American
Association for the
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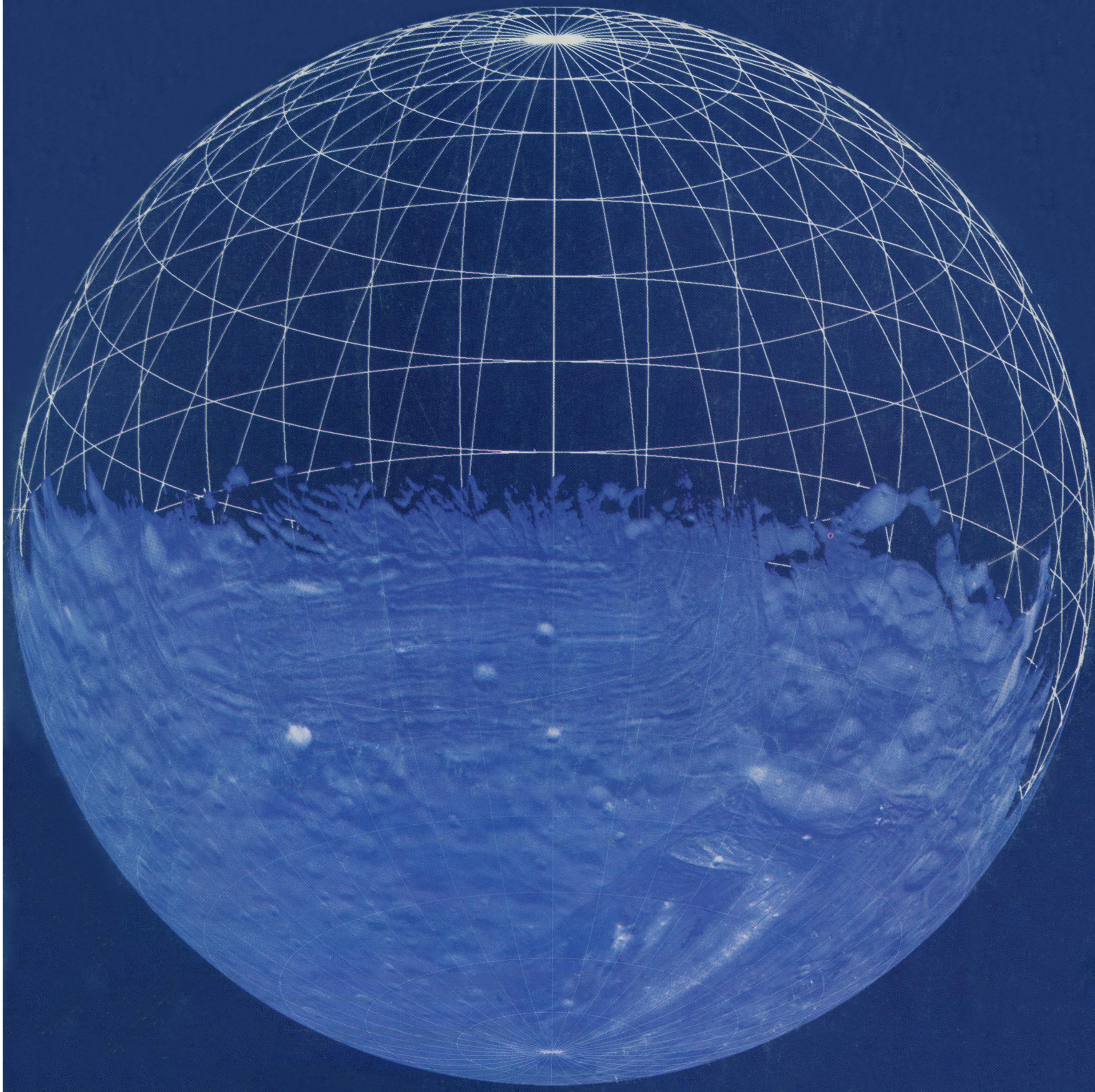
Science

VOYAGER 2

4 July 1986 $2.50
Vol. 233 ▪ Pages 1–132



Miles Diagnostics
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Dear Customer:

In order to continue the best possible service, we wish to assist you in understanding recent events relating to the Pentex® blood proteins.

