




down," says computational biologist Peer Bork, "because that is an extreme scenario and I don't think it will happen. But there is a chance that we will lose our critical mass in some [research] areas and will not be competitive anymore." One of these areas, Bork says, is the hot field of functional genomics, "which requires a lot of expensive equipment." And Serrano adds that "it is clear this is going to be a major blow for EMBL." Just how major, he says, depends on which interpretation of the ILO ruling that the staff chooses to insist upon, a decision currently being debated in the lab's corridors.

As *Science* went to press, the staff association was expected to meet this week to discuss its options. EMBL employees might agree to spread the back payments over a number of years to soften the blow or to take increased holiday time to partly compensate for the money they are owed. But Serrano says that many of the original complainants in the case are no longer at EMBL, and they may not be willing to compromise—in which case the matter could end up back before the ILO if the governing council does not agree with the staff interpretation. According to one staff member who prefers to remain anonymous, "there are people who don't care if the lab goes down the drain over this."

Kafatos will have to tread carefully to avoid such a scenario in the coming months. The best solution, he says, would be one that would "safeguard both the fair interest of all EMBL personnel and the continued well-being of EMBL as an institution." And he will be looking for any encouraging signs that the staff will rally behind him. Says Serrano: "Nobody in this building is interested in destroying EMBL." **–MICHAEL BALTER**

ANIMAL RIGHTS

## Booby-Trapped Letters Sent to 87 Researchers

Psychobiologist John Capitanio could see the razor blade through the back of the envelope mailed to his office at the University of California, Davis. He already knew what to look for: Capitanio had been told he was one of 87 scientists using nonhuman primates in their research across the United States targeted last month by a shadowy animal rights group that originated in Britain. Booby-trapped to slice the fingers of an unsuspecting scientist trying to open them, the letters mark a new and disturbing turn toward violence by the militant wing of the animal rights movement.

Although animal rights groups have vandalized many laboratories in the United States, in recent years most attacks on individuals have occurred in Europe (*Science*, 4 June, p. 1604). "This is the first time there's been a campaign of this ilk [in the United States] on this large a scale," says Mary Brennan, executive vice president of the Foundation for Biomedical Research (FBR), a Washington, D.C., watchdog group, which warned the intended victims after spotting a list of them on an animal rights organization's Web site. While some researchers, like Capitanio, seemed to take the missives in stride, others saw them as much more serious: "Some of my colleagues are feeling very frightened," Capitanio says.

As *Science* went to press, more than 50 of the 87 letters had been received, all bearing a Las Vegas postmark dated 22 October. In addition to a razor blade taped inside the upper edge of the envelope, each letter contained a short, typed message that read, in part: "You have until autumn of the year 2000 to release all of your primate captives and get out of the vivisection industry."

A group called the Justice Department has claimed responsibility for the letters in a 24 October communiqué on a Web site, the Animal Liberation Frontline Information Service, that posts information supplied by "underground" groups such as the Animal Liberation Front (ALF; www.enviroweb.org/ALFIS/index2.html). The FBR and another group, Americans for Medical Progress, spotted the posting the next day and alerted the researchers listed. No injuries have been reported.

The Justice Department originated in Britain, where it has acknowledged sending letter bombs and other devices to pharmaceutical labs, animal breeders, and researchers since 1993. One of the group's members served 3 years in prison. Three years ago, the group began sending similar threatening letters, complete with razor blades, to Canadian hunting groups and fur retailers. A fact sheet on the site associated with the ALF, which expresses a commitment to "nonviolence" despite having taken credit for past attacks on animal labs, explains that the Justice Department "see[s] another path … [that] involves removing any barriers between legal and illegal, violent and nonviolent."

Some researchers already accustomed to regular protests by animal rights groups seemed unfazed by the letters. "There's not a whole lot we can do about this sort of thing other than just stay alert and not fool around with anything that looks suspicious," says Peter Gerone, director of the Tulane Regional Primate Center in Covington, Louisiana. But others were less nonchalant, including a University of Washington, Seattle, AIDS researcher who declined to have his name published. "I have a family," he says. "I don't want to say I'm afraid, but there are certain situations where you don't take chances." Capitanio says he's okay now, but admits that "I might feel more nervous next autumn."

