Eisenstein acknowledges that tight funding and a focus on large facilities have resulted in "a big squeeze on grants." But he says that accepting unsolicited proposals from academics for new facilities, rather than holding open competitions, has served astronomy well by encouraging creative ideas.

However, both Eisenstein and Miller agree that the academy report could be a boon to a long-discussed proposal for NSF to pay for additional instrumentation at private observatories in exchange for blocks of time on those telescopes, which NSF would then dole out to researchers. "We need to start with practical things, and I have high hopes for this," says Miller. Eisenstein says he hopes to find enough money in NSF's 2002 budget, now under review by Congress, to begin funding the exchange program, assuming that both sides can agree on how to structure the arrangement. "The burden of proof is on us—with the full cooperation of the community—to figure out a way to implement this [program]," says Eisenstein.

Miller and a group of directors of private observatories say that such an agreement would be a welcome sign that NSF is listening to them. And they hope that the Augustine report will foster a new era of greater cooperation. "At least this gives us a mandate to make the best use of funds in a coordinated way," says Paul Goldsmith, director of the National Astronomy and Ionosphere Center in Arecibo, Puerto Rico.

–ANDREW LAWLER

GENOMICS

Painting a Picture of Genome Evolution

Normally, we associate evolution with organisms growing more complex as they acquire new genes over time. But as a new analysis of the genome sequences of two bacteria shows, genes can be lost as well as gained during evolution. Even more intriguingly, the work provides snapshots capturing gene decay in the act and thus illuminates the actual genomic changes that occurred over tens of millions of years of evolution.

The research, which is described on page 2093 by microbiologist Didier Raoult of the Marseilles School of Medicine in southern France and his colleagues, focuses on two pathogenic bacteria: *Rickettsia conorii*, the culprit in Mediterranean spotted fever, and *R. prowazekii*, which causes typhus. These organisms diverged from a common ancestor 40 million to 80 million years ago, and evidence of accumulated mutations in a gene shared by the two indicates that *R. prowazekii* is evolving more rapidly. To explore how the two grew apart, the Raoult team sequenced the complete 1.3-billion-base-pair genome sequence of *R. conorii* and then compared it to *R. prowazekii*'s genome sequence, which was determined 3 years ago by Charles Kurland of the University of Uppsala in Sweden and his colleagues.

The two *Rickettsia* are good subjects for this analysis partly because both are obligate intracellular parasites, which means they can survive only in the cells of their insect vectors or in the cells of animals they infect, such as humans. Thus, they rarely encounter other species with which they can exchange genetic material, making it easier to trace how their individual genomes change over time.

Evolution clue. The newly sequenced genome of *Rickettsia conorii*, shown here inside a host cell, is providing insights into evolution.

Scientists have long predicted that, for a minute bacterium trapped in an animal's cell, shrinking the genome can preserve energy and improve efficiency. The new analysis by the Raoult team gives a stamp of approval to this theory. It shows that *R. prowazekii*'s genome is smaller overall—1.1 billion bases compared to its cousin's 1.3 billion. It also has one-tenth as much repeated DNA and far fewer active genes; whereas *R. conorii* has 1374 such genes, *R. prowazekii* has only 834.

What's more, remnants of nearly half the genes that no longer function in *R. prowazekii* remain in its genome. The arrangement of this "junk" DNA even mirrors the configuration of the active genes in *R. conorii*. "It was like having one of the two being the ancestor of the other one and then seeing what has happened during all these years," says Raoult.

"This [sequence] is telling us something about evolution that maybe we already should have known," says David Walker, a pathologist at the University of Texas Medical Branch in Galveston, referring to the fact that bacterial genes decay. Because remnants of many of the genes lost by *R. prowazekii* stay behind in the pathogen's genome, he adds, the new sequence could shed light on why genes degrade and how their functions change as they do.

ScienceScope

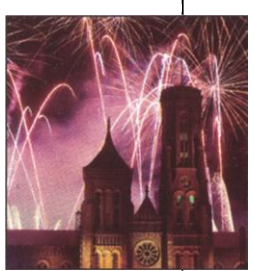
Strength in Numbers Biomedical researchers will now have to demonstrate that they—and not an industry or government funder—control data from a study in order to get the results published in some of the world's most prominent medical journals.

