American Association for the Advancement of Science

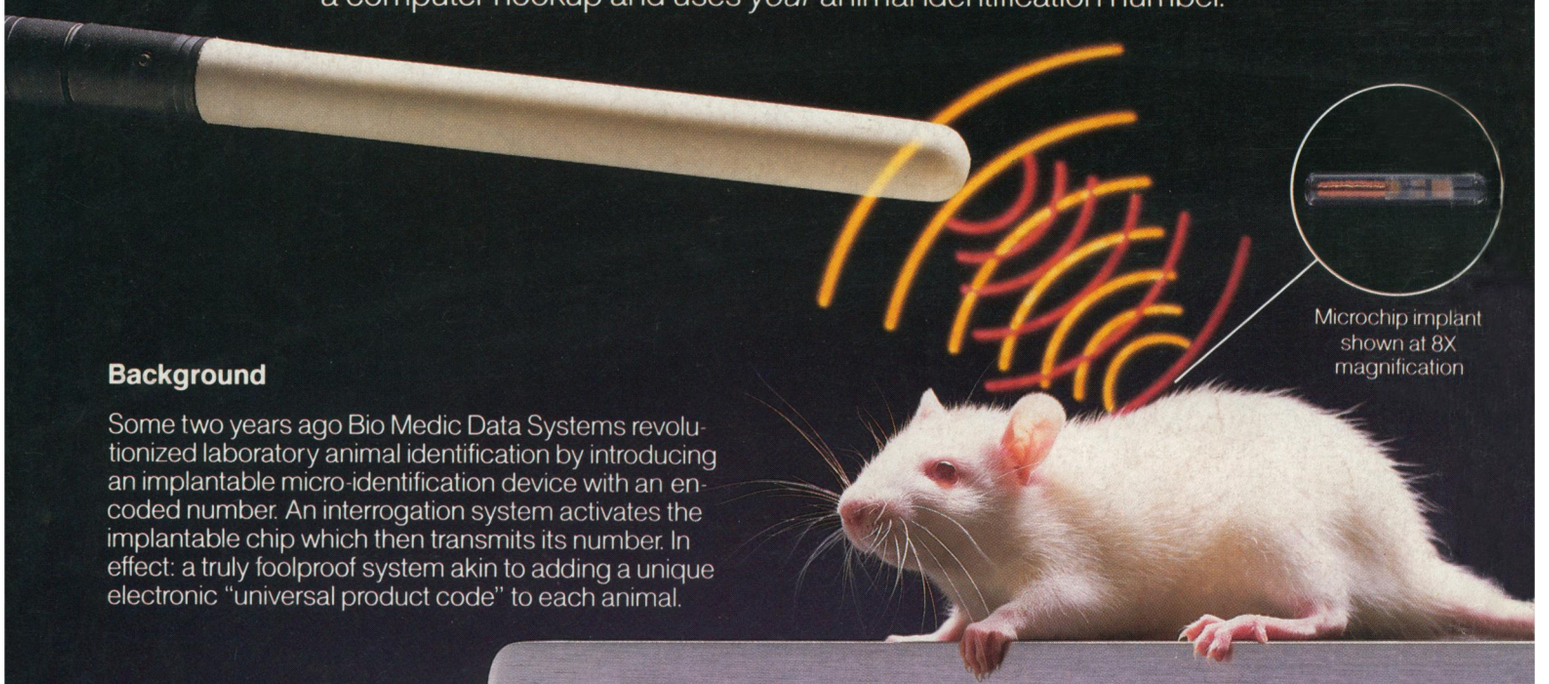
# SCIENCE

15 December 1989 $3.50
Vol. 246 ■ Pages 1361–1532

Voyager 2

# ANNOUNCING THE DAWN OF A NEW ERA IN LABORATORY ANIMAL IDENTIFICATION

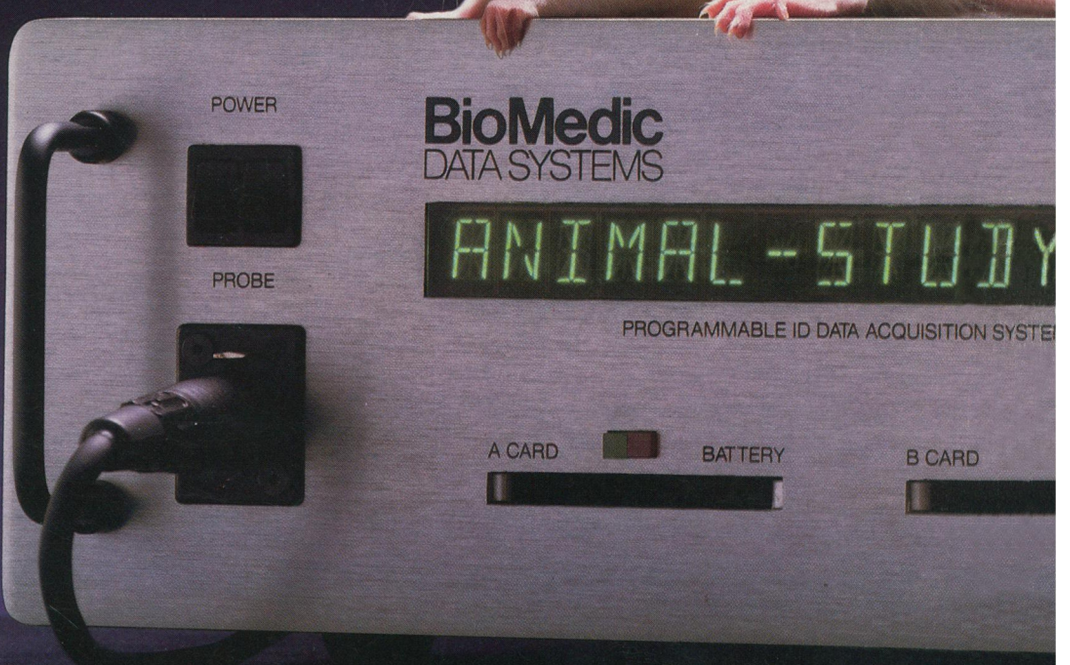
Simplicity itself: a programmable stand-alone system that doesn't require a computer hookup and uses *your* animal identification number.



Microchip implant shown at 8X magnification

## Background

Some two years ago Bio Medic Data Systems revolutionized laboratory animal identification by introducing an implantable micro-identification device with an encoded number. An interrogation system activates the implantable chip which then transmits its number. In effect: a truly foolproof system akin to adding a unique electronic "universal product code" to each animal.




## What are the Benefits?

This simple system obsoletes the traditional ear punching or tagging, toe clipping, and tail tattooing. As such, the age-old labor intensive techniques—in terms of the initial identification, the subsequent reading, and the inevitable re-dos—are replaced by a simple, easy, humane and remarkably efficient system. (A dramatic example: 200 animals can be identified in about 45 minutes.)

In addition: the imprecision of the conventional methods is replaced by *positive animal identification.* Animal misidentification or infection can indeed by catastrophic should they delay, impede, or destroy a crucial investigation. This simple foolproof system now converts ear punching or tagging, toe clipping, and tail tattooing into unacceptable risks ... and who needs that when a positive animal identification system is now available!

## What about Tissue Response?

As a result of a 105-week subchronic evaluation in rats and mice, there have been:

- no significant effects on normal body weights.
- no palpable masses observed.
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## Announcing the Dawn of a New Era in Laboratory Animal Identification

