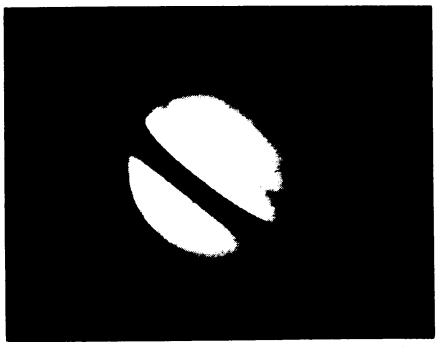
Voyager 1 approaching Saturn

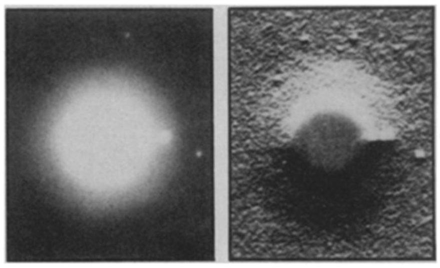
Last September, the Pioneer 11 spacecraft's photos of Saturn, first close-ups of the planet ever taken, showed so few visible features in the atmosphere that they "scared the hell out of us," says Bradford Smith of the University of Arizona. Smith, however, is also the leader of the "imaging team" for the Voyager 1 spacecraft, due to pass by the planet on Nov. 12. Even with nearly 200 million kilometers to go, Voyager 1's photos are showing more pronounced banding around the planet, although Smith says it is too early to be sure whether this is due to changes in the clouds or merely a better camera system. Still, he adds, there are faint signs of possible structure within the bands.

The spacecraft will begin full-time observations of the planet on Aug. 22, providing data in part for the targeting and calibration of even more intensive measurements that begin Oct. 24, when Saturn will be too big to fit in one of the camera's narrow-angle frames. With 10 full days to go, even a 2-by-2-frame mosaic won't hold it. Meanwhile, Voyager's radio telescope has already determined the planet's 10 hour 39.9 minute rotational period, and charged particle sensors are seeking Saturn's effects on the space around it. Scientists are now working to decide where to aim the cameras to hunt for unknown or little-known satellites, what filters to use to best photograph cloud features over Titan, and other issues that must be resolved well before the flyby takes place. □



NASA

Voyager 1 photo of Saturn (above), taken June 24 from 187 million kilometers out, shows details as small as 3,500 km, already slightly exceeding earth-based resolution. The sun was barely above the ring plane when photo was taken, so rings appeared very dim; off-planet portions of the rings were brightened by computer, causing the discontinuity in apparent brightness where the rings cross the planet's disk. Earth-based photo (below left), taken Nov. 14, 1966, by W.A. Feibelman (now with NASA*), enabled densitometer measurements indicating material outside main ring structure, extending to more than twice the then-known ring diameter. Recent computer processing of same image (below right — see July 11* Science*) makes this wider, "E-ring" structure visible.*



W.A. Feibelman, D.A. Klinglesmith III

Myasthenia gravis: Another approach

Myasthenia gravis, a chronic disease that causes progressive weakness of the voluntary muscles, is no longer the mystery it once was. The cause appears to have been identified, and relatively successful treatments have been devised. Now there is a suggestion of a potentially more effective treatment.

Myasthenia gravis has been explained as an autoimmune disease in which the patient produces antibodies against the muscle cell receptors for acetylcholine, the nerve chemical that stimulates muscle cells. As a result, the cells cannot receive acetylcholine, and muscles fail to contract. Drugs that prolong acetylcholine's action and increase its ability to bind with muscle cell receptors have been used to treat the condition, but they do not always produce the desired effect. Research that may lead to a better treatment is reported in the June Proceedings of the National Academy of Sciences by Talma Brenner and colleagues at Hebrew University-Hadassah Medical School in Jerusalem.

Because myasthenia gravis often disappears during the latter stages of pregnancy, Brenner and associates suspected that something in pregnant women might be involved. Last year they reported that some chemical present in amniotic fluid, umbilical cord and maternal blood can inhibit the binding of myasthenia gravis antibodies to acetylcholine receptors. Since then they have worked to determine what that substance might be.

