blasted the local fauna into extinction or induced global climate change that then triggered extinctions in southern South America. "Right now we only regard this as a coincidence," says Schultz, but an intriguing one.

Other researchers are less intrigued, noting the large uncertainties in the relative timing of the impact and its possible effects and saying that the apparent correlation could be meaningless. "Any particular moment would show quite a few extinctions" simply because the extinction rate in that geologic interval is high, says paleontologist David Webb of the University of Florida, Gainesville. "To claim [the extinctions] are sudden or unique is naïve." The coincidence with an ocean cooling is likewise "a nonstarter," says paleoceanographer Nicholas Shackleton of Cambridge University. Something big hit Argentina 3 million years ago, researchers agree, but to find out if it had any lasting effects on animals may take another decade of work. –RICHARD A. KERR

MATERIALS SCIENCE

Insulator's Baby Steps To Superconductivity

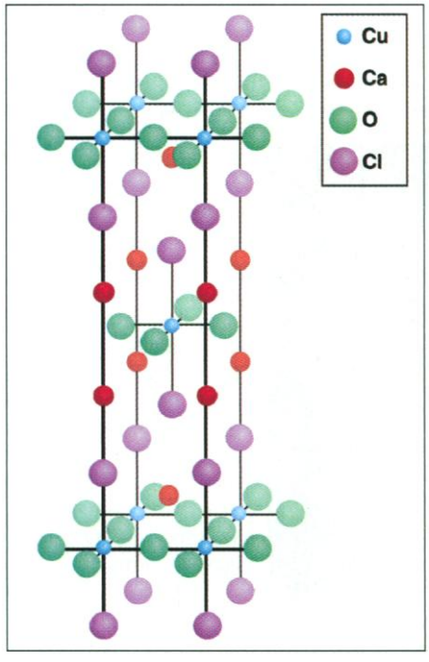
Even high-temperature superconductors—the wunderkinds of the material world—can't escape modern family dynamics. The superconductors' parent materials are seemingly conservative types, layered ceramic insulators that are unable to conduct electricity. Yet their offspring, which are spiked with small amounts of other elements, are as racy and rebellious as teenagers. They conduct electricity without any resistance whatsoever, and at temperatures far above the maximum predicted by the traditional theory of superconductivity. Like psychologists trying to sort out family traits, physicists have been struggling to understand how such staid parents give rise to such unruly children. Now an experiment reported on page 2067 reveals a distinctly postmodern result: The parents aren't as conventional as once thought. In fact, they harbor an electrical signature reminiscent of a metal, a property never seen before in any insulator.

"This is a very interesting result," says Princeton University physicist Nai-Phuan Ong. "Normally you would not expect an insulator to have any hints of [metallic behavior]." Tantalizingly, the ceramic insulator that the researchers studied also reveals hints that it may be influenced by some of the same factors that give rise to superconductivity in the offspring. "Is this just a coincidence" that related electrical signals are produced in both? asks Ong. For now, nobody knows, but the new results give physicists a deepening family mystery. "It challenges our ability to understand solids," says Z.-X. Shen, a physicist at Stanford University who led the new work.

The latest twist to the high-temperature superconductivity mystery centers on the way electrons behave in different materials. In all materials, electrons act a bit like marbles: Just as no two marbles can occupy the same space, two electrons in a material cannot have the same energy state. So the multitude of electrons in a material pile up in a range of different energy states, like marbles filling a jar. These states are organized in bands, with the valence band containing lower energy electrons with restricted movement and the conduction band containing higher energy, mobile electrons.

In metals these two bands overlap. This allows valence band electrons to hop easily into the conduction band, where they can whiz around and conduct electricity through the material. In semiconductors, a gap of forbidden energy levels separates the two bands, so a slight energy kick is needed to boost valence electrons into the mobile conduction band. In insulators, this gap is much larger, for the most part preventing any conduction.

