Unraveling solar magnetism

Threads continue to unravel from the cloak of mystery covering the sun's magnetic nature. At the recent meeting in Toronto, Canada, of the American Geophysical Union, John M. Wilcox of Stanford University offered the latest bit of magnetic fabric: a previously undetected magnetic feature at the middle latitudes of the sun's face.

Like most everything else associated with solar magnetism, the polarity of the sun's magnetic field has a 22-year cycle. Every 11 years, the polarities of the hemispheres reverse, so that after 22 years, the sun returns to "normal" — a field directed into the sun in the southern hemisphere and out of the sun in the northern hemisphere. But how does that change come about?

Wilcox and co-workers P.H. Scherrer and J.T. Hoeksema think they may have a toehold on the answer. Using magnetic observations of the most recent solar cycle from the Stanford Solar Observatory, which can detect magnetic intensities to a few hundredths of a gauss, the researchers found a very weak field — about ¼ to 1½ gauss, says Wilcox — at about 30° in both the northern and southern solar hemispheres. The feature stands out because it is of the polarity that will be the new polarity when the field reverses. The feature appears about one year after minimum sunspot activity, says Wilcox, and enlarges and spreads toward the north pole from its birthplace in each hemisphere.

Furthermore, when the researchers looked back at the five previous solar cycles beginning in 1926, they found good evidence that the newly identified feature had been present all along and that its position and other characteristics are constant. The timing of the appearance of the magnetic feature correlates well, says Wilcox, with that of a previously detected variation in the structure of the interplanetary magnetic field. (The interplanetary magnetic field is the field that is swept from the sun's surface throughout the solar system by the solar wind.)

Noting that this poleward migrating feature bears some similarities to the equator-ward migrating solar currents recently described by Robert Howard and Barry LaBonte of Hale Observatories (SN: 4/19/80, p. 245), Wilcox says there is "no obvious answer to how it fits with [that] work, but we suspect it is related."

"What's important is that all these are clues to guide the theoreticians toward a more realistic understanding of the magnetic structure of the sun," he says. "Even theorists would agree that the observations [of the magnetic structure] are ahead of theory at this point." □

Tropical herbal: Down to the chemistry

"The plant kingdom is an untapped source of chemical wealth," Richard E. Schultes told reporters at a recent meeting at Rockefeller University in New York. As a Harvard University botanist he has collected from the Amazon jungles more than a thousand plants used medicinally by the region's native inhabitants. "Most of the plants have never been looked at by chemists. And they contain chemicals so strange they were never thought of by chemists," Schultes says. "The chances of finding medically valuable agents in them is incredible."

Jungle trees of the nutmeg family (*Myristicaceae*) are one example. Schultes has observed that leaves, bark and the blood-red resin of certain of these flowering plants are used by unrelated groups of native Indians in plasters for skin treatment and in washes to clean infected wounds. In addition, these plants are the source of potently hallucinogenic snuff, an oral psychomimetic agent and an arrow poison. "So far only the hallucinogenic properties of these plants have been traced to the presence of constituents of clearly defined structures," says chemist Otto R. Gottlieb of Brazil's University of São Paulo in the JOURNAL OF ETHNOPHARMACOLOGY (Vol. 1, No. 4, 1979).

Gottlieb, who has been analyzing trees of the nutmeg family, now tentatively ascribes the alleged wound-healing power of the plants to chemicals called pterocarpans and neolignans. Some of these compounds have antifungal activity and may become valuable additions to the modern pharmacopoeia. Two other neolignans, from a tree called *Virola surinamensis*, protect the human body against penetration by larvae of a blood fluke that causes schistosomiasis. Gottlieb mentions that these novel neolignans structurally resemble compounds of the Malaysian nutmeg and mace plants, which also figure in folk medicine.

Previous attempts to identify wound-healing compounds of the *Virola* trees failed because dried material was used. Schultes emphasizes the advantage of analyzing fresh material in nearby laboratories and of using chemical techniques for which only a few leaves collected from inaccessible plants may suffice.

"Man in primitive societies has lived for millennia in close association with his ambient vegetation and has, through trial and error, discovered many unusual properties of the plants in his environment," Schultes says. "It is urgent that we try to learn as much as possible from him before the relentless advance of acculturation or extinction of races forever obliterates his knowledge of natural organisms and their peculiar properties." □

Heredity: Genes or experiences?

