Close-up of an asteroid: Galileo eyes Ida

Nearly a month after a successful photo session, the Galileo spacecraft last week finished radioing to Earth a high-resolution portrait of the second asteroid ever to be imaged from space. Known as 243 Ida, the asteroid was photographed from an average distance of just 3,400 kilometers some 3.5 minutes before Galileo's closest approach on Aug. 28.

The image, released by NASA's Jet Propulsion Laboratory in Pasadena, Calif., shows an elongated body riddled with craters. A mosaic of five pictures, it reveals features as small as 60 meters across – almost twice the resolution of the best image ever taken of 951 Gaspra, the only other asteroid ever studied close-up. The Jupiter-bound Galileo photographed Gaspra in October 1991 (SN: 6/27/92, p.426).

Astronomers classify both Ida and Gaspra as S asteroids, indicating that each has a composition similar to that of stony or stony-iron meteorites. But the two bodies exhibit important differences in age, size, and origin that the Galileo images highlight. Located near the outer edge of the main asteroid belt, a swath of rocky debris that lies between Mars and Jupiter, Ida is about 52 kilometers long. That is more than twice the length of Gaspra, which lies closer to the belt's inner edge, near Mars.

Ida resides in a denser part of the asteroid belt than Gaspra and therefore has a higher probability of colliding with other rocky bodies. Even so, the heavy scarring over Ida's entire surface strongly suggests that it has existed far longer than Gaspra, says Michael J.S. Belton of Kitt Peak National Observatory in Tucson, Ariz. In fact, Ida may be as much as a billion years old, about 10 times the age of Gaspra, estimates astronomer Richard P. Binzel of the Massachusetts Institute of Technology.

Unlike Gaspra, Ida belongs to a family of asteroids thought to have been created when a catastrophic collision fragmented a larger parent body. Known as Koronis, this family contains about 100 known members, and the new Ida images may shed light on the group's history, says Binzel. "I think there's a lot of very interesting facets to the Ida results because it comes from this recognizable family," he says. "We can point to other asteroids and say these pieces are related to Ida."

Binzel says he lost a bet that Ida would resemble an agglomeration of several pieces of rocky debris loosely held together, much like the various parts – head, chest, and lower torso – of a snowman. But while Ida appears to be a single solid body, Belton notes that a fine covering of dusty debris seems to blanket it, possibly to a depth of tens of meters. According to Belton, a layer of fine dust reflects sunlight more efficiently than chunks of rock and could account for the bright rings that surround many of the dark-floored craters on Ida.

The craters themselves, created when rocky particles punch into the asteroid, could indicate Ida's internal composition and whether its parent body was subjected to high heat before fragmenting, Binzel says.

According to Belton, the Galileo team faced several challenges in photographing Ida and retrieving the image. For starters, he says, a close-up portrait increases potential errors in pointing the craft and allows less time to record the images.

Because Galileo's main antenna remains jammed, the imaging data were stored on the craft's tape recorder and then slowly beamed to three radio receivers on Earth known as the Deep Space Network (DSN). At one point, one of the receivers failed temporarily; later, competition for the DSN intensified as

Galileo's view of the asteroid 243 Ida, photographed on Aug. 28.

NASA engineers tried to recontact the lost Mars Observer craft. The imaging team, notes Belton, had only until Sept. 22 to search through 30 frames to find the high-resolution portrait. After that, the craft's orbit would prevent efficient radio transmission until next April.

"There was a whole week there where we were very concerned," recalls Belton. "But then we got the image and we were very happy." Galileo will radio lower-resolution images of Ida, including color and stereo pictures, from April through June.

– R. Cowen

Gene therapy ameliorates clotting disorder

Generations of humans, from plebeians to royalty, have suffered from the blood-clotting disorder known as hemophilia. This week, a scientific team reports using gene therapy to treat dogs with a canine version of hemophilia B, an inherited bleeding disease that afflicts one of every 30,000 persons.

If genetic engineers can perfect the technique in dogs, they may be able to offer relief to humans, says Savio L.C. Woo of the Baylor College of Medicine in Houston.

"This is the first step," adds Kenneth M. Brinkhous of the University of North Carolina School of Medicine at Chapel Hill. "It has tremendous potential." Brinkhous and Woo led the multicenter research team reporting the advance in the Oct. 1 SCIENCE.

Hemophilia B occurs mostly in males. Those with the disease are deficient in the blood-clotting protein factor IX. The inadequate or inactive supply of clotting factor results in periodic internal bleeding. Although hemophiliacs can ward off such episodes by injecting a concentrated form of factor IX, the treatment falls far short of a cure, and the annual cost runs from $60,000 to $100,000 per patient.

Many researchers believe that a gene therapy solution to blood-clotting disorders would provide patients with longer-lasting, cheaper protection from bleeding episodes. To test whether such an approach would work, Brinkhous, Woo, and their colleagues turned to a canine model – that is, dogs that produced no detectable amounts of factor IX and therefore suffered from hemophilia B.

The team began by injecting three of the dogs with a crippled virus carrying the canine factor IX gene. These viral vectors, which cannot replicate, traveled through the bloodstream and entered the liver cells of each dog. In each cell, the gene coding for factor IX inserted itself into the DNA and turned on, instructing the cellular machinery to crank out the crucial clotting protein.

After therapy, the dogs began producing factor IX, although these levels were about 1,000 times less than normal. Yet even that modest amount appeared to transform the disease from severe to moderate, an improvement that has lasted up to nine months.

In addition, blood from the treated dogs showed a "really dramatic" decline in the amount of time it took to clot in the test tube.

Woo says they injected just one genetically engineered virus for every 10 liver cells. He believes that the amount of factor IX produced would rise if the team could deliver more of the viral vectors to the dog liver cells.

If they succeed with such animal experiments, researchers could begin human trials of gene therapy for hemophilia B. If gene therapy can coax human livers to produce even modest amounts of clotting factor, people with hemophilia could cut down on or even eliminate their routine injections of clotting factor, Brinkhous notes. Eventually, the team hopes to extend their work to hemophilia A, the more common form of the disease.

– K.A. Fackelmann