in collaboration with the Radiochemical Safety Bureau of the Russian Navy, whose Pacific Fleet is based nearby—went well for 2 years, Soyfer says. But then, he claims, the safety bureau's new director took a disliking to him and called in FSB agents in Vladivostok to help oust him from the project. After seizing the research materials, the FSB charged Soyfer in early July with revealing secret information that "compromised the state and military security of the Russian Federation." Soyfer denied the charge, and colleagues rallied to his side.

Later that month, 11 top scientists and a deputy of the Duma, Russia's parliament, signed a letter to acting President Vladimir Putin, then prime minister, pointing out that the government had decreed earlier that ecological data could not be classified as state secrets. "We urgently request that you take measures to end the illegal persecution of V. N. Soyfer and other scientists," they wrote. Even more valuable to Soyfer's defense, an expert panel of the prestigious Kurchatov Institute in Moscow reviewed the disputed data and stated in a 7 February letter that none were secret. "The FSB does not have grounds for its attack," says Soyfer, who's waiting for the FSB to formally exonerate him in the wake of the court's ruling that the search was illegal.

Whereas Soyfer's cause was buoyed by his Russian colleagues, Piontkovski drew most of his support from scientists outside Ukraine. His saga began on 16 October, when agents from the Ukrainian Security Bureau (SBU) seized documents and cash from the homes and offices of Piontkovski and two colleagues (*Science*, 29 October 1999, p. 879). The focus of the search was Western grants that involved analyzing and digitizing data on bioluminescence collected over the past 30 years, first by Soviet and then by Ukrainian and Russian ocean expeditions.

After accusing the researchers of illegally passing data to the West, the SBU worked up charges against Piontkovski of illegal currency transfers: receiving and distributing funds under a grant from INTAS, a European agency that supports East-West scientific cooperation. Despite numerous appeals, the Ukrainian Academy of Sciences leadership failed to achieve any breakthroughs, but once the case was handed to the prosecutor, INTAS sprang to action.

INTAS chief David Gould and a legal adviser flew to Ukraine on 9 February, meeting with officials in Kiev and then with the prosecutor in Sevastopol. INTAS was ready to pull the plug on 55 new grants to Ukrainian teams if other scientists faced the threat of prosecution simply for cashing INTAS checks, Gould says. The prosecutor dropped the charges less than 2 weeks later. As *Science* went to press, Piontkovski was in Kiev, seeking a visa for an extended stay in the United Kingdom or the United States.

Now, observers are anxiously following the cases of three other former Soviet scientists whose fates remain up in the air. The FSB is still investigating Vladimir Tchurov, a colleague of Soyfer's at the Pacific Oceanological Institute, who is accused of selling sensitive acoustic technology to China, and last November it arrested Igor Sutyagin, an arms control researcher at the Russian Academy of Sciences' USA-Canada Institute in Moscow, on espionage charges.

Meanwhile, in Belarus—where democracy is struggling to take hold—Yuri Bandashevsky, an outspoken critic of the government's response to lingering health effects of the 1986 Chornobyl disaster, has been imprisoned since last July on charges of taking bribes. (His case has not been tried.) After the trio of recent judicial triumphs, the hope is that good news will again come in threes.

–RICHARD STONE

GEOMICROBIOLOGY

Hardy Microbe Thrives at pH 0

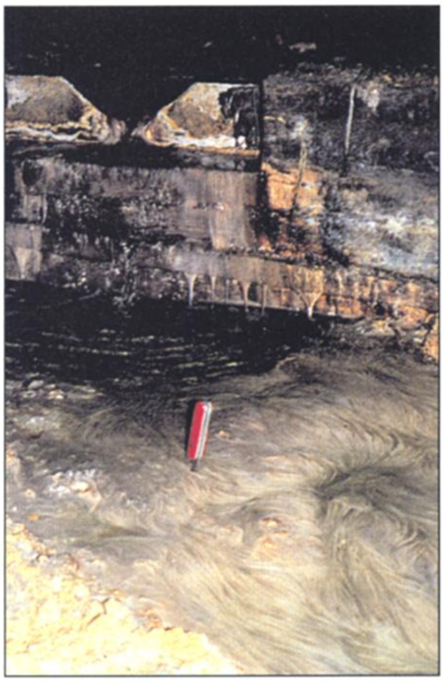
This one is extreme, even for an "extremophile." While surveying the depths of an abandoned copper mine, a team of geomicrobiologists has detected a new microbe that survives in some of the most acidic waters on Earth, at a seemingly impossible pH near 0. That makes this critter, a member of the microbial kingdom Archaea, one of a few record-setting bugs that can survive in conditions usually toxic to life as we know it.