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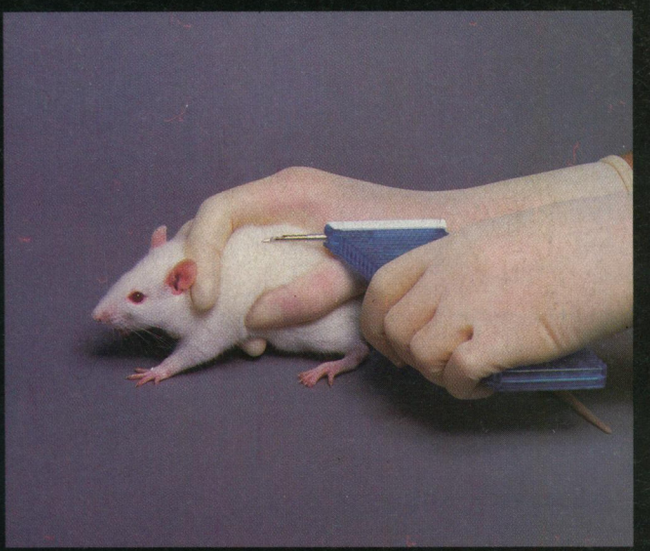

Microchip is subcutaneously injected into the animal.

## What about GLP Compliance?

ELAMS™ meets and exceeds the GLP guidelines providing a positive animal identification method that is cost effective and accurate.


## To Learn More about the ELAMS™

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## Who is Using Bio Medic Data Systems' Implantable Micro Identification (IMI™)?

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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COVER Six days after Voyager's historic encounter, Triton's orbit brought it around once again in line with Neptune. The crescent image of Triton is seen here just as it began to pass in front of the crescent of Neptune. Because scattering by high-altitude aerosols is enhanced at large phase angles, the characteristic blue color of Neptune's atmosphere is suppressed. This picture was taken by Voyager 2 on 31 August 1989. See page 1422. [Photo courtesy of Brad Smith, University of Arizona, Tucson, AZ 85721]

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## Bon Voyage(r)

ALTHOUGH the Grand Tour of the solar system for the two Voyager spacecraft is now over, as long as all systems remain "go" Voyager 1 and Voyager 2 could continue to transmit data back to Earth for another 25 years; both are currently cruising through interstellar space, examining charged particles, magnetic fields, and solar and interstellar wind fields. The Voyager program has been astronomically successful both figuratively and literally. Both spacecraft were launched in 1977: Voyager 2 left Earth on 20 August and Voyager 1 left on 5 September. That same year, both explored the Jupiter system, although they arrived at Jupiter several months apart; encounters with the Saturn system took place in 1980 for Voyager 1 and 1981 for Voyager 2. From Saturn, Voyager 1 headed off into interstellar space. Voyager 2 was boosted by Saturn's gravitational force toward Uranus for its 1986 flyby. From there it was deflected toward the Neptune system which it observed for several months before and after its closest encounter last August. What did Voyager 2 discover at Neptune and Triton? Plenty. Eighty-five pages of pictures, data, and analysis fill this issue of *Science* (beginning on page 1417), and Abelson's editorial draws together many of the most significant findings (page 1369). Further scrutiny of the Neptune data and further comparisons of these data with data obtained at the other planets should strengthen and improve our understanding of the structure, formation, and evolution of the solar system.

## The crack epidemic

THE year 1985 was a year when cocaine prices plummeted; the year also marked the emergence of a major crack epidemic in the United States. (Crack is a smokeable and rapidly addictive form of cocaine.) This was not the first big cocaine epidemic that the United States had experienced; in 1915, federal antinarcotics legislation was enacted in response to growing abuse of legal cocaine. Holden tells the story of the social and biological research on cocaine and crack in four articles that begin on page 1376. She provides profiles of the street anthropologists and sociologists who are intimately involved in studying the lives of crack addicts in New York, endeavoring to discover just what behaviors and patterns characterize addicts and their communities and what life is like for these individuals. Many addicts spend much of their time hustling for crack because although crack provides an intense and immediate "high" the euphoria of a pipeful lasts only 30 minutes. How does cocaine affect the brain and why is crack so much more potent and so much more rapidly addictive than other known drugs? The biochemical and molecular mechanisms behind the powerful actions of cocaine are becoming increasingly clear, but so far no pharmacologic treatment for cocaine addiction has been discovered although a number of possibilities are under evaluation. How the U.S. government's deputy drug czar is addressing the tasks of crack treatment, prevention, and research is also discussed.

