# Neptune's Nereid: Another mysterious moon

The moons of Neptune are strange bodies, indeed.

Triton has a retrograde orbit — moving clockwise around the planet Neptune while most other bodies in the solar system revolve counterclockwise — and it may host what would be the only known liquid-nitrogen ocean. Scientists have realized that Nereid, Triton's satellite sibling, is unusual too because it has a highly eccentric orbit, taking it 1.4 million to 9.7 million kilometers from Neptune. But since its discovery in 1949, Nereid has been largely ignored and Triton has basked in the astronomical limelight. Now two researchers have found that Nereid has other peculiar qualities that merit the spotlight as well.

In the June 2 NATURE, Martha W. Schaefer and her husband Bradley E. Schaefer, both at NASA's Goddard Space Flight Center in Greenbelt, Md., report the first detailed photometric measurements of the light reflected from Nereid. Observing over an eight-day period in June 1987, they found that Nereid's color is unlike that of any normal satellite or asteroid. Moreover, the brightness of light reflected from Nereid varied by a factor of four during their observations.

"There are not many things in the solar system that show as big a variation as that," says Martha Schaefer. One possibility is that Nereid has a highly irregular shape, so that when its largest part faces the earth, more light is reflected than when the smallest part is in front. But scientists know of no other satellites in Nereid's size range that are that irregular. The Schaefers estimate Nereid's diameter to be at least 660 km, and theorists believe the gravity of any object larger than 400 km makes it spherical.

Alternatively, the light variation could arise from distinct spots on Nereid's surface that reflect light very differently. In this respect, Nereid might be similar to Iapetus, a moon of Saturn. Its brightness varies by a factor of 10, a change in intensity believed to be caused by the existence of ice on one side and black carbonaceous material on the other. How such distinct regions came to be, however, baffles scientists.

Researchers hope to gauge Nereid's shape, exact size and any prominent surface features in August 1989, when Voyager 2 passes within 4.7 million km of Nereid — close enough for Voyager's camera to resolve details of about 50 km, according to Joseph Veverka at Cornell University in Ithaca, N.Y. Whatever causes the light variation, Nereid is "not a run-of-the-mill object," he notes. "And whatever we find out is going to be interesting."

Unfortunately, Voyager is not equipped to shed much light on Nereid's mass, makeup or origin. Because of its eccentric orbit, scientists have suggested that Nereid is an asteroid captured by Neptune's gravitational field. If this were so, say the Schaefers, it would be one of the largest and most unusual captured asteroids in existence. Instead, they lean toward the idea that Nereid accreted into a moon around Neptune or another planet and that both it and Triton were knocked into their peculiar orbits by some large body or planet.

"We are far from knowing the explanation," Veverka says. But every bit of data whets the appetite because Nereid is among a number of eccentric satellites inhabiting the outer solar system, and Veverka says they may provide the only clues to what kinds of bodies glommed together to form Neptune and Uranus billions of years ago. — *S. Weisburd*

# Genetics helps reel in bigger fish

Scientists in Maryland and Alabama are using a string of DNA to fish for advances in genetic engineering. So far the catch has been good: A growth-hormone gene transferred from rainbow trout into carp has produced bigger, faster-growing fish.

The scientists injected the growth-hormone gene into thousands of carp eggs, out of which grew 400 fish. Preliminary results show that 20 of the fish have incorporated the gene into their DNA, and most of those are making trout growth hormone and growing significantly faster than normal carp. This is one of the first successful attempts at genetic alteration of fish in the United States, says Thomas Chen of the University of Maryland's Center of Marine Biotechnology in Baltimore, who is conducting the research along with scientists from Johns Hopkins University in Baltimore and Auburn (Ala.) University. The new work adds fish to a genetically engineered menagerie that already includes such animals as pigs, fruit flies and mice.

The experiments may help reveal how genes are regulated, says Hopkins researcher Dennis Powers. Although most of the fish carrying the trout gene are growing faster, a few are growing more slowly than normal, and the researchers would like to know why. The difference may relate to where a carp incorporates the gene into its DNA, says Powers. The team also would like to know if the carp pass on the inserted gene to the next generation, he says.

The research could prove a boon to the aquaculture industry, Chen says, because altered fish may keep eating and growing during the winter months, when most normal fish do little of either. If this turns out to be the case, genetic alteration might allow fish farmers to shorten the time it takes to produce full-grown fish. The genetically altered fish might not survive well in the wild, outside of aquaculture ponds, Powers says. "The growth-hormone gene might make the fish want to keep eating and growing in winter," he says, "but there's not that much food in ponds at that time of year, so they might starve to death." — *C. Vaughan*

# Reagan-Gorbachev space agreement

Getting the U.S.-Soviet Cooperative Agreement on the Exploration and Use of Outer Space for Peaceful Purposes signed last year was an uphill struggle for its advocates on the American side. Such joint space activities still do not come easily, but last week at the Moscow summit, President Reagan and Soviet Secretary General Gorbachev agreed to expand the scope of the pact.

The two leaders' agreement approves "exchanging flight opportunities for scientific instruments to fly on each other's spacecraft." Besides endorsing increased exchanges of space-science data, it also speaks of allowing the scientists themselves to take part in missions operated by the other side.

The agreement does not go so far as to endorse specific missions, but it does include exchanging "results of independent national studies of future unmanned solar system exploration missions." It avoids setting forth plans for joint human exploration of Mars, but "scientific missions to the Moon and Mars" were identified as "areas of possible bilateral and international cooperation."

The initial version of the U.S.-Soviet space agreement had been in effect for a decade when Reagan allowed it to lapse in 1982 as a response to Soviet activities in Poland. Many U.S. space scientists began objecting to that decision even before it went into effect, and in 1984 Congress unanimously urged the President to "endeavor, at the earliest possible date," to reestablish the agreement.

Scientists from both sides had been exchanging data from time to time, but only as individuals, not on any basis that smacked of government-to-government cooperation. The few U.S. researchers who participated in the Soviet mission that sent unmanned spacecraft to Comet Halley, for example, were in a sense walking on eggs.

The language of the joint communiqué from the summit at least seems to suggest a less hostile approach. — *J. Eberhart*