Recently, the biochemical segment of Miles Scientific Division was sold to ICN Pharmaceuticals. At the same time, an agreement was entered for ICN to distribute the small pack sizes of the Pentex blood proteins used in research. The purpose of this letter is to clarify purchasing since some confusion appears to have resulted from these changes. Bulk proteins intended for process/product engineering, establishment of performance specifications, or trial manufacturing should be ordered directly from Miles in Kankakee. This may be done by either telephone or telex:

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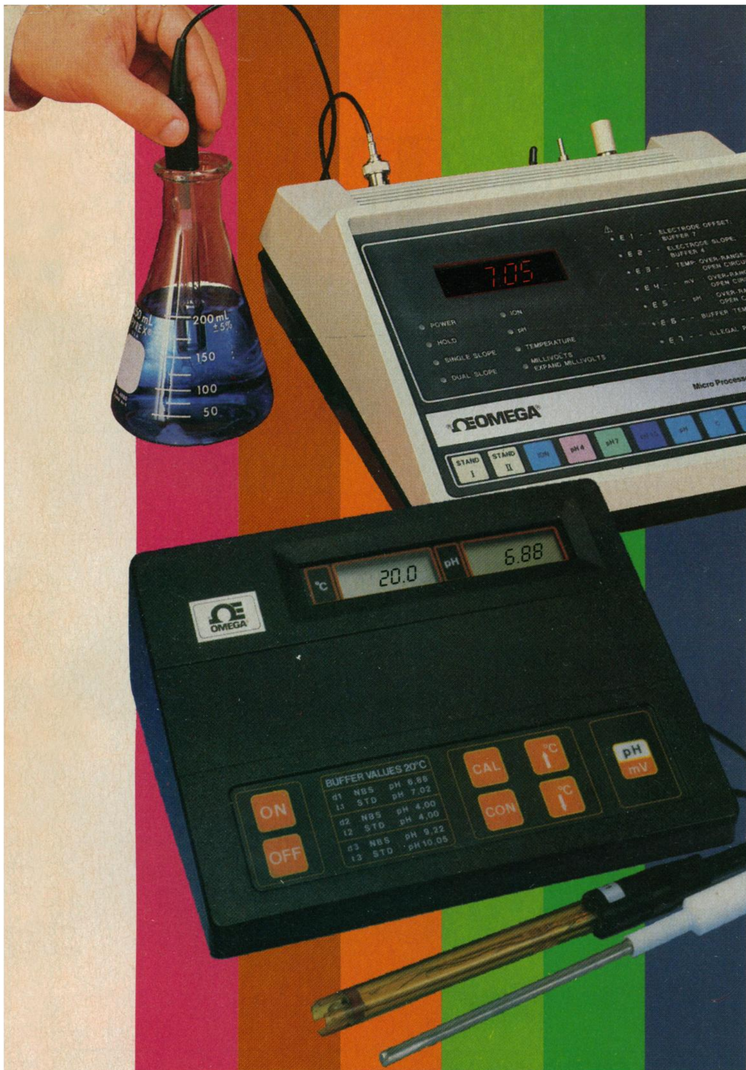
These same blood proteins are sold in large, or bulk, quantities to manufacturers and industrial users. This segment of the market will continue to be handled directly by Miles. The only change which has occurred with respect to these bulk products is that distribution and invoicing are now from Kankakee instead of Naperville, IL. We expect this change will improve order turnaround and technical service support since Pentex blood proteins will continue to be manufactured at Kankakee.

It continues to be Miles' policy to support top quality products with the same quality service. Thus, we look forward to continuing as your supplier of these Pentex products.