The editors of 11 major journals this week issued a joint vow to reject studies in which the sponsor was allowed to manipulate or withhold results. Researchers say that the move will help discourage drug companies from trying to tweak or cover up results that don't support their financial interests.

The journals will now "routinely require authors to disclose details of their own and the sponsor's role in the study." The guidelines do allow sponsors to ask for time—30 to 60 days—to review a manuscript before it is submitted. Signers included the editors of *The New England Journal of Medicine*, *The Lancet*, *The Journal of the American Medical Association*, and leading journals in Denmark, Canada, Australia, the Netherlands, and New Zealand.

The Washington, D.C.–based Pharmaceutical Research and Manufacturers of America endorsed the move. Sheldon Krimsky, a public health professor at Tufts University in Medford, Massachusetts, who has sounded the alarm about conflicts of interest in science, calls it "a bold step forward by a small but important group of journals."

Going Slow A panel asked to plot the future of science at the Smithsonian Institution met last week for the first time—and speed was not on the agenda.



The 18-member commission was appointed in the wake of Smithsonian Secretary Lawrence Small's controversial reorganization proposals made earlier this year (*Science*, 20 July, p. 408). But the panel's report may take a year or more to complete. "Given the importance and enormity of the task before us, we will take as long as it takes to do it right," says chair Jeremy Sabloff, director of the University of Pennsylvania Museum in Philadelphia.

The panel has already received a proposal from an ad hoc group of seven scientists at the National Museum of Natural History to divide the Smithsonian into three research institutes while keeping close ties between research and public programs. Smithsonian officials also submitted charts outlining their own reorganization proposals.

CREDITS: (LEFT TO RIGHT) COURTESY VSEVOLOD POPOV/UNIVERSITY OF TEXAS MEDICAL BRANCH IN GALVESTON; CHIP CLARK/NATIONAL MUSEUM OF NATURAL HISTORY, SMITHSONIAN INSTITUTION

port that they have identified an active fault that may explain not only the 1356 earthquake but two earlier ones as well. The finding provides the first indication of how frequently such events shake the upper Rhine graben, the rift valley system to which Basel and its environs belong.

Unlike the San Andreas fault in California, European faults responsible for earthquakes are hard to identify, says Domenico Giardini, director of the Swiss Seismological Service and a co-author of the report. That's because small earthquakes leave little trace on the surface, and major earthquakes are too rare to have left much of a historical record.

With a magnitude estimated at between 6 and 6.5, however, the 1356 quake should have been big enough to leave a visible mark, says Mustapha Meghraoui, a geologist at the University of Strasbourg, France. Meghraoui and colleagues Bertrand Delouis and Matthieu Ferry of the Swiss Federal Institute of Technology in Zürich set out to find it. After poring over aerial and satellite photographs and topographic maps, they zeroed in on a 50-meter-high escarpment that runs for 8 kilometers along the western side of the Birs valley in Reinach, south of the city of Basel. Something had obviously happened there—but was the feature really due to an earthquake, or just to erosion or landslides?

Searching for clues, the researchers visited an archaeological dig in the area. There, in the wall of a trench, they spotted signs of movement along a fault: a sharp contact between a very young sediment and an old sediment. The team crossed the road and started trenching at the base of the scarp, using geophysical evidence such as differences in the electrical resistivity of the ground to pinpoint the most promising sites.

"Before you open the trench, you cannot be 100% certain that you will find the earthquake," says Delouis, a seismologist, who says he followed close behind the digging machine. To date, eight trenches have been opened. Painstaking examination of the wall contents have revealed blocks of sand and clay clearly separated on a steep diagonal—the trace of so-called normal faulting, in which extensional (or pull-apart) forces cause blocks of crust to slide up and down relative to each other along a rupture. In the fourth trench, carbon-14 dating confirmed that three earthquakes had nudged the earth upward a total of 1.8 meters over the past 8500 years.

The new findings suggest that the fault unleashes a 1356-type earthquake every 1500 to 2500 years on average. That may not seem like much to worry about. But averages say little about when the next quake will strike, Meghraoui points out. Besides, he says, the Rhine graben probably harbors other faults capable of rattling the area: "The challenge is to find them and build a realistic seismic hazard assessment."

