

the decision. Atomic Industrial Forum President Carl Walske said the policy "mortgages our energy future" by foregoing energy from the breeder for a bargaining chip abroad. On the other hand, Richard Pollack of Critical Mass, a Ralph Nader-organized lobby, said the new policy would undermine our leverage overseas in stopping nuclear proliferation because the failure to close down the Clinch River plant along with the Barnwell facil-

ity made the policy too ambiguous.

Reaction abroad indicated that the nuclear exporting countries were unwilling to go along with Carter's plan. Participants at an international conference on the transfer of nuclear energy held in Iran gave the statement a lukewarm reception. There is some indication that the countries are worried that the United States is attempting to hoard all nuclear fuel as a means of attaining nonproliferation. □

The strange rings of Uranus

The recent discovery of apparent rings around the planet Uranus (SN: 3/19/77, p. 180) has grown more interesting still, with the possibility that there may be more rings than originally inferred and that the largest ring may be strangely irregular in shape.

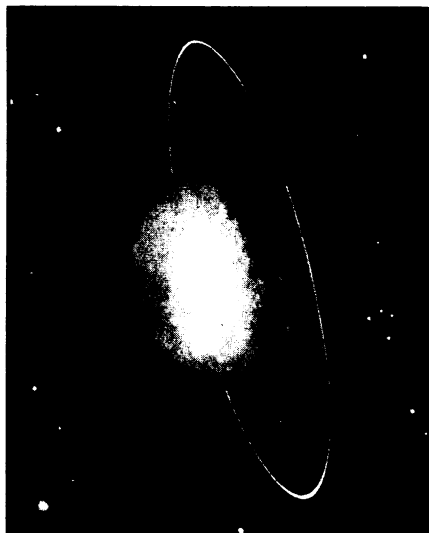
The March 10 observations were in the form of a series of "dips" in the measured light from a star (SAO 158687) shortly before and after it was blocked out by Uranus itself. The blockage, called an occultation, was recorded by James Elliot of Cornell University, flying over the Indian Ocean aboard a NASA airborne observatory, as well as Robert Millis of Lowell Observatory, working at Perth Observatory in Australia, and other astronomers in India, Japan and South Africa.

Elliot's original speculation was that the inbound and outbound "mini-occultations" represented a number of individual objects, or moons, with diameters as large as 100 kilometers. Study and comparison of the observations, however, showed that the spacing and duration of the inbound mini-occultations was almost identical to those recorded after the planet had passed from in front of the star. It is extremely unlikely that individual moons would be spaced so regularly, so it is now felt that the starlight was blocked by the two sides of a series of rings. The light was not completely shut off—only reduced by about 50 to 90 percent—and Elliot concludes that the individual ring particles are probably smaller than 2 kilometers across.

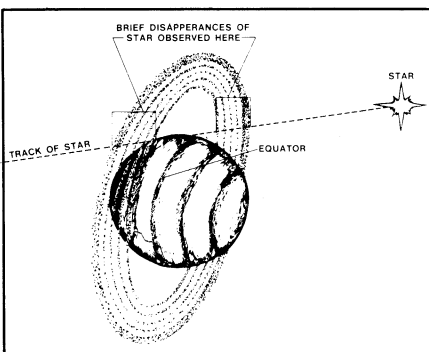
There seem to be five principal rings, which Elliot has labeled (beginning with the innermost one) alpha, beta, gamma, delta and epsilon, together occupying a band about 7,000 kilometers wide. Each of the four inner rings appears to be perhaps 10 kilometers wide, while the outer ring may be as wide as 100 kilometers. The outer ring may also be either thicker or more dense, since it occulted about 90 percent of the light from the star, compared with about 50 percent for each of the others.

Further study has now made the strange structures (far narrower than the rings of Saturn, the largest of which is more than 25,000 kilometers wide) seem even stranger.

Millis's data from Perth, although they



Uranus with possible rings, showing their steep inclination to the ecliptic plane.



Occultation track as seen from earth.

missed the alpha and delta rings while the telescope was being recentered (only the inbound occultations were visible from Perth), show two additional partial occultations *inside* the alpha ring. This could be evidence of two more rings, with the "shallowness" of the occultations possibly indicating that these rings are narrower or less dense than the others.