Yours very truly,

E. Dickinson
Pentex® Products

/jmr



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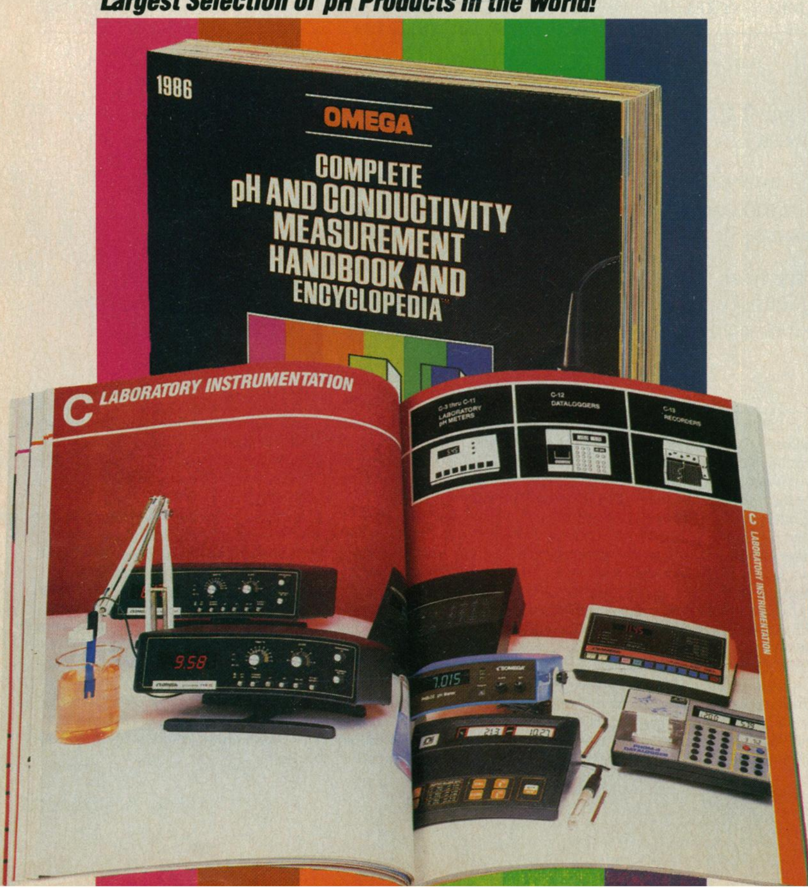

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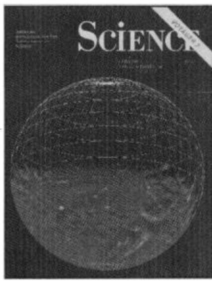
AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

ISSN 0036-8075
4 JULY 1986
VOLUME 233
NUMBER 4759

■ **SCIENCE is published weekly on Friday, except the last week in December, and with a plus issue in May by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005.** Second-class postage (publication No. 484460) paid at Washington, DC, and at an additional entry. Now combined with **The Scientific Monthly®** Copyright © 1986 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): $65. Domestic institutional subscription (51 issues): $98. Foreign postage extra: Canada $24, other (surface mail) $27, air-surface via Amsterdam $65. First class, airmail, school-year, and student rates on request. Single copies $2.50 ($3 by mail); back issues $4 ($4.50 by mail); Biotechnology issue, $5.50 ($6 by mail); classroom rates on request; Guide to Biotechnology Products and Instruments $16 ($17 by mail). **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of $1 per copy plus $0.10 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 $1 + .10. **Postmaster:** Send Form 3579 to *Science*, 1333 H Street, NW, Washington, DC 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

■ The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.