## Tumor suppressor genes

PROOF that tumor suppressor genes exist has been difficult because such genes have a "negative phenotype": they prevent tumors from arising, and it is only after they are inactivated and solid tumors start to grow that their part in inhibiting such growth is noticeable (page 1406). In a review article, Sager discusses recent research on tumor suppressor genes and describes what is now known about these genes. Tumor suppressor genes are believed to have an influence on a number of normal processes that take place inside cells and between cells. Among the processes that may be affected by them are control of cell proliferation, cell-to-cell communication, immune surveillance, angiogenesis, and others. When the tumor suppressor genes become dysfunctional, tumors—including retinoblastomas, Wilms' tumors, colorectal cancers, lung cancers, and breast cancers—can emerge. Each type of tumor is associated with the loss of some number of distinct tumor suppressor genes, and some of the same genes may figure in the development of more than one type of cancer. Cancer can thus be viewed as a "genomic disease" that results from an accumulation of mutations, gene losses, and gene rearrangements. The tumor suppressor genes appear to be one of nature's successful approaches to protection against cancer; thus, they may be a rich resource for clinical anticancer therapies.

## Differentiation factors

FOR many years the only well-characterized factor that had an effect on the differentiation of cells in the nervous system was nerve growth factor. Now two others that are present in vivo in low amounts have been produced in large amounts and sequenced, making possible an assessment of their biologic effects. Yamamori *et al.* studied rat heart cell cholinergic neuronal differentiation factor (CNDF), a substance that affects the phenotype of neurons by inducing the synthesis of one type of neurotransmitter and suppressing synthesis of others; this substance is not a neurotrophic factor because it does not affect the survival or the growth of neurons. The sequence of CNDF proved to be identical to that of leukemia inhibitory factor (LIF), and, in cultures with neurons, both proteins induced the same biologic activities. Because LIF and other so-called cytokines regulate differentiation in a range of different tissues of embryos and adults, it is unclear how the specificity of differentiation is conferred to cells in different lineages. Perhaps some additional factors, such as localized production and activation, come into play. In the 24 November issue of *Science*, the purification, cloning, and expression of rabbit ciliary neurotrophic factor (CNTF) from sciatic nerves were described by Lin *et al.* (page 1023). This protein showed no significant sequence homology with any other protein that has so far been characterized.

■ RUTH LEVY GUYER

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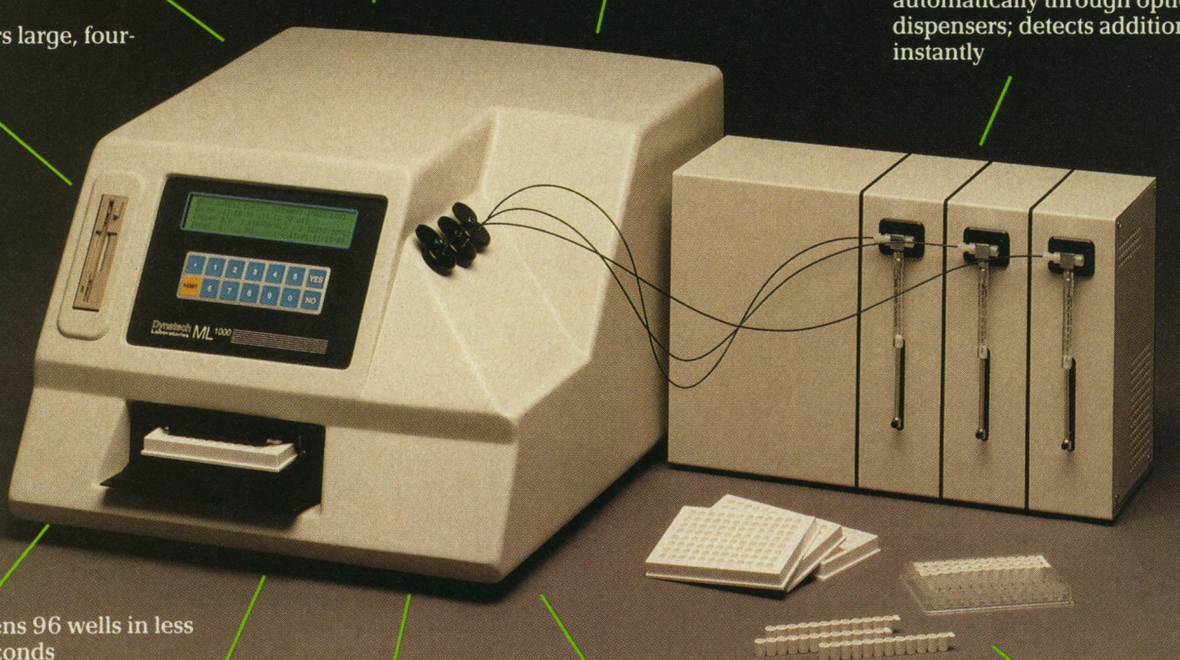


