Bone Fractures: Treatment and Risks

For the millions of people each year who suffer a broken bone, scientists report a new treatment that could hasten healing.

To repair a fracture using the proposed technique, a physician would place a thin tube into the damaged area, mix up a special paste, then inject it into the wound, says Brent R. Constantz, a specialist in biomineralization at the Norian Corp. in Cupertino, Calif. The paste, a new biomaterial described by Constantz and his colleagues in the March 24 SCIENCE, hardens in place and accelerates bone replacement.

After realigning a damaged bone and injecting the soft paste, the physician would wait 10 minutes for it to solidify, Constantz says. The paste crystallizes largely as carbonated apatite, or dahllite, a mineral that occurs naturally in the human skeleton. Within 12 hours, the biomaterial is as hard as normal bone, reports Constantz. In fact, he says, the body treats the new material as if it were bone, growing blood vessels into it and "remodeling" the crystals to match natural bone structure more closely.

The researchers believe this biomaterial will prove most useful for treating fractures of the hip, wrist, and shin and for repairing joints and vertebrae.

An average hospital stay for a hip fracture lasts 12 days. The new treatment could shorten that to 7 days, the scientists say. Given an average cost of $29,000 to mend a hip fracture, $20,000 of it for hospitalization, Constantz contends that speedier recoveries could amount to considerable savings.

In Holland, physicians already use the new material to treat fractures, the team reports. In the United States, the Food and Drug Administration has approved a multicenter trial for 324 patients in 12 hospitals. Half of the patients will get standard care and half will try the biomaterial. Physicians will evaluate all patients for 1 year.

The report by Constantz and his colleagues appeared the day after a study identifying risk factors for hip fractures came out in the March 23 NEW ENGLAND JOURNAL OF MEDICINE.

To identify what factors predispose some people to hip fractures, Steven R. Cummings, a physician at the University of California, San Francisco, and his colleagues studied 9,515 white women age 65 or older who had never previously broken a hip. In the course of the study, they found that women whose mothers had suffered hip fractures ran twice the average risk of having the same injury.

Also at higher risk were tall women, women who had broken any other bone after age 50, and women with an overactive thyroid gland. Elevated risks showed up for women who took benzodiazepine, used to control anxiety, and anticonvulsants, for avoiding seizures. Consuming too much caffeine and getting too little exercise also correlated with more hip fractures. Gaining weight after age 25 reduced the fracture risk; losing weight increased it.

"There are things people can do to lower their risk," says Cummings. Stay active and quit smoking for starters, he says. Women can cut their caffeine intake, avoid medicines that raise their risk, and take steps, such as estrogen replacement therapy, to increase bone density.

As many as one in six North American white women age 50 or older will suffer a hip fracture in the remainder of their life, as will 6 percent of comparable men. Of the more than 250,000 elderly people who break a hip each year, 20 percent may not survive more than a year, according to the National Institutes of Health. — *R. Lipkin*

Mars meteorite poses puzzling questions

Researchers confirmed last week that a recently identified meteorite of Martian origin ranks as the oldest piece of the Red Planet known to have struck Earth. Radioactive dating indicates that the meteorite, a 1.9-kilogram rock designated ALH84001, formed about 4.5 billion years ago, during the solar system's infancy and shortly after the Martian crust formed.

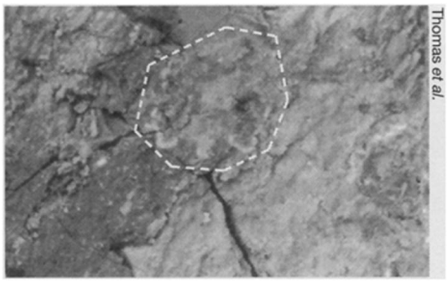
"This meteorite is giving us a look at Mars early in its history, when it was a warmer, wetter planet," says Everett K. Gibson of NASA's Johnson Space Center (JSC) in Houston. He and his collaborators, along with several other research teams, reported their findings at the annual Lunar and Planetary Science Conference in Houston.

Originally misclassified as a fragment gouged from an asteroid (SN: 3/26/94, p.206), ALH84001 has several intriguing properties, says Allan H. Treiman of the Lunar and Planetary Institute in Houston. For instance, among the 11 meteorites identified as chunks of Mars, ALH84001 has the highest concentration of carbonates.

The high carbonate content appears to support the long-held notion that water once flowed on Mars. Researchers speculate that carbonates crystallized within the meteorite when water rich in dissolved carbon dioxide percolated through rock just beneath the Martian surface.

In another finding, mass spectroscopy and electron microscopy reveal that ALH84001 contains polycyclic aromatic hydrocarbons (PAHs), report Kathie L. Thomas of Lockheed Martin Engineering and Sciences Co. in Houston and her colleagues. These organic molecules may originate from material delivered to Mars by comets that struck the planet.

Another interpretation is that the PAHs appeared as precursors of primitive life. On Earth, some PAHs are products of biological activity.



Micrograph of part of the Martian meteorite ALH84001. Circle shows carbonate region with the highest concentration of PAHs.

Measurements of the decay products of two radioactive elements confirm that ALH84001 is about 4.5 billion years old, Lawrence E. Nyquist of JSC and his colleagues announced at the conference. A team of German researchers reported a similar age last year.

Some scientists were reluctant to accept the earlier estimate, Nyquist notes, in part because the other known Martian meteorites are much younger. With only about 4 percent of the present Martian surface believed to have survived unchanged from such an early era, some researchers doubted that Earth would get "free delivery" of so old a sample.

The great age of ALH84001 suggests that the Martian crust formed in a hurry, no more than 100 million years after the birth of the sun, Treiman says. But age is only half the mystery, he adds. In the standard model for crust formation, low-density material floats to the surface of a young, molten planet like scum on a pond. However, ALH84001 contains relatively high-density material, including the mineral orthopyroxene. How could such a rock become part of the Martian crust?

"We're all puzzled," Treiman says.

— *R. Cowen*