Researchers also have ways to understand conducting and insulating materials based on the momenta—a function of the direction and speed—of electrons within them, relying on an equation from quantum mechanics called a wave function. When the range of different momenta of electrons in a metal is mapped out, the wave function always shows a specific shape—for example, a sphere, a shape implying that electrons have an equal chance of traveling in any direction at the same speed. Conventional insulators, by contrast, show no pattern whatsoever.



Postmodern parent. This insulating ceramic has metal-like properties, linking it to its superconducting offspring.

Many research groups have studied the way electron energies pile up in the ceramic parents of high-temperature superconductors and shown them to be insulators. Yet, when Shen's group at Stanford, together with colleagues at Iowa State University in Ames and Varian Associates of Palo Alto, California, used a different technique to test the momentum behavior of one of these insulators, they got a very different and perplexing response. In what is called angle-resolved photoemission spectroscopy, the researchers blasted the surface of the material, a flat crystal composed of calcium, copper, oxygen, and chlorine ($Ca_2CuO_2Cl_2$), with x-rays at precisely controlled energies. When the high-energy photons slammed into the sample, they evicted some of its electrons, launching them out of the material. Detectors then counted these homeless electrons and measured their energy and direction of travel. Much to their surprise, Shen's team found patterns reminiscent of a metal. "This is a new kind of insulator that has a sign it could be a metal," says Shen.

And that's not all. Another plot—this one showing how the energy of the electrons varies depending on the direction they are traveling—bore a striking resemblance to a pattern found in their superconducting offspring. Superconducting electrons, which always travel in pairs, can only move within planes of copper and oxygen atoms and only along the two axes of the crystal, not along the 45-degree diagonals. This gives the wave function a cloverleaf pattern, known as *d*-wave symmetry. To their surprise, Shen and his colleagues saw the same *d*-wave pattern in the energy of electrons in different directions, a fact that raises both eyebrows and questions.

"We believe there must be a connection" between the *d*-wave pattern in the insulating and superconducting ceramics, says Shen. This common shape "doesn't come out of the blue," adds Juan Campuzano, a physicist at the University of Illinois, Chicago, and Argonne National Laboratory. Just what the connection is, the new experiment does not say. "But this raises speculation as to whether electrons are taking the first baby steps toward superconductivity," perhaps briefly pairing up and then separating again, says Ong.

As with any attempt at explaining the physics of these materials, this explanation is "very contentious," says Campuzano, a sentiment with which Ong agrees. For now, at least, the petulant high-temperature su-

perconductors and their quirky parents will remain one of the most enigmatic families in physics. –ROBERT F. SERVICE

ANIMAL EXPERIMENTATION

India Backs Off on Central Control

NEW DELHI—Indian scientists are hailing a government decision to scale back a proposal for a centrally run system to regulate research involving animals. The final rules, adopted late last month, would instead place primary responsibility in the hands of animal ethics committees at individual universities and institutes, avoiding a bottleneck that scientists feared could stifle research. "I am satisfied that science will not suffer" once the rules are implemented, says Pradeep Kumar Dave, an orthopedic surgeon and director of the All India Institute of Medical Sciences here.

CREDIT: PALLAVA BAGLA

Keeping count. New animal care rules place responsibility in the hands of individual facilities like the National Institute of Immunology, above.

The initial proposal, from a committee chaired by social justice and empowerment minister Maneka Gandhi, would have prohibited all animal experimentation without the explicit written approval of the committee (*Science*, 18 September, p. 1777). Gandhi, an outspoken animal rights activist, said at the time that the government needed to step in after an attempt at self-regulation, based on 1992 guidelines from the Indian National Science Academy, had failed. But her proposal kicked up a ruckus among the scientific community. Passions ran high: Immunologist Nirmal Kumar Ganguly, director-general of the Indian Council of Medical Research here, warned of "chaos and confusion leading to anarchy" if the rules were implemented without amendments.