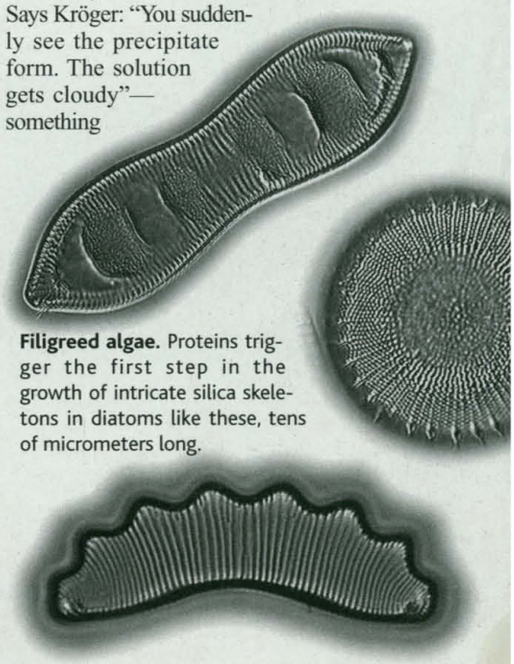
**–JOCELYN KAISER**

BIOMATERIALS

## Reverse Engineering the Ceramic Art of Algae

The glasslike silica laceworks within the cell walls of diatoms are so beautiful they'd be on display in museum cases if only they were thousands of times bigger. No one knows how these tiny algae pull off their bioceramic art, but researchers are closing in on the secret. On page 1129, biochemist Nils Kröger and colleagues at the University of Regensburg in Germany report new clues—silica-forming proteins dubbed silaffins.

Within seconds after they added their first silaffin samples to solutions of silicic acid, a silicon-containing organic compound, Kröger, Rainer Deutzmann, and Manfred Sumper knew they were onto something. Says Kröger: "You suddenly see the precipitate form. The solution gets cloudy"—something



**Filigreed algae.** Proteins trigger the first step in the growth of intricate silica skeletons in diatoms like these, tens of micrometers long.

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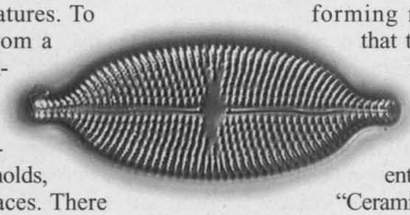
that takes hours to happen without silaffins. A scanning electron microscope showed that the precipitate had formed networks of minuscule silica spheres.

Kröger and his colleagues went on to analyze the proteins and show how their structures and chemical features could help catalyze the reaction of silicon-containing molecules into solid silica particles. The researchers "have done a great job of characterizing their proteins," says Galen Stucky of the University of California, Santa Barbara, who last year found what may be compounds with similar functions in silica-making sponges.

Besides helping to explain how diatoms transform dissolved silicon-containing molecules into sturdy solid particles, the finding is also a tantalizing clue for materials scientists who envy biology's ability to build sophisticated materials at ambient pressures and temperatures. To make any ceramic, from a dinner plate to a toughened drill bit, engineers and artisans now have to mix powders, press them into molds, and fire them in furnaces. There are no furnaces in sight when a developing child infiltrates itself with bone or a diatom drapes itself in silica lace, and materials scientists would like to know how they do it.



The Regensburg group suspected that diatoms make proteins that orchestrate the initial phase of biosilica formation—the growth of tiny silica spheres. For one thing, other researchers had already found organic molecules closely linked to diatom cell walls. After extracting the organic material from their diatom samples, the Regensburg researchers isolated three proteins that could instigate silica precipitation in a test tube—a pair of small, closely related silaffins (1A and 1B) and another larger one, silaffin 2. To begin unraveling how the proteins work, the group determined the amino acid sequence of silaffin-1B and ferreted out a gene from the DNA of the diatom *Cylindrotheca fusiformis*, which turned out to encode silaffin-1A as well. Kröger says the team also is now working to characterize silaffin 2.