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# Voyager 2 at Neptune and Triton

In this issue of *Science* investigators who participated in a great era of planetary exploration present results of their observations of Neptune and its related bodies. Many of the authors devoted parts of 17 years or more to designing and fabricating instruments and to subsequent observations, data reduction, and interpretation. The teams participated in exploitation of an opportunity that occurs only once in 176 years when a unique alignment of the outer major planets makes feasible a robotic visit to them. Voyagers 1 and 2 were propelled into space in 1977. Subsequently both visited Jupiter and Saturn. Voyager 2 went on to Uranus and Neptune. After each planetary encounter, *Science* published the first scientific reports of results obtained from 11 different instrument packages. It is a great testimonial to the skill of the scientists and engineers involved that the instrumentation survived 12 years in the harsh environment of space.

In the course of encountering the Neptune system, some 9000 images were obtained. Observations were conducted in the visible, infrared, and ultraviolet as well as at centimeter wavelengths. The magnetic field was probed, plasmas were studied, energetic particles were measured, and radio emissions from Neptune were noted.

In many instances the various instruments independently produced results that confirmed the validity of the findings or extended the range of observations. As a result, it was possible, for example, to study the atmosphere of Neptune over a range of pressures of more than $10^{12}$. The upper regions of the atmosphere consist mainly of atomic and molecular hydrogen, together with about 0.15 mole fraction helium. The lower regions contain about a $3 \times 10^{-5}$ mole fraction of methane and about $10^{-7}$ mole fraction of $C_2H_2$. Effective temperature at $10^5$ Pa (which corresponds to 1 bar) is 59.3 K. Internal heat sources in Neptune contribute 2.7 times more energy to thermal emissions than does solar power. The density of Neptune is 1.6. Presumably that means that it has a core of chondritic composition that is heated by radioactivity. Most of the mass of Neptune is probably $H_2O$ in various forms. The internal heat moves to the surface in a nonisotropic fashion. This leads to great surficial activity and high winds.

Neptune's magnetic field has an intensity of the same order of magnitude as that of Earth. However, the field can be represented as a dipole displaced far from the center of Neptune and inclined by 47° with respect to the rotation axis. Neptune also emits radio signals that disclose that it rotates with a period of 16.11 hours.

During the Neptune encounter Voyager 2 instruments detected six new satellites—chunks of dark rock 50 to 200 km in size.

Triton is a most interesting object. It is the one large moon in the solar system that orbits in a retrograde direction. Its orbital plane is tilted 20° to that of Neptune. Triton apparently was captured by Neptune billions of years after the solar system was formed. Triton's surface is not pock-marked with many impact craters. The density of Triton is about 2.08, indicating a substantial rocky core. The atmosphere, consisting mainly of nitrogen, has a pressure only about $10^{-5}$ that of Earth. The surface apparently consists largely of water ice covered by solid nitrogen, which highly reflects sunlight. Surface temperature is 38 K. A small amount of methane present in the atmosphere is photodegraded to form $C_2H_2$ and other hydrocarbons. The hydrogen escapes.

After Triton initially was captured by Neptune, tidal evolution probably produced significant heating and melting. On Triton, local topographic features include cliffs, ridges, pits, and craters with relief commonly exceeding 1 km. This implies a rigid material that will not flow at temperatures of 40 to 50 K during billions of years. Water ice almost uniquely represents the substance that satisfies the boundary conditions. Terraces on Triton are features that fit in with a picture of tidal melting and $H_2O$.