The notion that maternal experiences can be passed on vertically to one's offspring is off the mark, to say the least, since it seems on the surface to support the unpopular theory of Russian scientist Trofim Lysenko. Lysenko argued, contrary to 20th century genetic dogma, that heredity is the result of environmentally induced changes assimilated during the course of preceding generations rather than the result of transmission of genetic material according to Mendelian laws. But during the past few years some evidence has surfaced that seems to support vertical transmission of maternal experiences. And now still more evidence for such transmission is reported in the June 6 SCIENCE by Neil J. Skolnick, Sigurd H. Ackerman, Myron A. Hofer and Herbert Weiner of Albert Einstein College of Medicine.

In 1975 the scientists found that 10 to 20 percent of rat pups normally separated (21 days after birth) from their mothers will develop ulcers when placed under restraint, but a much larger percentage of rat pups prematurely separated (14 days after birth) will develop ulcers. Then the researchers undertook another experiment to see whether prematurely separated female rat pups could pass on ulcer susceptibility to their own normally separated offspring. First, a female rat pup was separated prematurely from its mother, and another female rat was removed at the normal time. Both were allowed to grow undisturbed to maturity and were then mated. Half of each female's litter was then separated either normally or prematurely from its mother, forming four groups of animals. All four groups were then restrained, sacrificed and examined for ulcers by an experimenter who was unaware of the origin of each group.

As Skolnick and his co-workers report, the two groups of rat progeny prematurely separated from their mothers had a high incidence of ulcers (around 80 percent) whether or not their mothers had been prematurely separated. Of prime interest to the investigators, however, was the finding that only 19 percent of the normally separated rats from normally separated mothers had ulcers, while 64 percent of normally separated progeny from prematurely separated mothers had ulcers — a highly significant difference statistically. The researchers concluded that "a prematurely separated rat mother transmits her acquired restraint-induced gastric erosion [ulcer] susceptibility vertically to her normally separated offspring."

Skolnick and his colleagues then conducted another experiment to see whether vertical transmission of ulcer susceptibility occurs postnatally or prenatally. Four female rat pups (two prematurely separated and two normally separated) were

reared undisturbed and then mated. After their litters were born, the prematurely separated and normally separated mothers were switched so that each litter had a foster mother with a different separation experience. Each litter was separated at normal time (day 21) from its foster mother, restrained, sacrificed and examined for ulcers. The incidence of ulcers in rats born to normally separated mothers but reared by prematurely separated mothers was only 24 percent, whereas the incidence in rats born to prematurely separated mothers but reared by normally separated ones was 66 percent — a highly significant difference. Thus, "increased restraint-induced gastric erosion susceptibility associated with premature separation is transmitted to the first generation of female rats by prenatal factors," the researchers concluded.

But what prenatal factor might transmit increased ulcer susceptibility? As Skolnick told SCIENCE NEWS, "It is really hard to speculate." Do the findings support Lysenko's theory? "I wouldn't say that," he replied. But he pointed out that the theory "hasn't been totally discredited" and that it is possible that inheritance might be passed on not only through genes but through some other, as yet undiscovered ways as well. □

Drug lag or no drug lag?

The title says it all: "FDA Drug Approval — a Lengthy Process that delays the Availability of Important New Drugs." The just-released General Accounting Office report says approval of an important drug takes 20 months, which is far longer than drug approval times in Canada, Switzerland or the United Kingdom. "The lengthy approval process delays the benefits important drugs can provide to the public," the report says.

The drug approval process must balance speed with protection, counters the Food and Drug Administration. In commentary on the GAO report, The Department of Health and Human Services says the GAO did not consider adequate scientific testing of new drugs, therapeutic needs of patients and property rights of drug manufacturers. The GAO contends, however, that the focus of its report was on the means by which test results and other application information are reviewed and processed.

"The FDA is strangling in its own bureaucratic bog," says Rep. James H. Scheuer (D-N.Y.), a member of the Subcommittee on Science, Research and Technology, the group that requested the GAO report. Scheuer told reporters that the FDA's problem has two components. One is the attitude of FDA employees who are reluctant to approve drugs. The second is poor work management. "It is simply pitiful and absurd that a drug can be delayed for four months or more while chemists' evaluations of New Drug [Applications] and letters to manufacturers are waiting to be typed and sent. Meanwhile the sick suffer and die," Scheuer says.