Still more perplexing is the matter of the wide outermost, or epsilon, ring. The inbound occultation, says Elliot, lasted about 7 to 8 seconds. The outbound occultation of presumably the same ring, however, lasted only 3 seconds. This translates to mean that the ring's inner edge is about 600 kilometers closer to the planet on the outbound side.

This asymmetry could mean that the epsilon ring is not in the same plane as the others, or that it is more elliptical, or perhaps that it is "ragged," with its particles distributed irregularly within it. Each of these ideas poses difficulties, particularly in the dynamical problems of the first two. But, says Lawrence H. Wasserman of Lowell Observatory, "the theorists will have a field day."

Meanwhile, Edward Bowell of Lowell is investigating an intriguing possibility: The relative transparency of the rings, compared with solid planets, means that dimmer stars could be used for occultation studies. There may thus be extra chances in the future to study the most recently discovered spectacular in the solar system. □

DNA rules backed by administration

The Secretary of Health, Education and Welfare last week asked Congress to regulate recombinant DNA research. Until future experiments allow a more precise assessment of possible risks, the Carter administration believes the best course is to allow the research to go forward, but only under strict safety conditions, Joseph A. Califano Jr. told a hearing of the Senate subcommittee on health and scientific research.

The administration bill, one of several under consideration, was introduced in the Senate by Edward M. Kennedy on April 1. It is based on the recommendations of a 25-member committee of representatives of different federal agencies. But the bill has a surprising difference from that group's suggestion. It stipulates that instead of the federal law superseding state and local laws, local laws more stringent than the federal regulations may be administered. The interagency committee had argued that potential hazards extend beyond the local levels, and therefore a single set of national standards must govern.

Another difference between the administration bill and two other bills on recombinant DNA before the subcommittee is the application of the rules to production and possession of recombinant DNA, instead of to research involving recombinant DNA. The interagency committee felt such wording would avoid problems of determining whether a given activity is research, pilot production or manufacture. "The language thus covers all use of recombinant DNA techniques," Califano said.

Unlike the bill proposed by Sen. Dale Bumpers (D-Ark.), the bill backed by the administration does not include any specific patent restrictions. Nor does it include the assignment of liability without regard to fault to persons carrying out recombinant DNA research, a clause of the

Bumpers bill that has alarmed researchers.

All three bills give the Department of Health, Education and Welfare responsibility for regulation, and the administration bill and that introduced by Sen. Howard M. Metzenbaum (D-Ohio) promulgate the NIH guidelines as at least initial interim standards. Under the administration bill HEW would license re-

search facilities and register individual projects.

The subcommittee has yet to meet in executive session to decide how to handle the bills. However, there is some time pressure. If the final bill authorizes money, for example for inspection of facilities, it must have action on the floor of at least one house by May 15. □

Switching cancer cells back to normal

More and more evidence is accumulating to show that cancer is not necessarily stable, but can be reversed and modulated, according to a variety of evidence reported at the annual meeting of the Federation of American Societies for Experimental Biology in Chicago last week. Under a variety of laboratory conditions, cancer cells lose their malignant characteristics and revert to normal, researchers from five laboratories reported. These results suggest clinical methods might be sought to return cancer cells to normal control.

The most dramatic experiments were those in which one type of tumor cell that had been grown by transplantation from mouse to mouse for eight years was injected into early mouse embryos. The embryos were then implanted into surrogate mothers. The cells derived from the tumor could, in the embryo, differentiate normally into the many types of mouse tissue. The healthy tumor-free mice that resulted often had cells from both the tumor and the original embryo. "The father was a tumor," jokes pathologist Henry C. Pitot. Genes, such as the one for fur color, that had not been expressed during the eight years of the tumor's existence were once again operating in an orderly and controlled manner. Although other types of tumors may arise by changes in the genes, the malignancy in this type of tumor, called a teratoma, is apparently not due to a mutation of the DNA but to a reversible loss of control of normal gene expression, researcher Beatrice Mintz concludes.

Mintz first performed these experiments at the Institute for Cancer Research in Philadelphia. Now M. W. McBurney of the University of Ottawa also reports experiments showing normalization of cancer cells transplanted into early mouse embryos.

