so feeble that any water within 2 or 3 kilometers of the surface should be permanently frozen solid, Clifford notes. Yet the apparent martian seeps spring from rock exposed at the now-frigid surface, and they presumably flowed through layers as little as 150 meters below to get there.

These drawbacks have many researchers reaching for alternatives. Carr, Clifford, and others are considering clathrates. These ices of water and a second component, such as carbon dioxide, form at low temperatures and high pressures but decompose to gas when warmed or depressurized. Clathrates of carbon dioxide, the most abundant gas in the martian atmosphere, may have formed in the crust, Carr noted, and could burst from rock walls to form fluid masses of gas and debris that would flow down like water, the way streams of hot gas and ash flow down from volcanic eruptions.

A less exotic explanation is water ice frozen into rock layers that melts only on geologically rare occasions. Clifford and hydrologist Victor Baker of the University of Arizona, Tucson, each independently suggested the same mechanism to *Science* that Mars geologist Kenneth Tanaka of the USGS in Flagstaff, Arizona, presents in his Perspective on page 2325. All three were struck by how the seeps prefer pole-facing slopes. Although among the coldest spots on Mars today, they note, such slopes would have been among the warmest 4 million or 5 million years ago. Planetary dynamicists calculate that back then a wobbly Mars was temporarily tipped over as far as 45° compared to its current 25° obliquity or inclination of its spin axis. That would have warmed Mars generally by sending part of the water ice in the southern polar cap into the atmosphere, strengthening the greenhouse effect. The tilt would have warmed high-latitude, pole-facing slopes even more, by putting them in full sun through long summers. "I'm more and more persuaded that what they're seeing is a reflection of what happens during high obliquity," says Clifford. "It's the most plausible explanation."

Bleary-eyed pair. Michael Malin (left) and Kenneth Edgett found 200 examples of seeps among 65,000 recent images of Mars.

CREDITS: (LEFT TO RIGHT) H. SMITH GARRISON/AP; DEVERE PATTON

Whatever happened, researchers are excited. Signs of near-surface water, whether liquid or solid or clathrates, "is an important result," says Baker. The muddy rivulets, whether a day or a million years old, "show the ground ice is there today," says Baker. That the water got loose in some way recently calls into question that Mars has been "cold, dry, and inactive since early times." –RICHARD A. KERR

OSTEOPOROSIS

Cholesterol Drugs Show Promise as Bone Builders

For the millions of people worldwide with osteoporosis, one tumble can break a hip, and a hug can crack a rib. Drugs called bisphosphonates can prevent many fractures by stopping the body from breaking down bone. But even today's best drugs prevent only about half the fractures, and none of them do much to spur the body to rebuild healthy bone.

That could soon change. Not only do statins, a group of drugs used by millions to head off heart disease, seem to prevent fractures, but they may also trigger significant bone regrowth in older people, according to four studies reported in the 28 June issue of *The Journal of the American Medical Association* (*JAMA*) and the 24 June issue of *The Lancet*. And another promising treatment, a recombinant fragment of human parathyroid hormone called rhPTH, is even closer to the clinic: Two clinical trials reported at meetings in the past 2 weeks show that the compound builds bone and lowers the risk of fracture by more than half. "These are really quite striking reductions in fractures," says endocrinologist Conrad Johnston of Indiana University School of Medicine in Indianapolis, president of the National Osteoporosis Foundation.

Like a work crew repairing an aging street, the body normally maintains bones by digging holes, then refilling them with fresh material. Osteoporosis, which afflicts 10 million Americans, most of them postmenopausal women, occurs when the body breaks down bone faster than it can replace it, rendering the bones thin and brittle. Bisphosphonates such as alendronate and risedronate, as well as estrogen replacement therapy, all slow bone loss by blocking cells called osteoclasts, which dig the holes. But none of these drugs stimulates the cells, called osteoblasts, that fill in the holes. As a result, treatment works best on people diagnosed early, while they still have most of their bone mass. But because many patients have already lost 20% to 30% of their bone mass by the time of diagnosis, Johnston says, "we want something that will build it back."

In a surprising finding last December, a team led by endocrinologist Greg Mundy of

ScienceScope

Relishing Victory The human genome wasn't the only organism whose sequence earned the spotlight this week. Plant geneticists are hailing the imminent completion of work on the wispy, ankle-high mustard plant called *Arabidopsis* (*below*), a model system for plant biologists.

