Looking Back at Uranus: Strangeness Confirmed

Only four days after the Voyager 2 spacecraft’s Jan. 24 flyby of Uranus produced the first close look at that distant planet, world attention was abruptly wrenched earthward again by the explosion of the space shuttle Challenger. But while NASA struggles to get back up off the ground, the Voyager scientists have been poring over their data, learning their way around the strange Uranian system.

The first results of their studies — as opposed to the “instant science” of the days immediately following the encounter — were published in the July 4 Science. And not only have they markedly refined many of the quick-look details, such as the sizes of the planet’s 15 known moons (10 of which were Voyager 2’s discoveries), but Uranus and its attendant phenomena turn out to be at least as dramatic as the initial results had hinted.

The moons: Outermost Oberon, besides revealing a mountain that the images show to be protruding at least 20 kilometers above the horizon, bears a number of straight and curved escarpments that the Voyager scientists believe to be evidence of a “global-scale tectonic episode” in the past. Titania, too, shows an extensive pattern of faulting that seems to have run back to some process that caused a global extension of the crust, they report, such as might have resulted from “the late stages of freezing in the interior of the satellite.”

Umbriel, much darker than the four other major moons and “strikingly uniform in its somber complexion, leaves scientists puzzling over the question of where all the dark material might have come from on the presumably ice-rich satellite. One suggestion is that another object struck Umbriel and shattered, generating dark fragments that later settled all over the surface. A problem with such a scenario, however, is that unless such an impact were relatively recent, there ought to be evidence of later impacts that punched through the dark stuff to reveal lighter material below. Unless, of course, the surface and subsurface material are similarly dark, and “extremely uniform to a substantial depth on a global scale.”

Far more complex-looking is Ariel, with valleys, cliffs and other scars in profusion. Yet the floors of many of its features are surprisingly smooth, as is an extensive, irregularly shaped plain. Whatever did the smoothing, the researchers maintain, “has clearly been emplaced, at least in part, as a flow of sequence of flows that overlaps and partially buries older craters.” The nature of the flows on Ariel, and on Titania as well, is uncertain. Water ice, assumed to be the major component of the satellites, has a melting point about 200 K (360°C) higher than the ambient surface temperature, according to the Voyager team, though an ice mixture of ammonia and water could do the job with far less heat. Another possibility could be “tidal heating,” caused by the same multisatellite gravitational tug-of-war believed to drive the volcanism on Jupiter’s active moon Io.

Strangest of all is Miranda (SN: 2/15/86, p. 103), with at least three large, closed patterns of light and dark bands, scarps and ridges, from about 100 to 300 km wide. At first look, the baffled Voyager imaging team dubbed them “circi maxim,” after the ancient Roman racetrack; now they have been separately — though not much more compellingly — named the “trapezoid,” the “banded ovoid” and the “ridged ovoid,” while the scientists wonder what caused Miranda’s tortured geologic evolution.

“Miranda probably was catastrophically disrupted and reaccreted several times,” they say, “by impact of objects large enough to produce a crater equal to or larger than the diameter of the satellite.” In fact, they suggest, “Ariel was probably disrupted and accreted at least once; Umbriel may have been disrupted once. There is a fair chance that Titania was also disrupted.”

The only one of the 10 newly discovered satellites to be even blurrily photographed, designated 1985U1, provided a different kind of surprise by turning out to be unexpectedly spherical. Most such small solar system objects are irregularly shaped, lacking the self-gravitation to pull them into roundness, yet 1985U1, about 170 km across, even survived an impact big enough to form a 45-km crater.

The rings: In addition to the nine previously known from earth-based obser-
Con(tr)ception: Hormonal coin toss

Two research teams at the Salk Institute in La Jolla, Calif., have discovered a reproductive hormone that may one day be useful in the treatment of certain kinds of infertility. Another reproductive hormone, also recently isolated by one of the same research groups, may have potential as a contraceptive. In an unusual demonstration of the body's thriftiness, the hormones are a matched set: Although opposite in activity, they are largely rearrangements of the same components.

The newly discovered hormones are intriguing because they act specifically on the production of follicle-stimulating hormone (FSH), which triggers the development of ova and the production of sperm. Inhibit, one of the recently isolated hormones, acts on the pituitary gland to decrease FSH secretion without affecting levels of other hormones that are normally released in tandem. Because of that specificity, says Kenneth Klivington, spokesperson for the research groups, "inhibit provides a potential ideal contraceptive for both men and women."

Unexpected findings during the research on inhibit led to the discovery of a substance that works in the opposite direction, stimulating release of FSH. That substance was reported in the June 19 NATURE. Two forms were isolated at Salk—one named follicle-stimulating hormone releasing protein (FRP) by a group led by Wylie Vale, and the other called activin by a group led by Roger Guillemin. Klivington says it may someday lead to a "choice treatment" for infertility.

Modern contraceptive technology is prone to problems. Even though birth control pills succeed in blocking fertility in women, there are side effects that ripple throughout the hormonal system; and there is no male hormonal contraceptive available at all. The problem for researchers has been the body's intricate dovetailing of the hormones that orchestrate reproductive events.

Scientists have long known that much of the regulation occurs in a hypothalamus-pituitary-gonadal hormonal loop: The hypothalamus in the brain stimulates the pituitary to secrete two hormones, FSH and luteinizing hormone (LH), which, among other things, stimulates the production of sex steroids like estrogen and testosterone.

Most birth control pills for women use estrogens and other steroids, which can disturb the rest of the hormonal balance. When researchers have attempted to use FSH-inhibiting substances as male birth control, they have been unable to block the release of FSH without also inhibiting LH. That meant that while production of sperm stopped, levels of sex steroids dropped as well—and so did the steroid-controlled sex drive.

But a contraceptive based on inhibit might block production of sperm or ova without "fouling up background levels of sex steroids," Klivington says. In using it, "you wouldn't mess up the psychological aspects of reproductive behavior."

The activating compounds may turn out to be valuable treatments for men and women who are infertile because of low levels of FSH. Klivington says. Currently, hypothalamic hormone is used to treat some of these cases of infertility, but that hormone is a blunt tool, raising levels of LH along with FSH. That can be a particular problem for women, because inappropriately high levels of LH at the end of the menstrual cycle may actually inhibit follicle selection and egg development.

Applications of the newly discovered hormones are still very much in the realm of the theoretical, researchers warn. For one thing, the work at Salk has used inhibit from animals and has so far been done only in test tubes. But inhibit in humans is very similar to that from animals, according to Anthony Mason at the San Francisco-based biotechnology firm Genentech. Mason worked with Guillemin on the isolation of inhibit. Another recent announcement, in the May 31 LANCET, is encouraging to the researchers: The paper confirms that inhibit can be found circulating in the blood in humans. (According to the researchers, led by Robert McAllchan at Prince Henry's Hospital in Melbourne, Australia, blood levels of inhibit may eventually be used to signal the best time for IN Utero fertilization.)

One of the most striking aspects of the discoveries has nothing to do with the function of the hormones, according to the Salk Institute researchers, but with the way they are put together. Inhibit is made up of an alpha subunit and one of two possible beta subunits. The activating hormones consist of two of the beta subunits linked together.

The rearrangement to produce different proteins seems to occur at the level of the subunits, the researchers say; rather than at the level of the genes which code for them. Examples of such rearrangements are rare. "If such rearrangements of several gene products are the norm, rather than the exception," Guillemin's team writes, "this process clearly extends the diversity of the final products (and their biological activity) derived from a limited number of genes."

— L. Davis

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