Astronomy

Waltzing past Mathilde

On its way to a 1999 rendezvous with a near-Earth asteroid, a spacecraft late last month took some 500 snapshots of a tiny rock called 431 Mathilde. After viewing the images, which depict a battered rock pitted with craters, planetary scientists had one key question: Why does this asteroid still exist?

The craft, known as NEAR (near-Earth asteroid rendezvous), spied five craters more than 20 kilometers in diameter gouged into the sunlit side of Mathilde, a potato-shaped body measuring about 50 km across. "This rock has been through collisional hell," says Joseph Veverka of Cornell University, yet its heavily pockmarked surface indicates it has survived for at least 2 billion years.

An initial analysis of radio wave observations suggests a possible explanation. The data indicate that the dark rock has a low density, akin to that of a pile of sand or rubble loosely bound by gravity. When an object strikes such a body, notes Veverka, "it's like hitting a sponge." Rather than shattering Mathilde, the shock wave from the impact may be absorbed.

NEAR has deepened another mystery about Mathilde, which resides in the belt of asteroids lying between the orbits of Mars and Jupiter. Researchers had already known that the asteroid spins very slowly, once every 17 days. That's puzzling because the frequent collisions with debris from other asteroids would tend to make Mathilde spin faster. Scientists theorized that Mathilde might have been slowed by the gravity of a moon a few km in diameter, but NEAR found no such companion.

The spacecraft, which came within 1,200 km of Mathilde—the closest photo shoot of any asteroid to date—also revealed that Mathilde appears the same inside and out. It reflects the same amount of sunlight, half as much as a chunk of charcoal, even from regions where a projectile has dug deep into the rock. The uniformity indicates that the rock, classified as a C-type asteroid because it contains carbonaceous material, is a pristine relic of the early solar system. —*R.C.*

Johns Hopkins Univ.

Sunlit portion of the asteroid 253 Mathilde.

Hidden companion

Earth has a second companion. In contrast to the moon, which orbits our planet, this body, an asteroid called 3753, moves about the sun. Moreover, the asteroid stays at least 40 times farther from Earth than the moon does. Nonetheless, new computer simulations reveal that the 5-kilometer-wide body is locked in a peculiar gravitational dance with Earth and the sun, causing the asteroid to have the same orbital period as Earth.

When the rock creeps ahead of Earth, our planet nudges it into an orbit farther from the sun, where it slows down. When the rock lags behind, Earth pulls it into a closer orbit, where it speeds up. Viewed from Earth, the asteroid appears to move in a horseshoe path, the only asteroid known to do so.

Although this partnership has apparently endured for thousands of years, the rock's dancing days may be numbered. A close approach by Venus in 8,000 years may dislodge the asteroid from its orbit. Paul A. Wiegert and Kimmo A. Innanen of York University in North York, Ontario, and Seppo Mikkola of Tuorla Observatory in Piikkiö, Finland, detail their finding in the June 12 NATURE. —*R.C.*

Biology

Insect shield fails to deflect virus

New research suggests that insects ward off infections by lining their intestines with a protective protein similar to human mucin, a major component of mucus. At least one virus, however, has evolved a way around this barrier.

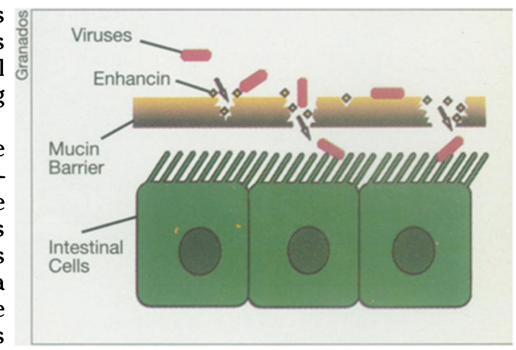
"This is the first intestinal mucin found in an invertebrate," says virologist Robert R. Granados of the Boyce Thompson Institute at Cornell University. "That's interesting because it's been known for years that mucin is one of the first lines of defense against microbes in higher organisms." Granados and his colleagues report their findings in the June 24 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

Insects' digestive tracts are coated with a sturdy, semiporous matrix of chitin—a tough substance in the outer layer of insects and crustaceans—and proteins. Until recently, scientists had not figured out what any of these proteins do. Now, Granados and his colleagues have found that the major protein component of the matrix is similar to human mucin, which lubricates the cells that line the intestine and helps protect them from microbes.

The group also showed that enhancin—a molecule made by a virus that infects insects—degrades the insect's intestinal mucin, thereby aiding infection.

"Normally, the matrix prevents viruses from attacking the underlying cells," says Granados, "but this virus has evolved a protein that can make large gaps and tears in the matrix."

Granados



Virus destroying mucin barrier in insect intestine.

This is the first mucin-degrading protein known to be made by a virus, he says, and represents a novel strategy by which viruses circumvent intestinal mucin barriers. —*E.S.*

Corporate divorce reveals genetic secrets

Until now, a business alliance has prevented the Institute for Genomic Research (TIGR) of Rockville, Md., from releasing much of the DNA sequence data it has gathered since 1992.

At the end of June, TIGR and its former partner, Human Genome Sciences (HGS), also in Rockville, dissolved the relationship, and TIGR made public previously private information about the genetic content of 11 organisms. These include microbes responsible for the three deadliest human infectious diseases—tuberculosis, malaria, and cholera—as well as several other pathogenic bacteria and a bacterium that is highly resistant to radiation.

"We walked away from $38 million in funding in order to have complete academic freedom and ensure that our discoveries have the maximal impact possible," says J. Craig Venter, president and director of TIGR. HGS plans to use the liberated funds to develop its own products, according to a company spokesperson.

Complete sequence information, which acts as a blueprint for an organism, provides a tool for studying gene function and relationships between different creatures. Researchers use it to gain insight into how microorganisms infect their hosts and to devise ways of combating disease. Making the data available is the best way to stimulate research, Venter says. "It puts everyone on an equal footing. Now, it'll be whoever's smartest wins—not whoever has the most secrets." —*E.S.*