The structures of these proteins harbor clues to the diatoms' silica engineering. The glasslike veil of a newborn diatom takes shape in a "silica deposition vesicle," where conditions are acidic. Both silaffins have an unusual amino acid motif, consisting of bonded pairs of lysines with a string of amine groups grafted on after the protein chain is formed. The researchers say that under acidic conditions, this motif should stimulate silicic acid molecules to form silicon-oxygen bonds, linking them together into silica particles. That might help explain how diatoms form solid silica from ingredients dissolved in their watery environs, but it doesn't explain how the algae coax the silica to form intricate patterns. Kröger conjectures that other features of the proteins could be at work.

Silaffin-1A and -1B both consist mainly of two chemically distinct components, one bearing multiple positive charges and another multiple hydroxy groups. To Kröger, the proteins resemble synthetic block copolymers—polymers in which two distinct segments, each repeated many times, alternate along the molecule. When some copolymers solidify, like segments cluster together, segregating into two separate phases that pattern the material with regions of contrasting chemical properties—somewhat the way drops of oil poured onto a saucer of vinegar form segregated droplets. Kröger wonders whether silaffins might be doing something similar within a diatom's silica deposition vesicle, forming molecular frameworks that then guide the growth of the silica.

However diatoms create their silica patterns, it's a trick materials scientists would like to emulate. "Ceramics are one of those unfulfilled materials we could use lots more of, if only we could get [them] easily," says materials researcher Paul Calvert of the University of Arizona, Tucson. Adopting biology's kinder, gentler methods could help engineers combine ceramics with other materials that can't take furnace temperatures. Quips Calvert: "You could make something with chocolate feet and a silicon carbide head." Unlikely material combinations, he says, could push forward such projects as "flexible electronics," in which silicon-based electronics are patterned onto polymer sheets. Diatom-like methods for making intricately shaped ceramics might also yield photonic materials, whose internal arrangements of solid and space could select and confine specific wavelengths of light for communication or computing.

The more scientists learn about diatoms' glassy laceworks, the more beautiful they seem. **–IVAN AMATO**

Ivan Amato is the author of *Stuff*.

OCEANOGRAPHY

## Has a Great River in The Sea Slowed Down?

For many millions of years, two "rivers" of seawater have been flushing the deep sea clean while shuttling chemicals and heat so as to reshape climate. Now, a new analysis of oceanographic data suggests that one of the two rivers has slowed dramatically within the past century, with implications for climate and the humans who are changing it.

## ScienceScope

**The Long View** It's way too soon for scientists to take it to the bank, but the National Science Foundation (NSF) has begun discussing new initiatives in mathematics and the social sciences.

NSF is still awaiting White House reaction to its 2001 budget request, which won't be finalized until January. But NSF director Rita Colwell says she is already thinking about highlighting mathematics in her 2002 request and the social and behavioral sciences in 2003. "Mathematics is the foundation for all the sciences," she told a 1 November symposium at the American Association for the Advancement of Science (which publishes *Science*). And scientists "need the social and behavioral sciences to interpret the huge databases" being compiled in many fields.

The fledgling initiatives are a response to a White House request for a 5-year plan from each agency. But the Clinton Administration will be history after next November's election, meaning that Colwell, whose 6-year term runs through 2004, must sell her ideas to the next set of political bosses.

**Double or Nothing?** Science groups are taking another crack at getting a cherished funding bill through the House. But few expect the bill—which would enable, but not require, the federal government to double nonbiomedical R&D spending to $68 billion by 2010—to survive a clash with Rep. James Sensenbrenner (R–WI), chair of the House Science Committee.

In a repeat of last year's unsuccessful campaign, Representative Heather Wilson (D–NM) and nine cosponsors last week introduced the doubling bill (H.R. 3161), which mirrors a companion the Senate passed earlier this year (*Science*, 28 May, p. 1452). But Sensenbrenner, whose committee must approve the measure, has derided earlier versions of the bill, calling it a "feel-good" effort that will produce little actual cash for research. Still, Sensenbrenner aides say the lawmaker hasn't yet made up his mind about the current version, which probably won't get hearings until next year.

In the meantime, doubling backers—who have made the measure a centerpiece for a high-profile campaign—are expecting the worst. But some believe the dogged effort could eventually pay off in a future Congress. Jokes one lobbyist: "We'd like a win, but a valiant defeat might be just as glorious."