As of last Saturday, 108 million of the plant's 120 million nucleotide bases had been sequenced and made publicly available, Anthanasios Theologis of the University of California, Berkeley, told the International Conference on *Arabidopsis* Research meeting in Madison, Wisconsin. The five participating international groups hope to finish the job by the end of July, well ahead of the original 2004 target date.

Government funders and sequencers boast that the *Arabidopsis* genome is extremely accurate, with only 1 error in every 20,000 bases, says Theologis, and contains few gaps. "It's probably the best done of all genomes," he adds. And although its completion will mark the first detailed genetic record of a plant, the real value will be as a template for the rice genome, some four times larger. "Nobody eats *Arabidopsis*," notes John Quakenbush, a researcher with the *Arabidopsis* group at The Institute for Genomic Research in Rockville, Maryland.

Hear Our Plea The honeymoon may be over between French scientists and their new research minister, Roger-Gérard Schwartzenberg. Schwartzenberg, who took over in March from sacked predecessor Claude Allègre (*Science*, 31 March, p. 2387), promised to boost several fields, particularly the life sciences. But on 15 June, three leading French biologists decried an "extremely serious" lag in French biology in a letter to Schwartzenberg, Prime Minister Lionel Jospin, and Finance Minister Laurent Fabius. France hasn't kept pace with major budget increases for biological research in the United States and Japan, notes the appeal, which seeks more funds and has been signed by nearly 400 biologists.

"Life sciences have an ambiguous position in France," says Henri Korn of the Pasteur Institute in Paris, who launched the campaign with Pierre Chambon of the Collège de France and Alain Prochiantz of the basic research agency CNRS. "On one hand they are given almost mythical status, [but] on the other no one really cares." The petitioners hope their plea will change things, but so far neither Schwartzenberg, Jospin, nor Fabius has responded.

the biotech company OsteoScreen and the University of Texas Health Science Center in San Antonio showed that statins—cholesterol-lowering drugs taken by more than 12 million people in the United States alone—dramatically boosted new bone growth in mice and rats (*Science*, 3 December 1999, p. 1946). But no one knew whether they would work in humans.

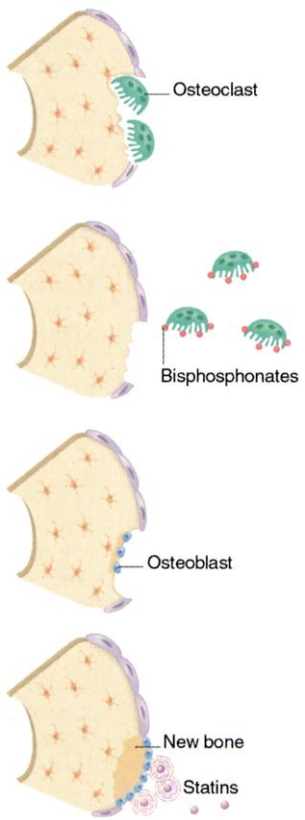
The new studies suggest—but do not prove—that they do. In the largest of the four studies, a team led by Herschel Jick of Boston University School of Medicine in Lexington, Massachusetts, compared the medical records of 3940 British patients aged 50 and over who had suffered fractures with those of 23,379 control subjects who had not, by matching each patient to controls of the same age and sex who saw the same doctor. After adjusting for the effects of other factors that affect bone strength, they reported in *JAMA* that statin users were 45% less likely to have suffered fractures than subjects who were not taking these drugs. "We were amazed," Jick says. "Life is usually not that simple."

Two other teams conducted similar case-control studies, with similar results. In the same issue of *JAMA*, a team led by pharmacoepidemiologist Jerry Avorn and Philip Wang of Brigham and Women's Hospital in Boston showed that subjects over age 65 who used statins were half as likely as nonusers to suffer hip fractures, even after adjusting for the effects of race, smoking, other diseases, and other drugs. And in *The Lancet*, a separate team at the same hospital led by pharmacoepidemiologist K. Arnold Chan reports equally encouraging findings.

