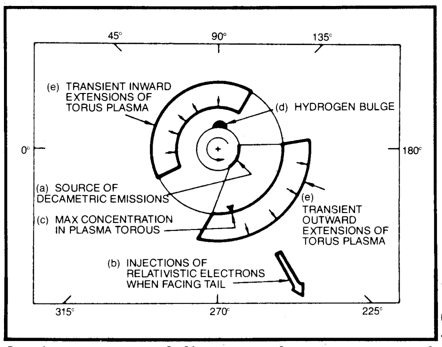
ringlet's outer edge. Superimposed on such details, he adds, is a tendency for the general mixture of sizes to vary with distance from Saturn. "The rings that you see if you look at centimeter sizes," he told the DPS, "are not the same as the rings you see if you look at meter sizes."

Perhaps the most tantalizing ring mystery of all has been the separate, seemingly "braided" strands photographed in the F-ring by Voyager 1, but which revealed only an ordered, concentric pattern in Voyager 2's limited coverage nine months later. One proffered explanation for the braids had been the influence of two small moons that bracket the thin ring, until a Voyager 2 photo showed both moons and the intervening expanse of F-ring with no trace of braids or other irregularities (SN: 8/29/81, p. 132). But the earlier photos won't go away, and, says Mark Showalter of Cornell University, the little moons may explain not only the braids but their subsequent absence. The moons follow slightly noncircular orbits, he points out, so the exact force felt by a ring particle depends upon just how far away each satellite is when it passes by — a constantly changing relationship. Sometimes the particles would be "herded" together into "clumps" (another F-ring phenomenon seen only by Voyager 1), and sometimes not. In fact, he notes, "with the large perturbations from the shepherding satellites, we should never have expected to see a simple, circular ring. And so the rather plain Voyager 2 images are perhaps the most perplexing of all."

Another major topic at the DPS meeting was Jupiter, which presents its own set of exotic phenomena, from active volcanoes on its moon Io to radio signals that have been detected on earth since the earliest days of radio astronomy. An attempt to provide a unifying theory for many of the seemingly disparate Jovian oddities was offered by Alex Dessler of Rice University, who has been evolving his concept for several years and presenting it, step-by-step, at a variety of scientific gatherings. Several of the most-discussed such phenomena, he points out, seem to be linked with certain specific areas around Jupiter's circumference: The powerful decametric radio bursts appear to originate largely from within a particular range of Jovian longitudes; the torus of mostly sulfur and oxygen ions that circles the planet at Io's orbit has a particularly dense, outward-bulging portion that also stays over a certain longitude range. Additionally, there is a bulge of hydrogen atoms that has been detected by various spacecraft over a particular portion of the planet's upper atmosphere. And also part of the set, says Dessler, is the flow of relativistic electrons that have been monitored from outside the orbit of Saturn all the way in to the orbit of Mercury, always bearing the roughly 10-hour modulation of Jupiter's rotational period. All of these diverse effects, according to Dessler, are manifestations of the same underlying process.



Jupiter-centered diagram shows proposed link among diverse Jovian phenomena.

The crux of Dessler's model is what he describes as "a very large weak spot" in Jupiter's magnetic field over a certain range of longitudes in the northern hemisphere. There, he says, the Io-spawned torus of sulfur and oxygen concentrates into a particularly dense region, which, because the torus is pulled rapidly around the planet by the magnetic field, bulges out due to centrifugal force. This also produces an inward (Jupiter-facing) bulge on the torus's opposite side, which extends so far in that it actually contacts the planet's hydrogen-rich upper atmosphere, producing the observed hydrogen bulge. Meanwhile, the electrical current that flows along the Jovian magnetic field lines through the torus is enhanced where the torus is most dense, contributing to the generation of radio bursts from the same, longitudinally fixed sector. "Of course," says Dessler, "just because this is the only such unifying theory doesn't necessarily mean it's right. Jupiter is enormously complicated, and there's room for lots of ideas."

Ideas will continue to abound. The concern of the DPS scientists is about whether there will continue to be spacecraft from whose data such ideas can find a firm footing. □

Intercepting genetic disease

The notion of preventing genetic defects by altering the womb environment is unorthodox, to say the least. One reason is that it involves preventing disease in the fetus, which is no small feat in itself. Another reason is that it implies that so-called genetic defects can be due to environmental factors as well as to genes. Still, there is increasing evidence that this concept can be successfully applied, Guillermo Millicovsky and Malcolm C. Johnston of the University of North Carolina at Chapel Hill Dental Research Center report in the September PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

In 1966 and 1971 some researchers prevented specific ear abnormalities in a strain of mice genetically predisposed to these defects by giving pregnant females a diet containing large doses of manganese. During the 1970s other investigators found that abnormally short fingers and toes could be prevented in a strain of rabbits genetically susceptible to these defects by exposing pregnant rabbits to high levels of oxygen or by supplementing their diets with folic acid or vitamin B_{12}. In 1975 and earlier this year still other scientists prevented inherited defects in vitamin synthesis in two human fetuses by giving their mothers large doses of the missing vitamins during pregnancy (SN: 5/23/81, p. 326).

Now Millicovsky and Johnston have prevented cleft lip and palate in mice genetically predisposed to this malformation — the so-called CL/Fr strain — by exposing pregnant mice to high levels of oxygen. What's more, they have shown that by decreasing the exposure of such pregnant mice to oxygen, the incidence of cleft lip and palate in the mice's offspring was increased. "To our knowledge," Millicovsky and Johnston say, "a decrease *and* an increase in the incidence of a genetic malformation in response to variation in the maternal environment has not been demonstrated heretofore." Just how oxygen affects cleft palate in the fetus is unknown.

In their experiment, Millicovsky and Johnston divided 15 pregnant mice of the CL/Fr strain into three groups of five each and placed all of them in chambers controlling breathing gases from day 10 to day 11 of gestation, the time during which the palates of fetuses of the CL/Fr strain undergo critical development. One group of pregnant mice was exposed to room air (22 percent oxygen, 78 percent nitrogen), another group to low oxygen (10 percent oxygen, 90 percent nitrogen) and a third group to a high level of oxygen (50 percent oxygen, 50 percent fitrogen). The animals were returned to their cages and sacrificed on day 18 of gestation in order to examine their fetuses for cleft lip-palate abnormalities.

There was a highly significant difference in the percentage of normal fetuses (those without cleft lip-palate) among the three groups of pregnant mice. Whereas only 11 percent of fetuses from the group exposed to low oxygen were normal, 63 percent of fetuses from the group exposed to air, and 87 percent of the fetuses from the group exposed to high levels of oxygen, were.

Millicovsky told SCIENCE NEWS that high levels of oxygen during pregnancy might be used to prevent genetically based cleft lip and palate in humans. For instance, high levels of oxygen might be given to pregnant women who already have children with cleft lip and palate because the women's chances of having a second child with the same malformation are high. Millicovsky is quick to caution, however, that more animal studies have to be performed before such disease prevention can be tried in humans. □