measured the ratio of neodymium isotopes both in the chondritic meteorites thought to represent the solar system's starting material and in rocks derived from Earth's interior. The neodymium ratios were the same, within analytical error, implying that chondritic meteorites and accessible parts of Earth still resemble the solar system's starting material. But advances in mass-spectrometer technology have whittled away at the error bars. When researchers measured the same sort of rocks this year, they found a 20-part-per-million difference that had been undetectable in the earlier scatter.

The minute isotopic difference has opened a yawning chasm between cosmochemists. One camp simply assumes that Earth got its makings from a part of the nascent solar system that happened to have a distinctive, nonchondritic composition. Others believe that the presolar nebula was compositionally uniform, not lumpy, but that shortly after Earth's formation, while its rock was still roiling in a "magma ocean," a portion enriched in heat-generating elements separated out and sank beyond geochemists' ken. Today, it may still lie between molten core and rocky mantle, its heat helping generate the core's magnetic field and sending plumes of hot rock toward the surface.

7 Protein Portrait

This year, researchers got their best look yet at the molecular structure of a voltage-gated potassium channel, a protein as essential to nerve and muscle as transistors are to computers. Sitting in the cell membrane, these tiny gatekeepers open and close in response to voltage changes, controlling the flow of potassium ions. The new atomic-scale portrait should be extremely useful for biophysicists seeking to understand the workings of these crucial proteins. It may also represent a step toward reconciling a recent debate that has rankled the usually calm community of ion channel researchers. Or maybe not.

It all started in May 2003, when Roderick MacKinnon of Rockefeller University in New York City and colleagues published the first-ever structure of a voltage-gated potassium channel and proposed a model to explain how it worked. Everyone agreed that the snapshot was a technological feat. But many researchers suspected that the channel, called KvAP, had been distorted by the preparations for imaging, and critics complained that MacKinnon's proposed mechanism contradicted decades of experiments. A flurry of angry e-mails ensued. Unpleasant things were said.

This August, MacKinnon (who subsequently won the 2003 chemistry Nobel)

Disasters: Searching for Lessons From a Bad Year

No doubt about it, the 12 months since the last Breakthrough of the Year issue have been an *annus horribilis*. Three major natural disasters—the 2004 "Christmas tsunami" in the Indian Ocean, Hurricane Katrina on the U.S. Gulf Coast, and the Pakistan earthquake—left nearly 300,000 dead and millions homeless. In Pakistan, the disaster is still unfolding as winter engulfs the devastated communities.

Insurance companies classify such events as "acts of God": misfortunes for which no one is at fault. But in their aftermath, many scientists are pointing out that natural disasters are anything but natural: Societies can mitigate their impacts by making the right decisions about where and how people live, how information is shared, and what kind of research to invest in. And some are pushing new ideas to make that happen.

For example, Aromar Revi, a New Delhi–based disaster mitigation consultant to the Indian government, envisions "a public database like Google Earth" that would allow researchers around the world to map the "risk landscape down to the ZIP-code level." Such a system would enable nations with a shared risk to build better warning networks. But there are serious hurdles to going global. For example, India refused to share data for an international tsunami warning system because it could also reveal their nuclear tests (*Science*, 9 December, p. 1604). Nor will such a network come cheap, but Revi says governments will soon realize that it "is worth every cent of the many hundreds of millions of dollars it would cost to build and maintain."

A disaster warning system is only as good as the science behind it. For some events, such as hurricanes and volcanoes, science has vastly improved forecasts. But for others, such as earthquakes, decades of research may have illuminated how and where they are likely to strike, but not when.

Don't blame God. Better planning could make natural disasters much less disastrous, experts say.

Even with greatly enhanced warning systems and infrastructure, natural disasters will continue to wreak enormous damages. Who will pay for it? After the past year's $200 billion in damages from weather-related disasters alone—three times higher than for any previous year—some economists are calling for a radical rethink of disaster relief. Rather than relying on the fickle charity of the international community, countries should invest in a new kind of disaster insurance that transfers the risk to financial markets, says Reinhard Mechler, an economist at the International Institute for Applied Systems Analysis in Laxenburg, Austria. Such a plan relies on scientists to create a finer-grained map of the probability of various disasters and the range of their impacts (*Science*, 12 August, p. 1044).

Science funding could soon feel the effects of the past year of disasters. Two months before Hurricane Katrina struck, the U.S. president's National Science and Technology Council capped a 10-year study by publishing a report called Grand Challenges for Disaster Reduction. The report singled out social sciences as an area deserving a boost, citing the need for strategies to get emergency information to populations that often distrust the authorities. More interdisciplinary science is also needed, says one of the report's co-authors, Priscilla Nelson, a civil engineer at the New Jersey Institute of Technology in Newark. Because the causes and impacts of disasters are so broad, she says, we need teams of geophysicists who can talk fluently with epidemiologists, and engineers with psychologists.

One thing is all but certain: Even worse years lie ahead. Vulnerable urban populations of the developing world are set to double by 2030, as are coastal populations everywhere. Meanwhile, changing climate threatens to bring more hurricanes due to warming and chronic coastal flooding due to rising sea levels, among other worrying possibilities. Looking back over 2005, says Nelson, these disasters should be taken as "opportunities to learn."

–John Bohannon

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