Not only does this microbe, dubbed *Ferroplasma acidarmanus*, survive, but it positively thrives. Indeed, it accounts for the overwhelming majority of life-forms found at the inhospitable mine, report Katrina Edwards of the Woods Hole Oceanographic Institution in Massachusetts and her colleagues on page 1796. And that, in itself, is "remarkable," says microbiologist John Baross of the University of Washington, Seattle. Most extreme environments studied so far—whether hot, frigid, acid, alkaline, or high pressure—support a diversity of life, usually a collection of hardy bacteria, notes Baross. But at the Iron Mountain mine near Redding, California, just this one microbe rules.

The bug's hardiness is even more surprising considering its architecture. Most microorganisms have cell walls to shield them from harsh surroundings, but not these Archaea. They are encased in what appears to be just a simple cell membrane—a seemingly flimsy way to guard against sulfuric acid and the high amounts of copper, arsenic, cadmium, and zinc also present in the drainage. Yet that membrane "seems totally capable of maintaining them in environments that would destroy most other organisms," marvels William Ghiorse, a geomicrobiologist at Cornell University. Moreover, because this microbe can't survive in water of a normal pH, "the high acidity seems to be essential to maintain the membrane." The researchers are trying to figure out how this membrane works.

Edwards helped track down *F. acidarmanus* while she was a graduate student working with Jillian Banfield, a mineralogist at the University of Wisconsin, Madison. They were trying to understand the role of microorganisms in the geochemical processing of sulfur and the generation of acid mine drainage. Earlier Banfield and Edwards had sampled water from 500 meters inside the same mine, using molecular probes designed to recognize genetic material specific to different types of organisms. At the time, they found no signs of the bacteria that are often cultured from mine drainage water (*Science*, 6 March 1998, p. 1519). But the probes did detect large populations of Archaea—microbes typically associated with other types of extreme environments, such as hot springs.

Over the past 2 years, the team periodically resampled the mine's waters and from them has isolated and grown the one species that is predominant: *F. acidarmanus*, which grows best at a pH of 1.2 but can grow in a range from pH 0 to 2.5. Most other organisms recovered from acid mine drainage grow best at a pH of 2.5 and survive anywhere from a pH of 1 to 4. Other re-



Dark secrets. Deep in a mine, strands of acid-loving microbes make water ever more acidic.

CREDIT: B. GOEBEL

searchers have also come across traces of microbial life in highly acidic settings. But Edwards and Banfield are the first to collect and quantify these Archaea from a natural environment. They have since found the same or similar species at other sites throughout the mine.

If these microbes are widespread in the natural world, as these findings suggest, how they got there "is the $64 million question," says Banfield. Given their need for such acidic habitats, it's unclear how they could spread. Princeton University geochemist Tullis Onstott wonders whether such microbes found in Earth's subsurface became established when these geological formations first formed and then existed in a dormant state through geological time until conditions became suitable for them to spring back to life. Whatever the answer, the discovery of this archaeal species suggests that yet more bizarre microbes may exist out there, perhaps bugs that survive at negative pHs. Predicts Onstott, "If you keep looking, you will find them." –ELIZABETH PENNISI

CANADA

Strong Economy Lifts Some Research Boats

OTTAWA—Flush with revenues from an unprecedented economic boom, the Canadian government last week unveiled a series of budget initiatives that would reinvigorate academe while making major thrusts in high-energy physics, genomics, and environmental technologies. But there's no increase for the country's research councils, and that could mean continued hard times for many scientists.

The first wave of good tidings came on 28 February with news of an additional $615 million in the 2000–01 budget for refitting university labs and $109 million for a national genomics initiative (*Science*, 3 March, p. 1569). The next day the federal government nudged the high-energy physics community into the winners' circle by announcing plans to spend roughly $136 million over 5 years on operations and upgrades at the national laboratory for particle and nuclear physics.