COVER Miranda, Uranus' innermost major satellite. This view was assembled from nine images returned during Voyager 2's close pass in January 1986. The images were acquired from widely different viewing stations due to the closeness of pass and high velocity of the spacecraft. In this view of the 490-kilometer satellite, the equator and terminator are almost coincident because the sun shines nearly on the south pole. Miranda's trailing hemisphere is in the center of the view as the satellite moves directly away from us in its orbit. See page 39. [Members of Planetary Cartography Group of the U.S. Geological Survey, Flagstaff, AZ, assembled this computer mosaic and rotated it to this perspective]

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This Week in SCIENCE

Voyager's voyage

THIS week's special issue documents another stunning tour de force for the Voyager 2 spacecraft that in January had its close encounter with Uranus (pages 39–109). Voyager left Earth to visit the outer planets on 20 August 1977, carrying an array of scientific equipment. (Each report in this issue describes results obtained with one instrument.) Flybys of Jupiter in 1979, Saturn in 1981, and Uranus in 1986 have provided information about each of these planetary systems as well as about the evolution of the whole solar system. Comparisons have been made among the outer planets and between them and the terrestrial planets. This mission has been remarkable: after 9 years in space and after traveling 3 billion kilometers from Earth, all the Voyager instruments are functioning well, little or no recalibration has been needed, and resolution is excellent. Voyager 2 is now headed away from Uranus toward Neptune for a flyby in 1989. It will eventually pass through the orbit of Pluto (but not close to the planet) and then will continue out beyond the solar system, transmitting data back to Earth until the solar batteries that power the instruments stop working.

Magnetosphere of Uranus

STUDIES of magnetospheres—the regions in which planetary magnetic fields govern local physical processes—are key objectives of planetary exploration. Uranus was found by Voyager 2 to have an unusual magnetic field tilted 60° from the planet's axis of rotation (as though something hit Uranus early in its evolution and knocked it out of alignment). Uranus' major rings and moons orbit within the magnetosphere. Like Earth, Uranus also has a rotating magnetotail, swept back to the nightside of the planet by the solar wind. The field, with its unusual and exotic geometry, may be generated by a dynamo deep within the planet.

Rings of Uranus

NINE rings—called 6 (closest), 5, 4, α, β, η, γ, δ, and ϵ—were detected around Uranus in 1977. The Voyager 2 mission identified two more, one between the planet and ring 6 and the other between δ and ϵ. In addition, about 100 new ring-like features were detected interspersed within the main rings. Blocked light from stars that passed behind the rings was used to study ring properties and arrangement. The rings are dark and large and consist of collections of well-separated particles. Micrometer-sized dust particles indicate a young age, perhaps 6 million years, for some rings; the planet itself is more than 4 billion years old. Formation of rings may occur when large bodies (such as satellites) fragment; the particles may then be gravitationally confined into rings by "shepherding" satellites (see Research News, p. 27).

Satellites of Uranus

URANUS has 15 moons in orbits beyond the rings—Miranda (cover), Ariel, Umbriel, Titania, Oberon, and ten new ones identified by Voyager 2. All are dark and lack atmospheres. One orbits inside the ϵ ring; the other nine orbit between the rings and Miranda. The two that straddle ϵ may apply torques to the ring particles to keep them from spreading and dispersing. Voyager images show that the Uranian moons are extensively cratered and faulted; their patchwork landscapes suggest that they were disrupted (perhaps when the alignment of the planet was disturbed) and then reassembled haphazardly.

Farming by computer

THE best yield of cotton comes to the farmer who knows exactly when to fertilize and irrigate and when to harvest the crop, which is hidden inside the boll (page 29). Planting and harvesting, the latter involving defoliants and boll openers, have largely been automated in this country; Lemmon describes a system in which decision-making has also been automated. The cotton management expert (Comax) system, a computer program that works at the level of a human expert, advises the farmer on crop management. It works in conjunction with a computer model (Gossym) in which the growth of the plant is simulated. With data collected by sensors at the farm on soil, water, and weather conditions, Comax and Gossym compute what irrigation, fertilization, and other treatments should be used to optimize the growth of the crop; the exact time of crop maturation can also be projected. In the first application of the system to a working 6000-acre farm, the economic yield was improved by $60 per acre. Such an increase may make even the most traditional farmer cotton to the idea of having a computer as an expert consultant.