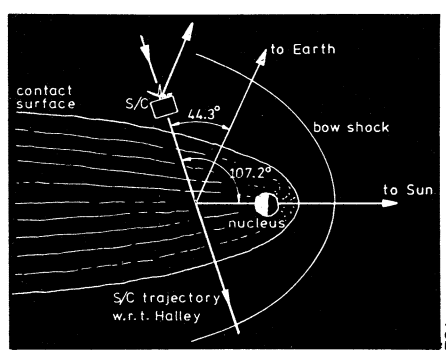
First they separated out various chemicals from amniotic fluid to see which of them might be able to inhibit, in the test-tube, the ability of myasthenia gravis antibodies to bind to acetylcholine receptors. They found that only amniotic fluid fractions containing alpha-fetoprotein had this ability. Then they put purified chemicals known to be present in human amniotic fluid in the presence of myasthenia antibodies and acetylcholine receptors. Only alpha-fetoprotein significantly inhibited the antibodies' binding to the receptors. Finally, they showed that antibodies to alpha-fetoprotein could keep amniotic fluid from inhibiting the binding of myasthenia antibodies to acetylcholine receptors. All these findings, they conclude, show that alpha-fetoprotein is the chemical in amniotic fluid, umbilical cord and maternal serum that inhibits the binding of myasthenia antibodies to acetylcholine receptors. They therefore suggest that alpha-fetoprotein might eventually provide a new treatment for myasthenia gravis.

In fact, the researchers speculate, the protein may eventually benefit patients with rheumatoid arthritis, lupus, multiple sclerosis and some other putative autoimmune diseases. The reason? These diseases, like myasthenia gravis, tend to disappear in latter pregnancy, suggesting that alpha-fetoprotein is combatting them. However, if the protein does inhibit these diseases, it is probably by altering autoimmune mechanisms rather than by binding antibodies to acetylcholine receptors. □

ESA comet-bound with or without NASA

With the National Aeronautics and Space Administration and various scientists around the country struggling to initiate some kind of U.S. spacecraft mission to comet Halley, the European Space Agency last week decided to go ahead and develop its own. NASA has been invited to participate, but, in a marked change from past NASA-ESA cooperative ventures, ESA this time is fully prepared to go it alone if the United States fails to come through.

The spacecraft, a modification of ESA's GEOS earth-orbiting research satellite, is to be launched between July 7 and 22, 1985, and to fly by the comet on March 13, 1986, a few weeks after the comet's closest encounter with the sun. The flyby will happen in a rush, at a relative velocity of 68 kilometers per second (244,800 km/hr), so all of the mission's observations will be made in a single four-hour period. The data will be radioed back to earth as they are collected, rather than stored on board for later playback (which would allow more intensive measurements), because of the possibility that dust close to the



ESA

ESA *flight planned through Halley's tail.*

comet's nucleus could destroy the spacecraft.

Among the eight scientific instruments now envisioned for the craft is a camera based on an 800-by-800-element charged-coupled device, the same size as the heart of the advanced camera being developed for NASA's Galileo Jupiter orbiter. Comet nuclei are hidden by gas and dust from earth-based observers, and ESA planners hope that their spacecraft's sophisticated sensor will be able to photograph details on Halley's nucleus as small as 50 meters across. Such pictures could reveal not only the nucleus's size, shape and brightness variations, but perhaps its rotation rate and the ways in which it gives off its dust, gas and ice in response to the sun's heat. Other instruments will include neutral, ion and dust mass spectrometers for composition measurements; a dust impact detector; an electron/ion plasma analyzer and magnetometer for studies of the comet's charged-particle environment; and an ultraviolet spectrometer for remote and *in situ* examination of the coma or cometary "atmosphere."