In spite of its 38 K surface temperature, Triton displays geyser-like activity. This was noted at the south polar region, which currently faces the sun. Presumably solar radiation penetrated into the solid nitrogen, causing greatly enhanced pressure and an eruption that carried any opaque material up to 8 km above the surface.

The Voyager program was a great success. We owe the teams that participated admiration and gratitude.—PHILIP H. ABELSON

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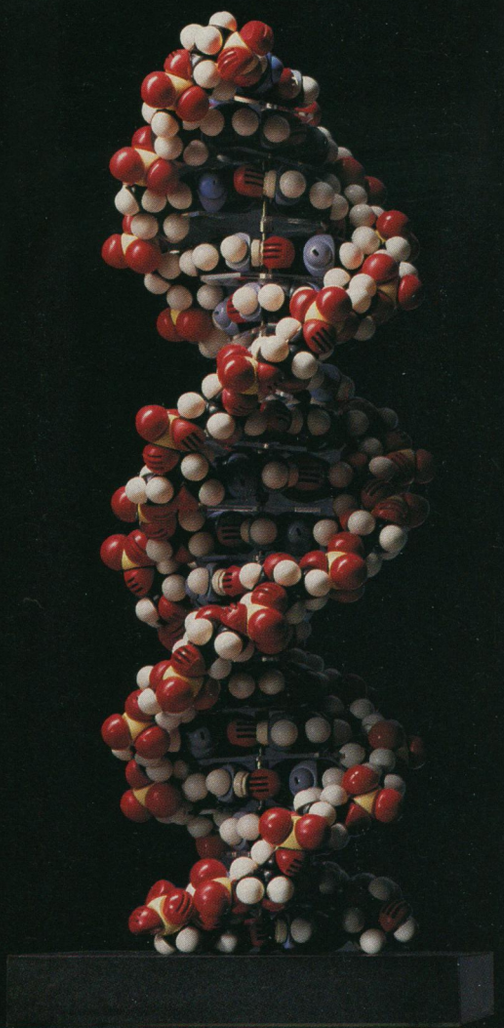

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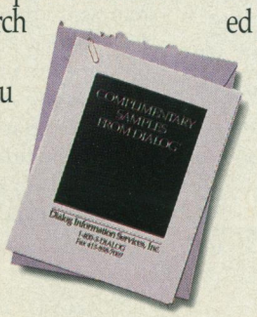


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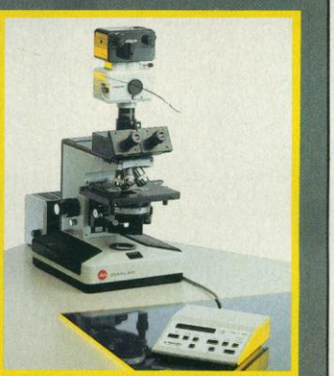

