ward a 1986 encounter with Uranus. Preceding both probes is Pioneer 11, whose flyby this Sept. 1 will take it the same distance outside the main rings as will Voyager 2's, making Pioneer 11 a guinea pig to test the safety of the ring-plane crossing for the latter mission.

Yet in choosing Pioneer 11's course, the National Aeronautics and Space Administration overrode the majority of the project's scientists, who had voted to send the craft between the inner part of the main ring system and the planet itself. While the Saturn trajectory was being chosen in 1977, some of the scientists said that in order to get some data close to Saturn, they'd rather go "inside" even if the spacecraft might be destroyed by ring particles after what amounted to "half a mission" (SN: 10/15/77, p. 249).

According to a just-published study of evidence for the extra, inner ring, called the "D ring," that's just what might have happened.

"There *is* a D ring," says astronomer Stephen M. Larson of the University of Arizona in Tucson. His evidence is a pair of observations of Saturn made in 1977 with a charge-coupled device (CCD) detector on the 154-centimeter Catalina telescope in Arizona. The CCD, Larson says, is about five times as sensitive in measuring dim light as conventional photographic methods, giving it a better chance of distinguishing a faint inner ring from the reflected glare of Saturn. Also, the observations were made at an 8,900-angstrom wavelength at which the methane in Saturn's atmosphere absorbs rather than reflects sunlight, making the planet much dimmer relative to the rings.

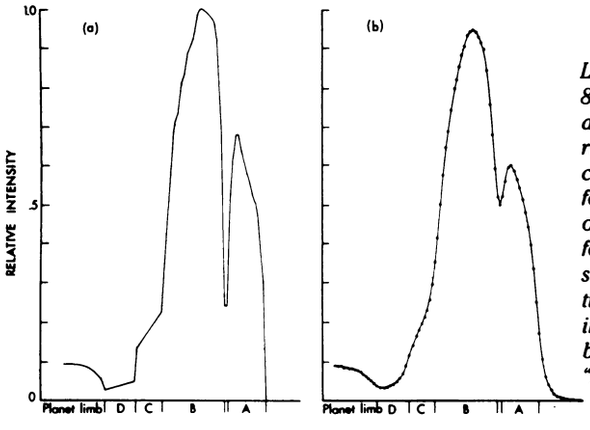
Using previous observations of the rings, Larson first constructed a "model" of how the brightness of the rings ought to vary radially, from Saturn all the way out across the ring system. Then he calculated a "smearing function" to mathematically represent the distortions caused by earth's atmosphere on the night the CCD observations were made, also including related effects due to the telescope's optical system. The model of what the rings should actually look like, corrected for the distortions of the atmosphere and telescope, would presumably match the brightness profile recorded by the CCD.

The result, reported in ICARUS (37:399) is an almost perfect match — and the D ring does seem to be present.

It is dim, to be sure, ranging from five percent to as little as three percent of the brightness of the ring system's brightest part. Even the gap known as the Cassini Division in the main ring structure, a region largely cleared of particles by satellite gravitational effects, is brighter by comparison. But to a passing spacecraft, Larson's data suggest, the D ring would not be a negligible barrier. Crossing the D ring at the 16.5° angle that was being considered for the "inside option," he says, Pioneer 11 would have encountered as many as 10,000 one-centimeter particles (or an equivalent cross-sectional area in different sizes), and at speeds of tens of thousands of kilometers per hour.

So Pioneer 11 will go outside, penetrating the ring plane about 34,000 km beyond the outer edge of the main rings. But there's also evidence (a bright line visible in some observations when the ring plane was viewed edge-on) for material out there as well. W.A. Feibelman of Allegheny Observatory in Pennsylvania reported the line to extend as much as twice the known ring diameter (and thus to about four times the distance of Pioneer 11's crossing from the main ring system's outer edge), and a later observation increased Feibelman's number by about 50 percent. Using Feibelman's data, University of Arizona astronomer Bradford Smith has calculated the possible outward ring extension to be about 100,000 times less dense than the D ring, Larson says, so the hazard should be greatly reduced — but it's still greater than zero. The spacecraft will be penetrating the ring plane at a much shallower angle (between 5° and 6°), which will roughly triple the area of the ring to which it will be exposed, and it will pierce the plane twice (swooping down and up again).