Another method of switching cells between cancerous and normal states was described by Selma Silagi of Cornell University Medical College. Silagi adds small amounts of the chemical 5-bromodeoxyuridine to the culture medium of cells from a pigmented mouse tumor. That chemical is incorporated into the cells' DNA in place of the natural component thymine. Cells derived from the tumor, after three cell divisions in the presence of 5-bromodeoxyuridine, are incapable of forming tumors in adult mice. The re-

verted cells also lose other characteristics of tumor cells, such as production of pigment and of a protein-destroying enzyme. But if the chemical is removed from the medium and is eventually replaced with thymine in the DNA, the cells resume their tumor characteristics and again cause tumors when injected into mice.

An aspect of this work that may have great clinical relevance is that the treated cells, which no longer cause cancer, can prevent untreated cells from inducing tumors. If the two cell types are mixed together before they are injected into mice, the mouse's immune response to the treated cells kills the tumor-causing cells as well. Inoculation with treated cells will also prevent a later injection of cancer cells from causing tumors. Now the researchers are isolating components of treated cells' membranes that will provoke the immune response, so as to avoid having to inject living cells. Silagi believes this research will lead both toward a better understanding of malignant cells and toward a method for immunizing patients after surgery to prevent recurrence of their tumors.

Reversion of cancer cells, although shown in animals only recently, has been observed in plant cells for over 20 years, Frederick Meins Jr. of the University of Illinois points out. Research on plant tumors revealed that their uncontrolled growth can result from inappropriate production of a substance called cell division factor. Researchers have devised ways to manipulate how much of this factor is produced by cells grown in culture outside of a plant. The most recent work by Meins shows that the change of a plant cell from normal to a tumor is progressive. There is a gradual increase of the growth factor production. The change is also reversible. The researchers find that if a tumor cell's production of the cell division factor is momentarily blocked, the cell returns to normal control. These findings indicate that the tumor cells retain their potential for normal growth and development.

Finally Pitot, of the University of Wisconsin, suggests on the basis of research on liver cancer that very early in cancer development cells may be converted to normal tissue, whereas later, when the cells exhibit marked alterations in their chromosomes, the cells may be irreversibly transformed into cancer. The

prevailing hypothesis had been that initiation, the first stage in cancer development, is irreversible.

The researchers told a news conference that finding cancer is not always irreversible is no panacea, but it is one ray of light that in the future may be important.

The ability of cancer cells to become normal is also providing a new tool for experimental study of human genetic diseases. Mintz and co-workers are deliberately producing mutations in tumor cells growing in culture. The researchers then select cells with specific biochemical changes known to be involved in certain diseases. These cells are injected into mouse embryos where they participate in forming the body tissues. Sperm and eggs derived from the altered cells can create a mouse model of the corresponding human disease. □

A functioning artificial penis

To date, penis construction in female-to-male transsexual operations has left massive scarring and awkward-appearing organs with little or no sexual functions. A first-time combination of several known techniques and some novel techniques by surgeons at the University of Missouri Columbia Medical Center has led to the creation of a more aesthetic and sexually functioning artificial penis.

The nine-month procedure, performed by Charles L. Puckett and Joseph Montie of the medical center on a female transsexual wanting to become a male, was reported last week at the 23rd annual Urology Seminar in Kansas City, Mo. Urologists at the meeting described the results as "beautiful" and "fantastic."

Prior to penile construction, the patient underwent four years of hormone treatment, mastectomies and removal of female reproductive organs. A groin skin flap from the patient was then used to form a penile shaft. The groin flap, often used in other plastic surgery, has many advantages over the abdominal and chest skins used for earlier sex organ construction. It is quite similar to the actual penile tissue, eliminates disfiguring scars and the need for grafts and is hairless.

In earlier penile constructions, no attempts were made to sculpture a realistically shaped penis. In Puckett and Montie's operation, however, tucks were made at the tip of the penis to imitate a glans. Tactile sensations were also achieved by moving the clitoris, much enlarged by hormone treatment, and placing it at the exterior base of the penis. This step provided sensations not achieved in past operations. As in earlier procedures, though, a scrotum and artificial testes were constructed.