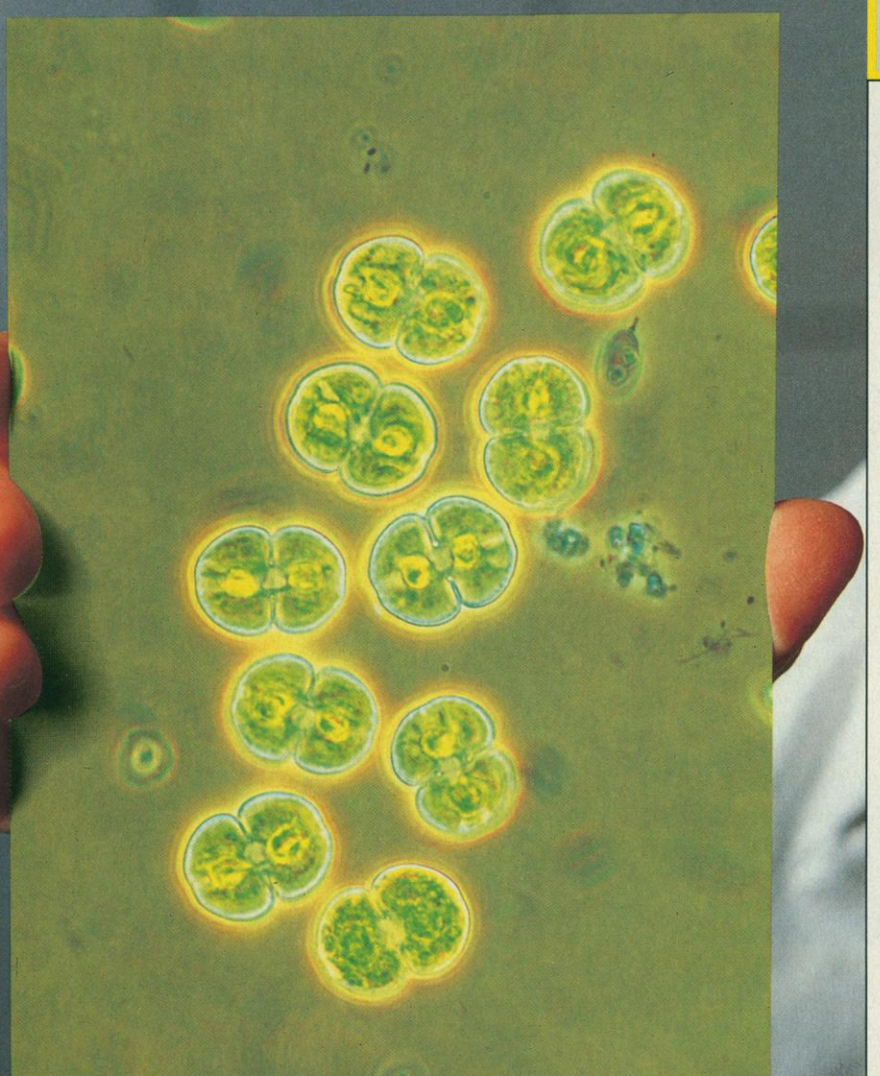

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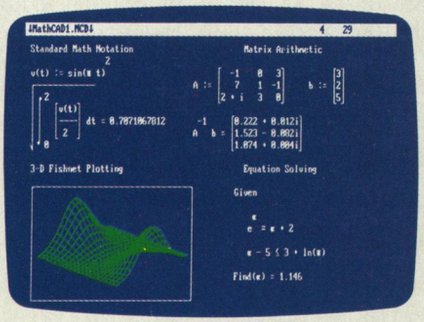


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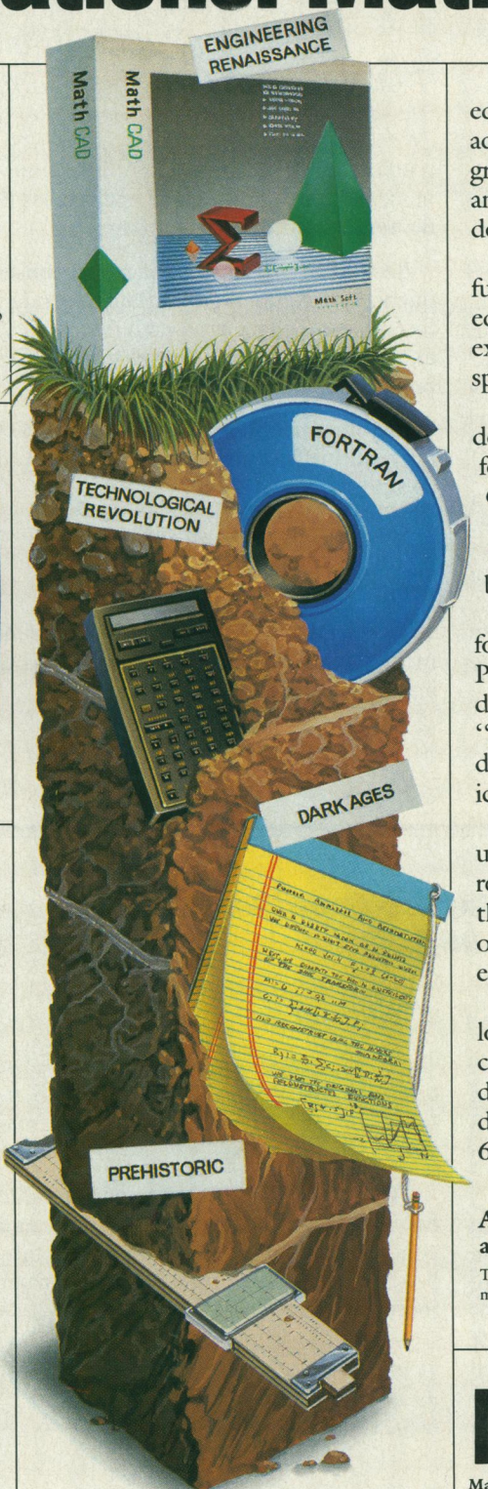