"It's a huge vote of confidence in basic research in Canada," says Alan Astbury, director of the Tri-University Meson Facility (TRIUMF) in Vancouver, built in 1974 to develop a Canadian research capacity in particle physics. "This will allow us to do what you might call real nuclear physics." TRIUMF plans to use roughly $15 million of its windfall for a fourfold boost in the energy level of its nearly constructed Isotope Separator and Accelerator (ISAC), to 6.5 million electron volts. ISAC takes low-mass particles, evaporates the nuclei, ionizes them, and then accelerates them to higher energies. The upgrade will allow scientists to work at an energy level "which at the moment doesn't exist in North America," Astbury says, explaining that accelerators like the Relativistic Heavy Ion Collider at Brookhaven National Laboratory in Upton, New York, operate at much higher energy levels and generate "very short-lived" nuclei. Another $10 million will go toward components for the Large Hadron Collider being built by CERN, the European particle physics center near Geneva, bolstering Canada's contribution to international physics.

Stronger global ties are also expected from a national genomics initiative, first proposed in 1998 (*Science*, 3 July 1998, p. 20). Martin Godbout, acting president of the nonprofit corporation overseeing implementation of the initiative, says it will allow Canada to participate in a number of international consortia. The G-5 of genomics nations (the United States, United Kingdom, Germany, France, and Japan) "has become the G-6," he noted with pride.

Provincial governments are expected to at least match the federal contribution to Genome Canada, creating a genomics center in each of five specified regions. Each center will receive up to $15 million a year to pursue work of interest to industries such as agriculture, health, forestry, or fisheries. "They'll have to include proteomics and sequencing and genotyping, so the technology platform will be a prerequisite for each center. But the centers will be allocated by sector," Godbout says.

The $615 million for refurbishing university labs, which will be channeled through the Canada Foundation for Innovation (CFI), is seen as dovetailing with an earlier commitment to create 2000 new research chairs (*Science*, 22 October 1999, p. 651). The 3-year-old CFI program, which would have run through its initial $680 million next year, is intended to rejuvenate university research facilities, including networking and databases. With the CFI awash in applications, president David Strangway said the new monies will allow the foundation to clear its backlog, undertake more "strategic" competitions aimed at bolstering specific scientific sectors, and possibly create a $70 million pot for international joint ventures in such areas as information technology or biotechnology.

Although the government invested heavily in university infrastructure and personnel, the nation's three research granting councils received no increase in their support for basic research grants, despite skyrocketing demand prompted, in part, by the new infrastructure programs. "It's an appalling budget," complained Jim Turk, executive director of the Canadian Association of University Teachers. "The universities will be worse off."

Similarly, the National Research Council (NRC) was stiffed for the second straight budget despite Industry Minister John Manley's earlier vow to make it a top priority and an aggressive lobbying effort by NRC officials (*Science*, 18 September 1998, p. 1781). NRC president Arthur Carty says he's "devastated" and must now consider a range of cuts. His options include across-the-board reductions, closure of one of its institutes, or ending the agency's contribution to such national projects as one to develop fuel cells and another to build a synchrotron light source. "It's pretty morale-sagging," Carty noted.

–WAYNE KONDRO

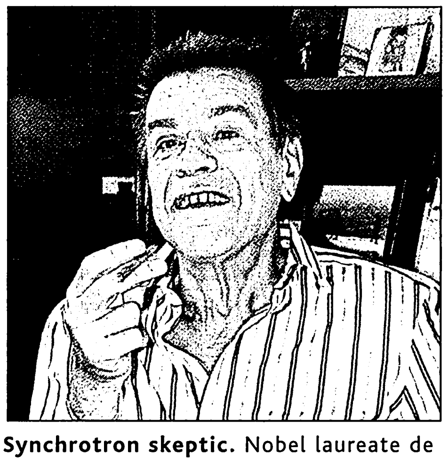
Wayne Kondro writes from Ottawa.

BIG SCIENCE

Top French Researchers Spar Over Synchrotron

PARIS—A lively and often heated debate broke out last week among some of France's top scientists over plans to scuttle a major French synchrotron radiation facility and instead back a joint venture across the English Channel. But for all their oratorical fireworks, the scientists, who spoke at a parliamentary hearing, were essentially haggling over a possible consolation prize: whether France should build a second, smaller synchrotron facility on its own soil.

Scientists use x-rays produced by synchrotrons to probe the atomic structure of proteins and other compounds. French researchers had been counting on getting an advanced x-ray source, the long-planned SOLEIL facility, until research minister Claude Allègre canceled the project last year. Instead, Allègre opted for French partnership in a new synchrotron to be built with the British government and the Wellcome Trust, the mammoth British medical charity (*Science*, 6 August 1999, p. 819). Allègre's de-



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Synchrotron skeptic. Nobel laureate de Gennes questioned importance of x-ray sources.