Gene activation in photosynthesis

ACTIVATION of plant genes associated with photosynthesis requires light, developed plastids, and undefined tissue-specific factors (page 34). Simpson *et al.* assessed how such factors turn on genes associated with photosynthesis by using genetic chimeras; each chimera was constructed from two genes, one that encodes the detectable enzyme neomycin phosphotransferase II [NPT(II)] and a second (genes named *rbcS* and *LHCP* were used) involved in regulating photosynthesis. NPT(II) was only produced upon activation of the promoters of *rbcS* or *LHCP*, and expression was highest in cells of mesophyll tissue. For each chimera, organ-specific expression was demonstrated through evaluation of gene activation in leaves, stems, sepals, roots, petals, stigmas, anthers, and seeds; the pattern of tissue specificity differed for the two chimeras. Furthermore, each chimera interacted with different photoreceptors, indicating additional complexities in the regulation of the photosynthetic process.

SCIENCE

4 JULY 1986
VOLUME 233
NUMBER 4759

Changing Times

At a time of financial stress brought about by a declining agricultural economy, reduced world prices for oil and gas, reduced demand for coal, and increased imports from abroad, the taxable incomes from many farm and energy-producing states would seem inadequate to keep pace with pre-1985 expenditures for science and related activities. The states most dramatically affected are those in the deep South, the northern plains and Rocky Mountains, and a few in the northeastern and central portions of the United States. On top of the economic plight, many of these states have not been very competitive in acquiring research funds from federal sources. One study showed, for instance, that the top ten states received 66 percent of federal research funds, whereas the bottom ten received 1.5 percent.

Some may argue that only a few states should be funded to carry the entire burden of this nation's research effort. On the other hand, it seems that a more broadly based scientific enterprise might provide some of the answers needed to cope with troubled economic times. Such activity could help encourage new businesses or help old ones find novel products.

To some extent, steps to cope with this problem are already being taken by the National Science Foundation. In 1980 an experimental program to stimulate competitive research (EPSCoR) was established. At that time, Arkansas, Maine, Montana, South Carolina, and West Virginia were selected from seven competitors to receive funding at a level of \$500,000 to \$600,000 per year each for 5 years with comparable local matching funds.

These modest sums of federal money had large catalytic effects. The advice of U.S. senators and representatives was sought, and presidents of the state universities participated as did members of the university faculties. Influential people from industry and in the legislatures had roles on advisory committees active in each state. Additional local funds were pledged. Out of much consultation, many research proposals emerged. These were evaluated by a large number of expert reviewers situated in other states. In addition, outsiders made project site visits. The best proposals were identified and supported.

The result of having EPSCoR in Montana, South Carolina, Arkansas, and other states has been a notable increase in the success of independent proposals submitted to NSF, the National Institutes of Health, and other agencies. Just as important has been the maintenance of research committees that have played critical roles in helping with the development of state science and technology alliances. These alliances have funded university–industry-related research. Project peer review at a national and international level has resided with the state EPSCoR programs.

Realizing the benefits of EPSCoR, in 1985 Congress supported NSF in expanding the program to 11 more states and Puerto Rico. In spite of difficult economic times, the states, realizing the value of the EPSCoR program, have allocated matching commitments that exceed NSF dollars two- to sixfold. Few other federally sponsored research programs can say as much. In addition, in many states, the working relationship established between industry, government, and the university is a novel event—one that is needed and one that should be encouraged.

However, some additional things would help. The people in the poorer states need the assistance of scientists in other states to (i) help with peer review of projects, (ii) participate as research collaborators, and (iii) visit the states and establish rapport with scientists in them. As a nation we sometimes seem more willing to help foreign governments with their science than those comparable enterprises in our own third world states.

For the benefit of the nation, NSF should continue its involvement with EPSCoR, and Congress should encourage the development of comparable EPSCoR programs in agriculture, commerce, energy, environment, and defense. Federal agencies and organizations including the National Academy of Sciences need to be encouraged to have participants from a broader number of states on their panels, committees, and boards.

Times are definitely changing, and the way in which science is funded, administered, and utilized needs to be closely examined especially as it relates to many of the states and territories of this nation.—GARY A. STROBEL, R. G. Gray Professor and Director, MONTS, Montana State University, Bozeman, MT 59717