BIOMEDICINE

Monitoring blood flow to the liver

The frontiers of biotelemetry continue to expand as more and more physiological processes are translated into the language of electronics. Now, blood flow to another hard-to-observe area of the body, the liver, can be monitored by a device called the pulsed Doppler flowmeter, developed by engineers Henry Allen, James Knutti and James Meindl of the Stanford University Medical Center in Stanford, Calif. High blood pressure in the portal vein, which leads to the liver, produces blood flow changes that can result in life-threatening hemorrhaging. The researchers hope that by characterizing these changes over time, physicians can improve surgical treatment of the condition.

The flowmeter is implanted in the body and is powered by batteries. It bounces sound waves of a certain frequency off red blood cells that are moving through the portal vein and hepatic artery, and analyzes changes in frequency that result from contact with the cells. These changes are then transmitted by electromagnetic waves to an external receiver. So far the flowmeter has been been used in dogs with no ill effects.

Retardation and large chromosomes

Much of the topography (size and fluorescent staining intensity) of human chromosomes is identical from person to person. The rest, however, varies from individual to individual. Past observations have suggested that mentally retarded patients often have the same chromosomal structural variant — an unusually large chromosome number nine. It also appeared that this variant might possibly have contributed to the disorders, since an extra chromosome number 21 or a translocation of chromosome number 21 is known to be responsible for Down's syndrome (mongolism). D. Soudek and Helena Sroka, cytogeneticists at the Kingston (Ontario, Canada) Psychiatry Hospital, attempted to confirm such observations.

As reported in CLINICAL GENETICS (Vol. 16: 109-116), Soudek and Sroka compared the sizes and fluorescent staining intensities of chromosomes from 100 mentally retarded patients in two institutions and from 100 mentally healthy military cadets. Whereas they found some chromosomal size and staining variations more common among the retarded, and others more common among the controls, the only one to approach significant difference was an unusually large chromosome number nine among the retarded.

Steroids for male infertility

Infertility in men is often the result of low sperm count. In some men the problem is compounded by the presence of antisperm antibodies, which interfere with fertility by preventing sperm from penetrating the cervical mucus. Antisperm antibodies exist in the serum of eight to 13 percent of subfertile men, and can cause fertility problems even in men with normal sperm counts.

Now, a British study suggests that steroids can help men who have fertility problems due to antisperm antibody levels. The study was performed by W. F. Hendry and his co-workers at the Chelsea Hospital for Women in London.

Forty-five infertile men were given various dosages of prednisone or methylprednisone, and researchers assessed the effects of the drugs by changes in sperm count, antisperm antibody levels and later pregnancies in subjects' wives. As Hendry and his colleagues report in the Sept. 8 LANCET, sperm counts became normal in 10 of the 15 low-sperm-count men, and four of their wives became pregnant. Among the 32 men with normal sperm counts, antibody levels dropped for all of them and 10 of their wives became pregnant.

SPACE SCIENCES

Complexions: Ganymede vs. Callisto

Photos taken by the two Voyager spacecraft earlier this year of Jupiter's Galilean satellites revealed the four big moons to have four distinct personalities: volcanoes on Io, icy streaks on Europa, apparent tectonic faulting on Ganymede and shoulder-to-shoulder craters on Callisto. Although eruptive Io certainly wins the drama award, the differences in appearance between the outer two satellites have been seen as particularly noteworthy. Why should Callisto show a face of almost nothing but craters, while Ganymede — similar in size and density (and thus presumably in composition) and in an adjacent orbit — is heavily scored with widespread patterns of grooves suggesting all manner of possible tectonic activity?

A possible answer has now been suggested by Patrick Cassen and Ray T. Reynolds of the NASA Ames Research Center and Stanton J. Peale of the University of California at Santa Barbara (the same research team that successfully predicted the possibility of Io's internal activity from an analysis of its tidal interactions with Jupiter and Europa, still a favored explanation for the volcanoes).

The key clue to the Ganymede-Callisto difference, they propose, is that Ganymede is not *exactly* the same size as Callisto, but slightly larger (about 2,640 km in radius vs. about 2,420); it is also slightly more dense (1.92 grams per cubic centimeter vs. 1.81). As such, Ganymede may have a core about 50 percent more massive than Callisto's, and thus a proportionately greater amount of heat-producing radioactive elements in its interior.

The other part of the case is the belief by a number of scientists that most of the impact craters visible on such bodies as earth's moon and Mercury (and possibly Callisto) were formed early in the history of the solar system — perhaps within its first half-billion years, when a far greater number of meteoritic objects were present than exist today. Cassen and colleagues calculate that on Callisto the internal heat that might have produced tectonic effects could have died out before the end of the early bombardment episode, so that surface evidence of the tectonics would have been erased. Ganymede's greater heat source, however (possibly also including greater heating due to gravitation during the formation of the more massive core), might have been able to keep the satellite churning until well after the bombardment ended, so that the tectonic cracks and fault systems are still visible today.

Earth's l-o-n-g magnetic tail

The "tail" of the earth's magnetic field — the portion of the field that is drawn out away from the sun by the solar wind — may be far longer than previously believed, according to Devri S. Intriligator of the University of Southern California and colleagues. The evidence comes from the sun-circling Pioneer 7 spacecraft, which detected a sharp reduction in the intensity of the solar wind plasma, as though it were being blocked by the tail, at a region where the tail would be if it extends nearly 20 million kilometers from the earth. This is some 3,100 times the radius of the earth, more than three times as far from the planet as Pioneer 7's previously most distant detection of the same possibly tail-related effect, the researchers report in the July GEOPHYSICAL RESEARCH LETTERS. It does not necessarily mean that the tail extends continuously that far, says John H. Wolfe of the NASA Ames Research Center, but it could possibly represent detached downstream segments of the tail.

A possibility of related interest is that when the Voyager 2 spacecraft reaches Saturn in 1981, it may find that planet in the magnetic tail of Jupiter. A Jovian tail of such length would scale down to an earth-tail 1,300 earth-radii long, says Wolfe, so the 3,100-earth-radii data may be grounds for hope.