The FDA has already initiated a program of changes that are intended to reduce the approval time for important drugs by 25 percent over a three-year period. The GAO points out that even if the program is successful, drug approval will still take about 15 months.

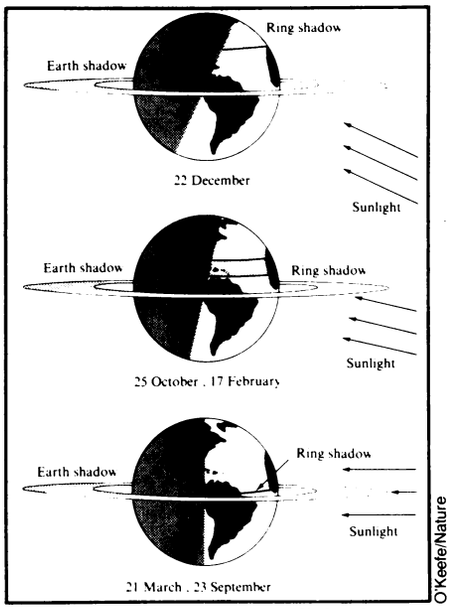
The GAO and FDA sharply disagree about the extent of the dreaded lag. According to the GAO the United States falls years behind other countries in drug approval. The FDA disagrees. "The few significant new drugs that represent major advances in therapy tend to be introduced in most developed countries at roughly the same time," says FDA's Wayne L. Pines. "There is no evidence that the United States lags significantly behind other countries in the introduction of major new medical advances."

The GAO bases its opinion on a list of 14 selected drugs; the FDA provides a catalog of 13 drugs to back up its contention. Each group claims its roster includes the most important recent therapeutic drugs, but only three drugs appear on both lists. The GAO tally goes back to drugs introduced in 1963; the FDA has selected drugs dating from 1972. In addition to the different drugs on the lists, four of the six countries included in the comparison differ. The GAO compares dates of drug introduction into the United States, United Kingdom, Canada, Norway, Sweden and Switzerland. The FDA includes the United States, the United Kingdom, Germany, France, Italy and Japan.

No drugs on the GAO list were introduced first in the United States, and only two were introduced here the same year as their earliest availability elsewhere in the sample. The rest became available here one to twelve years later. In contrast, on the FDA list seven drugs were introduced in the United States first or in the same year as their earliest use in any country examined and all but one were introduced within two years. "The isolated examples cited [by the GAO] of drugs available in Europe but not in the United States are not evidence of anything except the known phenomenon that different countries often have different drugs," says HHS.

The GAO report makes several specific recommendations to speed up the FDA, including use of expert committees and paraprofessionals, clarification of policy on acceptance of foreign data and development of a program for post-marketing surveillance of new drugs. The FDA points out, however, that many of these recommendations already are in pending legislation. □

Ring around earth terminates Eocene



O'Keefe/Nature

As the angle of incoming sunlight changes with the seasons, the ring's shadow moves, making winter hemisphere colder.

It had to happen. For a long time the rings of Saturn were unique in the solar system. Then other major planets began to exhibit rings, as sharper observations became possible. Now there is a suggestion that there may once have been rings around the earth.

The suggestion comes from John A. O'Keefe of the NASA Goddard Space Flight Center in Greenbelt, Md., and appears in the May 28 NATURE. O'Keefe starts with the "terminal Eocene event," a catastrophe that occurred about 34 million years ago. Winters became much colder (although summer temperature was not much affected), and there was a widespread extinction of the small animals called radiolaria. Dust in space could have shadowed the earth to produce the climate change, O'Keefe points out.

The date of the terminal Eocene event coincides with the age of the North American strewn field, the largest field of tektites. Tektites are small bits of glass that are found scattered over wide regions of the surface of the earth. It is usually assumed that tektites fell from space. The instantaneous production of so much homogeneous glass out of common rock and soil over such an area — the "North American field" runs from the Caribbean to the Indian Ocean—is hard to imagine. A single distant source, a volcanic blast on the moon perhaps, would be better. Part of a spray of debris from such an event would hit the earth, O'Keefe suggests, but part would miss and go into orbit. That part would settle into a ring, and the dynamics are such that it might have lasted a few million years. □