If Pioneer 11 is actually damaged or destroyed during the crossing, one consequence could be a decision to re-aim Voyager 2 farther out from the main rings, sacrificing the visit to Uranus. Whatever happens, however, scientists stand to learn — albeit perhaps the hard way — from the attempt. □



Larson's model for the 8,900-angstrom brightness distribution of Saturn's rings (a) becomes a smooth curve (b) when corrected for atmospheric distortion on the observing night and for telescope effects. Dots show how CCD observations fit the predicted curve, including measurable brightness where a possible "D ring" may lie.

Diabetic rats cured by islet transplant

The immune system is a mighty barrier to successful transplant of body tissue. Insulin-producing islet cells, for example, survive only a few days when moved from a rat of one strain into a rat of a distantly related strain. Now a two-pronged approach to evading a rat's defense system has allowed rat islets transplanted by Washington University scientists to function successfully in the recipient for more than 100 days. That success may lead to the eventual use of islet transplantation to treat some forms of human diabetes.

The experimental diabetics in the study reported in the April 20 SCIENCE were rats treated with a drug that specifically destroys their insulin-producing cells. Like human diabetics, the treated rats could not control blood sugar levels, and they excreted sugar in their urine. Paul E. Lacy, Joseph M. Davie and Edward H. Finke performed an islet transplant by injecting about 1,000 clusters of pancreatic cells into a vein that empties into the liver. The islets lodged in the liver sinuses, Davie said in a telephone interview. In the most successful experiments, the islets functioned normally in the liver for an indefinite period. The recipient rats could again regulate their blood glucose level, eliminate sugar from their urine and gain weight at the same rate as normal rats.

The successful protocol combined two procedures. Islets were incubated for a week in the laboratory before being injected into the recipient, and the recipient received an injection of antibodies that attack white blood cells. The approach was based on the hypothesis that "passenger" white blood cells in the transplant are partially, or entirely, responsible for the recipient's immune response.

Lacy and collaborators were surprised to find that the insulin-producing cells of an islet remained healthy after a seven-day incubation in tissue culture medium at room temperature. But during that time, the passenger white blood cells lost some of their immunity-triggering power. When transplanted into a distantly related strain of rat, the laboratory cultured islets survived longer than freshly dissected cells.

An additional boost to the islets' successful transplantation came from an injection into the recipient rat of rabbit antibodies (ALS) raised to attack rat white blood cells. How the antibodies work is a matter of some question, Davie explains. One possibility is that they depress the recipient's immune system during a crucial period in which the islets establish themselves. The other explanation, the one Davie finds more interesting, is that the antibodies attack any remaining white blood cells of the transplant. "ALS would remove the last few immune stimulatory cells," he says.

Extensive experimental work remains to be done before the procedure is applicable to human surgery. The investigators are now exploring the generality of their finding by testing whether the transplant procedure is successful in hamsters and mice, as well as in rats. And in an experiment further afield, they are trying to transplant islets between different species. Perhaps some day cow pancreatic cells may produce insulin in humans.

If further work confirms the importance of white blood cells in stimulating immunity, the rationale that surgeons now use in doing transplants will need revision. Davie says that instead of tranferring a tissue as rapidly as possible and inhibiting the recipient's immune response, the best results may come from taking the time to modify the transplant by removing the stimulatory cells. "Then you may not have to immune-suppress the recipient," he says. The mighty immune barrier may never have gone up. □

Illinois patients: 'Guinea pigs'?

First came allegations that "scores" of Illinois mental patients in the 1950s and 1960s had been involuntary guinea pigs for experiments in which their adrenal glands were removed for research purposes. Now, Cook County public guardian Patrick Murphy says that in an expanded law suit he details a "history of experimentation" involving lobotomies and drug research on "probably thousands" of Illinois state hospital patients from the 1950s to the present.

Named in the expanded version of the suit, which Murphy said he planned to present to the court on April 23, are the Illinois Department of Mental Health and the University of Chicago, "and I may add the University of Illinois," Murphy told SCIENCE NEWS. Ultimately, he said, he plans to file four separate suits aimed at requiring a court order "before any experimentation is done on a DMH patient."

Murphy's original action, filed last week, alleged that at least 26 patients at Manteno Mental Health Center underwent "unauthorized and secret" adrenalectomies under the supervision of the University of Chicago's Charles B. Huggins, co-winner of a Nobel prize in 1966 for discovering uses of hormones in treating prostate cancer. University officials denied the charges and indicated that Huggins, who was not referred to by name in the suit, was involved in such operations, with full family consent, on only six schizophrenics, two of whom had cancer.