All of these experiments may end up under the aegis of European scientists, but many U.S. researchers would like a chance to take part, and to that end ESA has in effect provided a carrot: ESA's $116 million estimate for the mission's cost does not include the experiments (in Europe their funding comes with the participating scientists) but it does include the cost of a launching by ESA's Ariane rocket. ESA has invited NASA to provide (and pay for) a U.S. Delta rocket and launch services, as well as the ground stations of the Deep Space Network for tracking and data acquisition — "in return," says an ESA report on the mission, "for an appropriate share of the scientific payload." Without such cooperation, according to an ESA official, U.S. researchers might be able to take part only as members of teams under European leadership. This could affect the U.S. participants' ability to influence experimental goals and operations as well as instrument design.

This may not sound like the most open-armed approach to cooperative planning, but ESA may be applying the lessons of past experience. ESA had agreed to provide a probe that would have been sent to Halley's nucleus from a NASA-built flyby — until NASA failed to get its own part funded. Further money troubles caused NASA to delay its half of a NASA-ESA two-spacecraft mission to study the sun's poles (reducing the likelihood of concurrent observations), and similar woes have put off NASA funding connected with Spacelab, the ESA-built research module for the U.S. space shuttle. Nonetheless, NASA hopes to be able to take part in ESA's Halley mission (a decision is needed late this year), as well as to fly its own, aimed to reach the comet before perihelion to complement the ESA post-perihelion plan. □

Vertebrate sans O2: Fishbowl fermenter

The common goldfish has a not-so-common talent: At low temperatures, it can survive several days in the complete absence of oxygen. Although the precise basis for this capability remains unknown, researchers recently reported that the fish's survival in anaerobic conditions may depend, to a large extent, on its production of ethanol — a two-carbon alcohol.

"The goldfish has evolved a novel pathway of vertebrate anaerobic metabolism in which glucose carbon is metabolized to ethanol," report P.W. Hochachka and colleagues of the University of British Columbia at Vancouver in the July 11 SCIENCE.

In other vertebrates, when glucose is broken down for energy under anaerobic conditions — during violent muscular activity, for example, when the energy need is greater than that supplied by aerobic respiration — lactic acid is produced. The accumulation of this lactic acid in the goldfish bloodstream, however, would be risky business, Hochachka and colleagues report.

The vertebrate bloodstream is equipped with buffer systems designed to maintain a constant pH. Normally, one major buffer system is the carbon dioxide (CO_2)-bicarbonate (HCO_3^-) equilibrium: $CO_2 + H_2O \rightarrow HCO_3^- + H^+$. But because the large volume of water that passes over the fish's gills acts as a CO_2 sink, draining the fish of its CO_2 supply, the goldfish has a poor CO_2-HCO_3^- buffer system. If the goldfish — with such an inadequate buffer system — were to rely on conventional anaerobic glucose breakdown, then lactic acid build-up would result in a debilitative disturbance of its pH. Anaerobic production of the neutral ethanol seems to have evolved to compensate the fish's poor buffer system. □

Landmark architecture: Found and lost


Univ. of Chicago

Enough remains intact of 5,000-year-old fortress to confirm that it had a vaulted roof.

You dig and sift and search in a race against time, but you know all along that you can't win. The site you are working will be obliterated by a high-rise building, by pipeline construction or by the waters rising behind a new dam. This is the frustration of salvage archaeology, but there can be rewards — especially if you make an important find. And that's what is being claimed by archaeologists excavating a soon-to-be-flooded site in the Hamrin Basin of northern Iraq. Teams from the Oriental Institute of the University of Chicago and from the University of Copenhagen have found a 5,000-year-old round fortress with a vaulted roof made of mudbrick. It is one of the earliest known vaulted roofs (parts of which are still intact), and McGuire Gibson of the Oriental Institute says the building is a landmark in architectural history. Mudbrick, he adds, is an unusual substance for a monumental building of this type.

The fortress, which is strategically located on what was the most important thoroughfare for trade, warfare and travel between Mesopotamia and the East, indicates that fortified settlements existed much earlier than had been suspected. The main structure (27 meters high with 4-meter-high, buttressed walls) contained stone implements, flint sickle blades and copper tools and weapons along with hundreds of fragments of a distinctive pottery that was used to date the settlement.

Because the structure is made of mudbrick, the vault cannot be removed and preserved as an architectural landmark. The waters are expected to cover it late this year or early next year. □