By examining medical data from six health maintenance organizations in different regions of the United States, they found that women over 60 who used statins regularly were half as likely to suffer a hip, vertebra, or wrist fracture as similar women who didn't take the drugs. What's more, a team led by rheumatologist Tim Spector of St. Thomas' Hospital in London showed in *The Lancet* that statins seem to boost bone density significantly—a key measure of bone strength. After excluding the effects of hormone replacement therapy, age, height, and weight, the researchers found that the bones of women who took statins had 8% more mass than the bones of those who didn't.

Johnston and other experts caution that it's too soon for doctors to prescribe statins to treat osteoporosis. To prove that statins really strengthen human bones and prevent fractures, researchers need to perform large clinical trials in which patients are randomly assigned to take statins or placebos. "They've done a good job [controlling for] everything you'd expect, but maybe there's some difference between people who take statins and people who don't," says Johnston.

Whether or not statins pan out in clinical trials, rhPTH already has. Last week at the Endocrine Society meeting in Toronto, Robert Neer, director of the Osteoporosis Center at Massachusetts General Hospital in Boston, presented results of a randomized trial that show that rhPTH reduces the risk of recurring fractures in women. Subjects who had already suffered vertebral fractures were 65% less likely to suffer a second spine fracture and 54% less likely than controls to suffer nonspine fractures after self-injecting rhPTH for 1 to 2 years. The drug also seems to enhance the bone-preserving benefits of hormone replacement therapy, according to trial results presented 2 weeks ago at the World Congress on Osteoporosis by Felicia Cosman of Helen Hayes Hospital in West Haverstraw, New York, and her colleagues.



Repair crew. Today's drugs, such as the bisphosphonates, block osteoclasts from breaking down bone; statins may stimulate osteoblasts to build new bone.

But on the downside, rhPTH, unlike statins, must be injected. "Patients generally don't like to give themselves an injection every day," says epidemiologist Steven Cummings of the University of California, San Francisco. "We need options." And despite the plethora of auspicious results, he cautions that it's too early to abandon bisphosphonate drugs, which have passed muster in several large, randomized trials. Even so, the new findings are generating quite a buzz among both researchers and clinicians. "It all looks very promising," says Johnston. "We may have a lot of good drugs before long. **–DAN FERBER**

Dan Ferber is a writer in Urbana, Illinois.

EUROPEAN SCIENCE

Bug Bastille to Open Under New Management

PARIS—In the next few weeks, Europe's most advanced high-security pathogen lab is expected to open for business in the southern French city of Lyons. A striking glass-and-steel structure built on stilts over an existing building, the lab will join a handful of facilities around the world capable of handling the most dangerous human pathogens—such as the Ebola and Lassa fever viruses (*Science*, 26 May, p. 1320). But the long-anticipated debut of this "hot" lab is not turning out to be a joyous occasion for some of those involved.

Last week, the Marcel Mérieux Foundation, which paid for the lab's construction, announced that the Pasteur Institute will take over its "scientific direction." The arrangement, which took a consortium of researchers planning to use the lab by surprise, gives Pasteur the authority to name the lab's director. The leading candidate is a Pasteur scientist, and that would leave the lab's current director, virologist Susan Fisher-Hoch, out in the cold. Fisher-Hoch says she's a victim of a smear campaign aimed at shunting her aside.

This inauspicious spat is the latest twist in a long saga. In 1996, physician Charles Mérieux, patriarch of the Lyons-based family of vaccine producers and creator of the foundation bearing the name of his father, a student of Louis Pasteur, decided to build the lab privately after agencies in Europe balked at its $8 million price tag. Mérieux hired Fisher-Hoch, who had spent much of her career in a biosafety level 4 (BSL-4) facility at the Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, to design and build the lab (*Science*, 13 March 1998, p. 1630). Technical glitches and safety concerns have delayed the lab's opening, originally planned for late 1998.

Putting the Pasteur in charge of the lab's science makes sense for both Mérieux and the Pasteur. The European Union and French agencies turned down repeated requests to help cover the estimated $1.4 million per year to keep the lab running; the foundation and Pasteur are now negotiating the institute's financial contributions to the lab. "The Pasteur Institute was a logical choice," says David Heymann, director of the World Health Organization's division of emerging and other communicable diseases in Geneva. And Pasteur Director-General Philippe Kourilsky says the arrangement allows Pasteur to run a BSL-4 facility without the hassle and expense of trying to build one on its already cramped campus in the heart of Paris.

ILLUSTRATION: C. CAIN