise. Havidan Rodriguez, who is leading a team from the Disaster Research Center at the University of Delaware, Newark, that is asking evacuees along the Gulf Coast how their basic needs are being met, says the task "is turning out to be more difficult" than similar efforts in Sri Lanka after the 26 December 2004 tsunami. "The breakdown of infrastructure is far greater," he says, "and the poverty is endemic."

One major focus is to reconstruct how the hurricane overcame New Orleans's defenses. The Hurricane Center (HC) at Louisiana State University (LSU), in nearby Baton Rouge, has become the de facto headquarters for that effort. After a whirlwind tour of the region, the center's researchers reported that the storm surge reached a height of 9 meters in some places. They are also updating a model of the floodwater's impact on the city. If the pumps hold out and no new tropical storms hit, says HC coastal scientist Hassan Mashriqui, the city should be fully drained by the end of the month.

Another priority involves tracking the consequences of dumping the city's contaminated floodwater into the surrounding environment. Initial tests by the Environmental Protection Agency and the Louisiana Department of Environmental Quality have allayed the worst fears: Fecal bacteria counts are high, but according to a preliminary analysis, it would take exposure of "a year or longer" to the chemicals at measured concentrations to cause serious health effects. Toxic algal blooms are another fear; the LSU Earth Scan Laboratory has been using an Indian satellite to search Lake Pontchartrain for signs of growth. Colder temperatures next month are expected to make blooms less likely and reduce the risk of further storms.

To help cover the costs of these and other projects, the National Science Foundation (NSF) is providing supplementary funding to existing grants. This week, NSF hoped to award about 30 "exploratory" research grants of between \$10,000 and \$30,000 chosen from some 120 proposals it received. A second competition closes this week for a larger pot of money. The timing could not have been worse, says NSF's Dennis Wenger, because "Katrina hit right at the end of the fiscal year." But "we're making it work." —JOHN BOHANNON



Go with the flow. Scientists are monitoring the impact of floodwater being pumped back into Lake Pontchartrain.

part, are worried about damage to sensitive equipment such as electron microscopes.

With their campuses closed until January, many scientists have accepted offers of temporary digs at other institutions. Xavier University microbiologist Shubha Ireland feels especially lucky. She was offered a spot in a molecular biology lab at Oak Ridge National Laboratory in Tennessee. ORNL officials also secured a part-time administrative job for her husband Rick, a lawyer. And a local real estate developer donated a new four-bedroom house for the family to stay in for 6 months. "It's like a dream come true," says Ireland.

Although some scientists expect to use the time mainly to write papers, many others are determined to get back to the bench as quickly as possible. "Nobody is going to miss a beat—at least not in my group," says Zeev Rosenzweig, a chemist from UNO now living in McLean, Virginia, and working at the

nearby National Science Foundation (NSF). Rosenzweig moved up by 2 years the start date of a rotating position as officer for NSF's analytical and surface chemistry program and intends to relocate most of his group to the Washington, D.C., area.

Some hope their research will benefit from the unexpected move. UNO physicist Leonard Spinu was invited by a colleague from his native Romania to the National High Magnetic Field Laboratory at Florida State University in Tallahassee, which has some of the best facilities anywhere for his research on magnetic nanomaterials, he says. Tulane neuroscientist Andrei Belousov says his time in the lab of Sacha Nelson at Brandeis University in Waltham, Massachusetts, could spark new collaborations. "I hope it's something we can work together on, not simply charity," says Belousov.

Still others are preparing to rebuild

essential research materials. Haas, who lost 20 years' worth of samples for studying the ubiquitin system, expects to spend time re-expressing recombinant proteins at LSU's biomedical research center in Baton Rouge. "We've just got to bang out clones," he says.

Especially hard-hit are graduate students. Tulane's Vincent Shaw, whose adviser is evolutionary biologist Duncan Irshick, found a temporary spot at Brown University in Providence, Rhode Island. But he and his labmates needed to finish a paper in press, experimental animals now likely to be dead, and freezers full of thawed samples. "Researchwise, I am in a bad place," says Shaw.

Funding agencies are working to smooth these temporary transfers and help displaced researchers get back on track. NSF and NIH are relaxing rules to accommodate those caught in the catastrophe.

"We want to protect researchers so that they don't get stuck with the tab" for incurring expenses related to relocation or repair of federally funded projects, says NSF's Jean Feldman, who oversees a hotline that is getting 50 calls and e-mails a day.

In addition to information, the hotlines provide some therapy, says her NIH counterpart, Carol Alderson. "Some PIs [principal investigators] are resilient and just want to know what it'll take to get back to work," says Alderson. "Others sound like the people you hear on television; they've gone through the worst, and they don't think that their institution will ever recover."

Although federal agencies have promised to be as flexible as possible, there's a limit to how far they can bend. NIH, for example, has struck deals with Tulane and LSU allowing faculty to temporarily submit grant applications directly, but NSF says any proposal must still come from the institution. At the same time, both agencies plan to be lenient about enforcing application deadlines, with NSF decreeing a 1-year extension for any scientist in the three-state region whose grant would have expired this month or next.

Although grateful for the outpouring of help, New Orleans administrators worry that some universities are seeing the disaster as a chance to snap up talented faculty. At least a few have already taken permanent positions. "We do not want to see a brain drain. It would be terrible for the region," says Tulane's Whelton. "Our full aspiration is to get back in business and have an even stronger institution than when we left. And we'll need all the help we can to get to that point." —JOCELYN KAISER

With reporting by Adrian Cho, Eli Kintisch, Jeffrey Mervis, and Elizabeth Pennisi.

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