



One of the many streets of Manhattan that flooded and lost power after the storm surge in New York in October 2012.

# After the deluge

**Gordon Fishell** describes how he rebuilt his mouse research programme following the devastation wrought by Hurricane Sandy.

Six months ago, nearly all of my lab animals at the New York University (NYU) School of Medicine in Manhattan died. On 29 October 2012, Hurricane Sandy swept through the northeast coast of the United States. Salty water from the East River broke into the basement of my building, drowning 3,000 mice that carried 80 different traits I was studying. The mouse colony — which I used to study how neurons communicate with other cells — had been built up over 20 years. Many of my colleagues experienced similarly catastrophic losses.

Had I known exactly when and where the storm would pass, and just how bad it would be, I would have done more to prepare. We knew that a hurricane was coming, so we left the lab assuming that no one would be there for a few days. We put things away and checked that the emergency power was on. The animal-care people gave our mice extra water and food; we couldn't move the mice, because they had to stay in a germ-free environment to avoid infections, and there was nowhere large enough to put them.

On the day of the storm, all mass

transportation was closed, so I was forced to stay at home in Westchester. We knew early in the day that the water was rising — the park behind my house was flooded, so my son and I paddled around in our canoe. When I checked the weather report at 5 p.m., I saw that the storm had started tracking directly over the medical-school campus, and was going to hit in about two hours — at high tide. We were done for. It was obvious that our labs were in great danger, and there was nothing I could do.

The next day, I went stir-crazy at home — telephones and power were down, so there was no way of finding out how bad it was. My colleague Daniel Turnbull tried to drive us into Manhattan, but the bridges were closed. While in the car, I had limited phone reception and called Goichi Miyoshi, a postdoc who had made it into the lab. He told me that the generator had failed so the power was out, but that many crucial elements — cell lines, DNA constructs, primers and so on — were safe because he and other lab members had arrived at 7 a.m. and begun moving items to another building that had electricity.

"What about the mice?" I asked. "Are they okay?"

"They're all dead," he said.

We turned the car around and went back home. I felt an awful sense of despair, for the suffering and loss of the animals, for the years of work lost and for the impact this would have on the people in my lab who had put their hearts and souls into their research. I mourned for 12 hours, then realized that I needed to work out how to move forward.

## DAMAGE LIMITATION

When I finally reached the NYU medical-school campus, two days after the storm, it was organized chaos. There were trucks everywhere carrying dry ice and liquid nitrogen, and a loud buzz from the huge generators supplying emergency power to some of the buildings. Inside the medical centre where I work, the temperatures were exactly the same as outside — around 10°C. People were in shock but pulling together in a heartening way. Dafna Bar-Sagi, senior vice-president and vice-dean for science, who had barely slept in two days,



Researchers at New York University's medical school battling to keep samples cold after the flood.

► gave two updates as Richard Cohen, vice-president of facilities management, dealt with a seemingly endless list of logistic issues. The lifts were out of action, so my colleagues and I carried dry ice and liquid nitrogen up five dark flights of stairs to our labs, guided only by the feeble light of a few glow sticks on the steps and landings. (We were lucky — some labs were on the 13th floor.)

When I arrived, the lab was dark and quiet. The silent refrigerators and freezers held thousands of dollars' worth of kits, antibodies, serum and other lab tools that were slowly thawing, now useless.

As quickly as possible, I gathered everyone in my lab and said: "Tell me the most important experiments you need to do, the ones you planned to publish within the next three years. Tell me how you plan to get the animals, breed them and conduct the experiments. Let's shorten the time between today and getting back on our feet."

To continue her experiments, graduate student Sebnem Tuncdemir went to the Salk Institute for Biological Studies in La Jolla, California, to collaborate with neurobiologists Edward Callaway and Martyn Goulding. Others went to labs around New York, at institutions such as Cornell University and the Memorial Sloan-Kettering Cancer Center (MSKCC). It is hard to express my gratitude for the generosity and acts of kindness shown by the scientists who opened up their labs to us. We found ways to make the best use of the downtime — doing data analysis, writing papers, planning a thesis. Fortunately, my 14-person lab was largely made up of senior people who were finishing papers and looking for jobs, and those who weren't yet in the thick of their projects.

In the first few weeks, we lived without the normal channels of communication.

The university servers were down, so we couldn't send e-mails. Mobile phones were mostly down, too. People who could get onto the Internet communicated using personal e-mail accounts. Facebook went from social network to communication tool and came in handy to send messages to each other. Communication was not the only problem — around one-third of the researchers in our lab didn't have power at home, meaning no warm beds or showers for two to three weeks. Yet most of them still came to work. Amazingly, given the damage, within three weeks power was restored in the lab.

#### RODENT RESCUE

Over the years, I have sent a sample of each of my transgenic mice to my collaborators so that they could pursue similar work, which I felt was my duty as a publicly funded scientist. I never thought it would one day save my lab. Researchers around the world could now send me back my own mice and offered others of their own — even compound strains carrying multiple alleles. I received more than 150 e-mails offering help in the first week. Six months later, I've regained about 35% of what I lost.

Even though I am slowly re-acquiring my strains, researchers have often bred them with others, meaning that we must breed out the traits we don't want. Sometimes we start from scratch, which also takes time — to get four different genetic traits requires four rounds of breeding. Given that each breeding takes two months, and efficiency is about 50%, that translates to 16 months. We will be lucky to have rebuilt our colony within two years.

Furthermore, I have had to submit at least 50 new contracts that enable institutions to exchange patented alleles (material transfer

agreements) because the original contracts expire after three years. This was particularly frustrating. At times, an off-site location would have a mouse ready for me, but we could not get it shipped because of the legal issues.

Then there is the issue of where to keep the new mice. Because of the damage, we have subcontracted space at the MSKCC, and are housing some animals at commercial suppliers, such as the Jackson Laboratory in Bar Harbor, Maine. We will eventually move the colony to the third floor of the NYU science building, but it won't be ready for two years.

#### TIME TO REFLECT

Throughout this experience, I've had to adjust my expectations for my lab. Not every project can be delayed for six months and survive — in some cases, our competitive advantage has disappeared, so we have had to let those projects go. This might mean that we will get scooped on data that we would have published first had the hurricane not happened. But it has been liberating to stop running the race of competitive science and focus on where we are still ahead of the curve. The US National Institutes of Health is letting me rewrite some of the aims in my ongoing grants, so that I can use the money to pursue new projects.

There are other perverse upsides to this otherwise awful experience. We are much more prepared to handle a similar situation. I'm going to sit down with my lab and develop an emergency-response plan, in case the unexpected occurs again. I will make contingency plans that enable us to access our e-mails, research data and other information even if our server is down for two weeks.

I like to think that the hurricane has also helped my students in some ways, even though it has been frustrating and heart-breaking, and has set back or ended important projects. There were many times when the students needed to act before getting my approval, simply because we couldn't communicate, and they ultimately made the right decisions. The experience taught them how to be free agents; they are more responsible now for their science.

And there was good news even on the darkest of days. A week after the flood, when workers accessed the soaked room of the former mouse colony, they found something unexpected. Before the hurricane, Jennifer Pullium, director of laboratory animal resources, had asked her staff to move some mice to the highest racks, in case the unthinkable happened. When it did, the rising salt water came within inches of their cages. Against all the odds, they had survived. ■

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