The final rules give institutional panels the authority to approve animal experiments for entire programs and projects rather than the experiment-by-experiment basis envisioned in the initial proposal. All biomedical institutions using animals still must register with the social justice ministry within 60 days, but institutions need not wait for a response before carrying out the necessary oversight duties.

The institutional panels will be composed of biomedical scientists both from within the institution and outside, as well as a veterinarian, a nonscientist, and a government representative. The first order of business for many institutions will be to create such a panel: A recent survey revealed that only 50% of all laboratories had any form of animal ethics committee. The committees will be responsible for day-to-day monitoring of experiments, but they must report periodically to the ministry, which can suspend or revoke the license of any laboratory found wanting.

The final rules also remove a proposed ban on contract and collaborative research involving animals with overseas educational institutions, although they still prohibit contract research—such as the use of monkeys to test drugs for multinational drug companies—carried out purely for monetary considerations. It will also be more difficult for Indian institutions to import animals from overseas labs: The rules allow transfers only between labs already registered with the Indian government, in effect limiting the pool to domestic facilities.

The rules are expected to become law by the end of the month, putting an end to what Gandhi calls "rogue firms" that have ignored proper procedures for animal safety. "It's time for them to put up or shut up," she says. –PALLAVA BAGLA

Pallava Bagla is a correspondent in New Delhi.

GERMAN RESEARCH

Extremists Steal Minister's Spotlight

It had the makings of a banner week for German science, with the new education and research minister, Edelgard Bulmahn, announcing plans to increase federal funding for research and higher education, dismantle some outmoded nuclear-power research facilities, and strengthen programs to help women and young scientists. The premiere basic-research organization, the Max Planck Society, also pitched in with a positive spin on its plans for the year ahead. But the week also saw a sharp reminder of deep divisions in public attitudes toward science: The boldest headlines went to an incident in which a prominent German researcher was placed under police protection following threats from animal rights activists.

In a speech in Bonn, Bulmahn announced that the government plans major investments and reforms in Germany's trou-

ScienceScope

NIH STAKES CLAIM FOR GENETIC DRUG DATA

The National Institutes of Health (NIH) plans to spend $100 million over the next 5 years to secure public access to genetic data that might otherwise be locked up by drug firms. The move comes as researchers scramble to turn unprecedented knowledge of the human genome into drugs tailored to fit an individual's genetic makeup.

Later this month, NIH will unveil a plan to establish a public pharmacogenomics database holding information about individual genes and functions that could be useful to basic researchers and drug designers. It augments another NIH program, announced last month, to search for genetic variations that alter drug effectiveness. The new initiative, which will fund a network of about a dozen centers, is "very timely," says biochemist Fred Guengrich of Vanderbilt University in Nashville, Tennessee. And it will have "a real soup-to-nuts flavor," adds Rochelle Long of the National Institute of General Medical Sciences, involving researchers from a variety of disciplines working on a range of diseases.

GEORGETOWN FACULTY ON WARPATH

A high-profile campus feud is heating up. Researchers at the Georgetown University Medical Center in Washington, D.C., are threatening to sue their employer, claiming the university's board of directors unfairly rejected a faculty protest of a new salary policy.

Last spring, 18 scientists filed a grievance complaining that the policy, which requires researchers to hustle up the lion's share of their pay through grants, violates tenure and academic freedom (*Science*, 5 June, p. 1531). A grievance panel ruled in the scientists' favor, but on 30 October the board ruled the dispute out of bounds for a grievance proceeding. The board did suspend further implementation of the policy pending a review.

Faculty members, unappeased, say the board has run roughshod over campus rules. "It's like declaring martial law," says professor Karen Gale. The grievants' lawyer, Steve Hoffman, says he'll go to court if the university fails to nix the policy by 13 December. A Georgetown spokesperson insists that "the review is a fair approach made in the spirit of cooperation and collegiality."

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