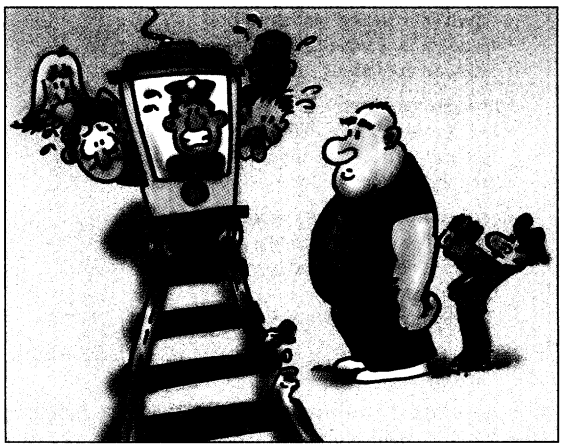
Donat Fäh, a geophysicist with the Swiss Seismological Service, says that data from this and future studies will go into regional earthquake catalogs to help develop building codes, especially for critical facilities such as chemical and nuclear power plants and long-lived features such as artificial lakes. **–GISELLE WEISS**

Giselle Weiss is a writer based in Allschwil, Switzerland.

COGNITIVE NEUROSCIENCE

Moral Reasoning Relies on Emotion

Suppose, in a classical moral dilemma, you see a trolley with five frightened people in it headed for certain disaster. They can be saved from plunging off a cliff if you hit a switch and send the trolley onto another track where, tragically, another person is standing who would be killed by the trolley. What to do? Most people say that it's worth sacrificing one life to save five others.



Right or wrong? Sometimes saving a net four lives just feels wrong.

But suppose the doomed trolley can only be saved if you push a bulky person onto the tracks, where his body would stop the trolley but, alas, he would be killed. Although faced with the same trade-off of five lives for one, most people say it would be wrong to stop the trolley this way. Paradoxes such as this mean job security for philosophers. They've been debating them for decades but have been unable to come up with a logical reason why sometimes

ILLUSTRATION: JOE SUTLIFF

ScienceScope

Patent Fight The Institut Curie in Paris this week said it will formally oppose a European patent for a breast cancer test awarded in January to the biotech firm Myriad Genetics, based in Salt Lake City, Utah. The test detects mutations in the *BRCA1* gene, which are responsible for more than half of all hereditary breast cancers.

Earlier this year, Curie had threatened to file the protest with the European Patent Office in Munich after discovering a mutation in *BRCA1* that is not detected by Myriad's test (*Science*, 8 June, p. 1818). The institute claims that the Myriad patent is too broad and would block the use of other genetically based tests. "Such a monopoly will put the brakes on the development of research," says Curie geneticist Dominique Stoppa-Lyonnet. Myriad executives were not available for comment.

French research minister Roger-Gérard Schwartzenberg has supported the action. Last week he said the government would extend to diagnostic tests an existing law that forces biomedical firms to grant licenses to their products if their patents are "exploited under conditions contrary to the interests of public health."

Cash Prize Hoping to stem the flow of blue-chip graduate students to prestigious U.S. institutions, the University of Toronto will become the first Canadian university to guarantee minimum financial stipends for all doctoral candidates. Starting this fall, the school's roughly 4000 Ph.D. students will each receive at least $11,000 to cover tuition, fees, and living expenses.

The funds will give a boost to students in the oft-neglected social sciences and humanities, who typically must pay their own way, while reducing the need for students to take part-time jobs that could interfere with their studies, says vice provost of students Ian Orchard. The stipends should also help science departments compete with U.S. institutions, Orchard adds. U.S. schools give students an average of $7800 annually—nearly 50% more than under Toronto's former policy, according to a university task force.

Orchard predicts Toronto's move will put pressure on other Canadian universities to sweeten the pot, too. But while University of Alberta provost Douglas Owram applauds Toronto's initiative, he says his school doesn't "have the resources right now" to keep up.

Contributors: David Malakoff, Josh Gewolb, Michael Balter, Wayne Kondro