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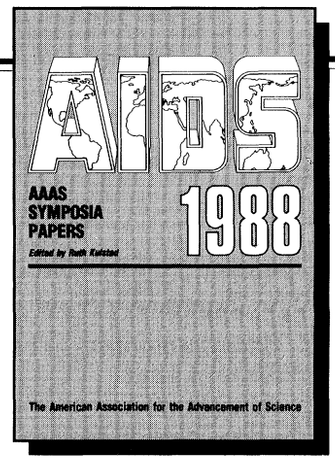
# AIDS

Books from AAAS




## *AIDS 1988: AAAS Symposia Papers*

*Edited by Ruth Kulstad*
*Foreword by C. Everett Koop*

This volume contains many of the groundbreaking papers on AIDS presented at the 1988 AAAS Annual Meeting.

The wide variety of the papers presented here reflects the current thinking about AIDS research today—that control over the AIDS epidemic must be achieved through a collaborative, multi-disciplinary effort that includes not only the medical and biological sciences, but the social and behavioral sciences as well.

This fully indexed volume is organized into five major sections: The first explores the epidemiology and natural history of AIDS and the HIV infection both in the United States and internationally. It also looks at the difficulty of predicting the course of the virus—statistical issues; patterns of HIV-1 incubation, infectiousness, and transmission; and approaches to demographic impact modeling.

Section two discusses the social consequences of AIDS as they relate to gender, intravenous drug users, and public policy, and it examines the dilemmas that AIDS presents to the medical community.

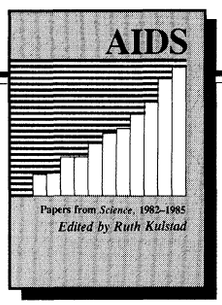
The third section focuses on the AIDS prevention strategies currently employed around the world.

Section four considers the economic, political, ethical and legal issues surrounding the epidemic.

The final section presents several recent medical and biological studies on AIDS and HIV.

***AIDS 1988*** is a timely, authoritative source of information on the growing body of AIDS research being conducted around the world. It is essential for medical, biological, social, and behavioral scientists, and for everyone who is professionally or personally concerned about the AIDS epidemic.

*1988; 478 pp.; softcover*
*index; 12 appendices*
***#88-19S** – $29.95 (members $23.95)*




## *AIDS: Papers from Science, 1982-1985*

*Edited by Ruth Kulstad*

This collection includes frequently cited research papers and news reports on AIDS that were published in *Science* between August 1982 and September 1985.

Many of the papers relate directly to AIDS research, while others touch on relevant aspects of the immune system. The news stories help to explain the ongoing research, while focusing on some of the sociological questions raised by the disease. The book is arranged chronologically, enabling the reader to trace the history of the AIDS epidemic through September 1985—a history that is of great sociological interest.

This fully indexed collection is valuable not only for the experimental data and conclusions, but also as an excellent bibliographic reference of AIDS work in major journals worldwide.

*1986; 654 pp.; softcover*
*detailed indexes and illustrations*
***#85-23S** – $19.95 (members $15.95)*

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