

Galileo finds evidence of a watery Europa

First Mars, now Europa? Alas, unlike last week's report about the Red Planet, a new study doesn't directly tackle the question of whether life might have existed on this icy Jovian satellite.

Scientists are intrigued, however, by new images that provide the clearest indications to date that Europa may have had—and might still have—a watery interior. Water is required for life as we know it.

"These fantastic new images... are reminiscent of the ice-covered Arctic Ocean on our planet," says NASA Administrator Daniel S. Goldin. "[They raise] the possibility of a liquid ocean on Europa, the only other place in our solar system where we suspect such an ocean might exist."

Taken by the Galileo spacecraft on June 27, the pictures show two lines of evidence suggesting an ocean of water or slushy ice beneath Europa's surface, notes Galileo scientist Ronald Greeley of Arizona State University in Tempe.

Some of the images, presented at a NASA briefing this week, reexamine at slightly higher resolution regions viewed by the Voyager spacecraft 17 years ago (SN: 7/6/96, p. 8). The new pictures confirm that fractures have divided several areas of Europa's icy crust into plates resembling terrestrial ice floes. Moreover, these plates "look as though they have been pulled apart and in some cases rotated into new positions," as if they had floated on water or warm ice when they formed, says Greeley.

The Voyager images, which could reveal only plates more than 20 kilometers in diameter, suggested that Europa's icy crust was at least 10 km thick when the plates formed. Galileo discerns plates half as large, indicating a thinner crust, with water or warm ice just a few kilometers beneath the surface.

Researchers don't know whether liquid water still exists on Europa, because they aren't sure when the plates formed and rotated, says Greeley. The surface, he notes, isn't heavily peppered with craters, indicating that the region may be relatively young and that water was present recently. The first

close-up images of Europa, scheduled for December, may help to date the surface.

Galileo also eyed Belus Linea, a banded structure consisting of two dark stripes flanking a bright stripe. Greeley speculates that geysers of water-ice erupted in a line along the structure's center, clearing the area of dark contaminants and dumping them along either side. A further rush of water then brightened the central stripe, he says. — R. Cowen

Equatorial region of Europa shows that the crust has fractured into plates.



Controversial surgery benefits epileptics

It's an operation bracketed by question marks.

The first question mark is the contour of the initial incision. Just above the ear, it permits doctors to lay bare the brain and snip away troublesome nerve circuits that trigger epileptic seizures. The second question mark is less literal but more compelling: Does the surgery benefit the patient?

In scores of patients who have had the surgery—known as anterior temporal lobectomy—during the last 40 years, the answer has appeared to be yes. Yet no studies had comprehensively measured the surgery's impact on patients' lives.

Now, research by doctors at the University of Pennsylvania in Philadelphia has remedied that lack. The study, which followed patients for 5 years after surgery, found that removing a small amount of brain tissue eliminated seizures in 62 of 89 people who had suffered severe, frequent seizures for years. Eighteen of these patients were able to stop taking anticonvulsant medication.

The surgery eliminated up to 80 percent of seizures in another 18 individuals, 8 of whom subsequently had seizures on fewer than 2 days a year or seizures that occurred only at night.

"The effectiveness of the surgery extends well beyond helping with seizures," says Michael R. Sperling, a neurologist at the university and an author of the report in the Aug. 14 *JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION*. "Epilepsy surgery saves lives."

Some people with epilepsy die young for unknown reasons. There were no deaths during the study among the people who remained free of seizures. Some of the others didn't fare as well. "Four of those who continued having seizures were dead 5 years after surgery," says Sperling.

Surgery is recommended only for people whose seizures persist despite drug therapy and whose damaged brain circuitry is confined to a single region. In

most cases, that region lies within one of the temporal lobes. These protrusions on either side of the cerebral cortex are situated above the ear and behind the eye.

The right temporal lobe holds spatial memories, such as shapes and faces; the left contains verbal memories. Because the boundaries of these memory regions are imperfectly charted, however, cutting into the temporal lobe presents risks.

"I've never had a death in 500 temporal lobectomies," says Michael J. O'Connor, a neurosurgeon at the university. But he reports that improper insertion of an electrode into the brain paralyzed one of his patients, and several have complained of diminished memory.

"I certainly have unhappy patients—and a lawsuit to prove it," says O'Connor, who speaks out about the risks of the surgery because he believes people should make informed decisions.

The study found that the benefits of the surgery often extend into many aspects of a person's life. Before the surgery, 24 percent of patients were unemployed; 5 years after surgery, that figure had dropped to 11 percent. Those who no longer had seizures were able to drive, socialize, and live independently, Sperling says.

O'Connor likens the surgery to a battle. "After the war, these patients have won their independence." He adds, "There are none missing. Remarkably few have big scars."

Barbara G. Vickrey of the University of California, Los Angeles says her study of 248 patients, published in the Dec. 2, 1995 *LANCET*, revealed similar benefits in the first 5 years after the surgery. Though her study depended on a review of medical records rather than direct observation of patients, she found that many patients who had suffered epileptic seizures for more than a decade improved after surgery.

Vickrey says these people should have been referred for surgery years earlier.

— S. Sternberg



Galileo image of Europa highlights a banded feature, Belus Linea (arrow).