However, Murphy says, "from my sources, I understand there were more [than six]." At Murphy's request, a circuit court judge has already issued an order prohibiting the destruction of any records that might be related to the case. □

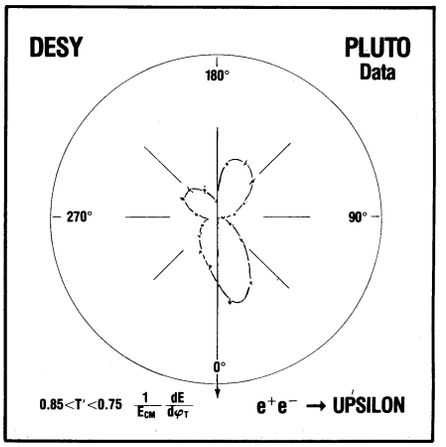
Squeezing out the universal glue

Deep in the heart of particle physics is a force called the chromodynamic force. Its function is to bind quarks to other quarks. Protons and neutrons are among the things that are made out of such bindings. All the matter in the universe is made of protons and neutrons, and so the chromodynamic force becomes fundamental to the structure of all matter. Without it, matter more complicated than single quarks could not be built. Since current theory also says that matter as simple as single quarks cannot exist, there's a paradox here that could put the universe out of existence. However, this story is not a philosophical piece, but a report on an experimental attempt, assuming the existence of the chromodynamic force, to see whether that force acts as theory says it should.

The theory, called quantum chromodynamics, prescribes that the chromodynamic force should be embodied by a field quantum, which is a special kind of particle called a gluon. If a force exists between two quarks, it means that they are exchanging gluons. This sort of thing is standard behavior for forces on the subatomic level. All of them have field quanta, the exchange of which produces the effects of the force. An experiment to test the existence of gluons is, among other things, an attempt to see whether chromodynamics conforms to this general rule in its own particular way. An experiment in the DORIS colliding beam facility at the DESY laboratory near Hamburg has looked for evidence of gluons. The first analysis of the data led the experimenters to say "maybe." A recently completed reanalysis prompts them to say "yes."

What the DORIS apparatus does is to produce head-on collisions of electrons and antielectrons (positrons). This causes a matter-antimatter annihilation, out of which many kinds of particles may form. Under study here were upsilon particles, a newly discovered, extremely heavy variety. Upsilons are supposed to be made of a quark and an antiquark, and when one of them decays, it should produce three gluons. The gluons do not last long. Each of them turns itself into a jet of various kinds of particles. These are the particles that finally come out of the whole process and get recorded by the detectors, and the jet structure should show up in the distribution of their energies and momenta.

The first analysis of the data, reported a few months ago (SN: 3/24/79, p. 186), showed strong evidence that the basic theory was correct but did not show the jets. Now a reanalysis has been done according to ideas suggested by theorists at DESY and at the CERN laboratory in Geneva. Mainly it involves including electrically neutral particles along with the charged particles in the analysis of the final products of upsilon decay. This permits a more complete reconstruction of an upsilon decay event. In addition, a more preferential way of locating the jet axes (using particles with high momentum to define them) was adopted. Now, the experimenters say, the jets appear.



DESY

Particle energies distribute into three lobes characteristic of the predicted gluon jets.

The result was communicated to a seminar held at DESY on March 30. The DESY announcement doesn't say how it was received, but as the report circulates, it is likely to come under sharp scrutiny from colleagues. This is hardly the first time that an experiment has been recalculated, but it may be the first time in recent memory that it has been done publicly in a field that is as fiercely competitive as this one. □

An antibody business

A new San Diego firm with just three full-time scientists, a few consultants and a legal and business staff has announced plans to produce pure, specific antibodies for medical, diagnostic use. Hybritech Inc. plans to cash in on the new technology of using hybrid cells as living factories for specific molecules (SN: 12/30/78, p. 444). Antibodies from animal blood are already used in some diagnostic tests, but the hybrid cells give purer, more reliable and less expensive material. The company's first product is antibodies useful for detecting hepatitis B. Because diagnostic materials are subject to fewer Food and Drug Administration regulations than are drugs, Hybritech expects to begin making money in its first year by selling antibodies to already established companies. Eventually it plans to branch into therapeutic materials, but probably not for at least five years.

Hybritech is organized by the same investors who started Genentech, a San Francisco firm developing recombinant DNA techniques (SN: 9/16/78, p. 195). Both groups are aggressively pursuing the payoffs of the most recent biological technologies. □