American Association for the Advancement of Science

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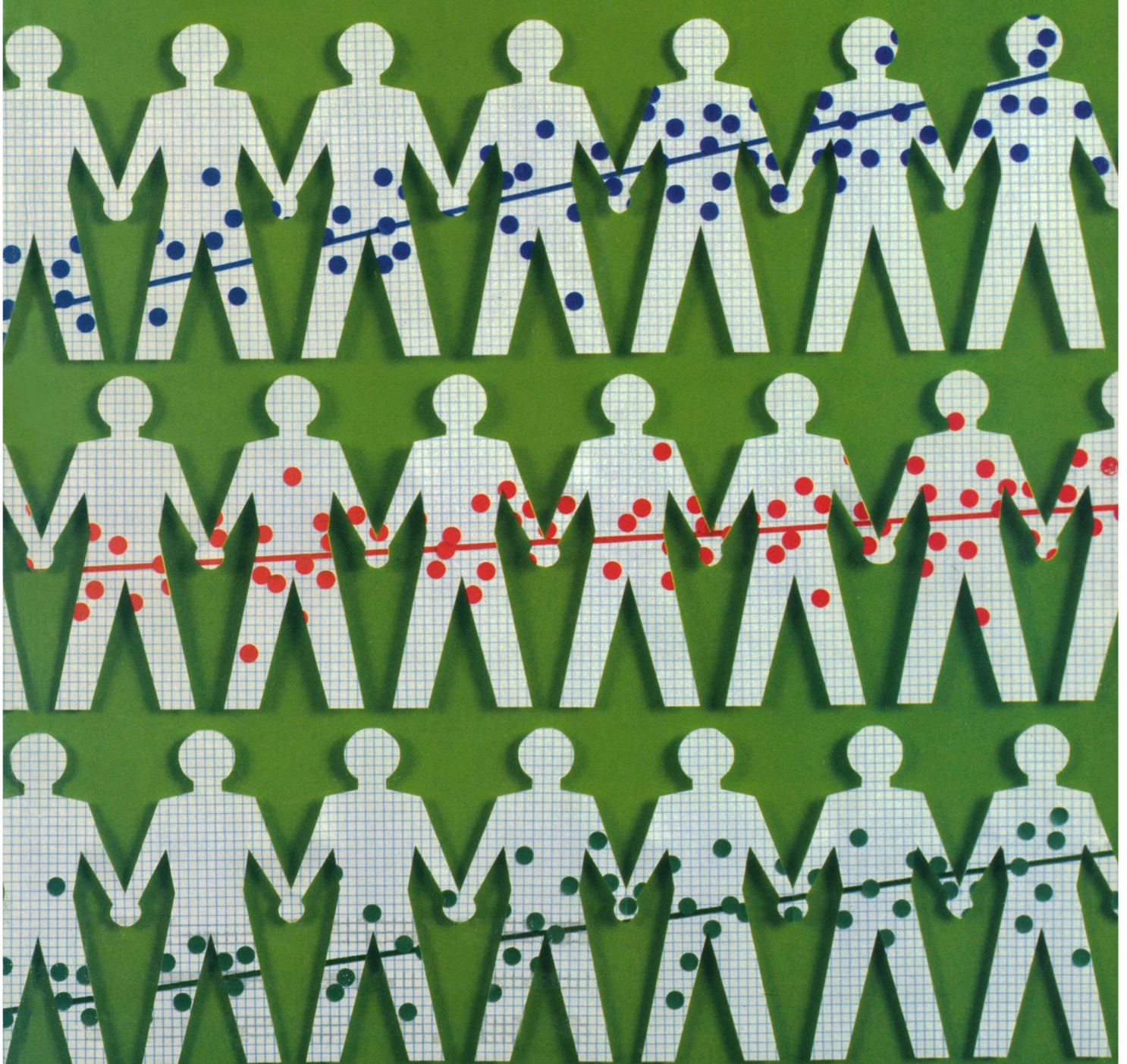

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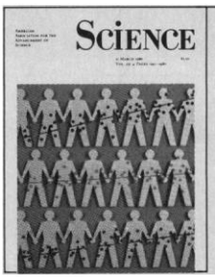
■ The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of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



COVER Epidemiology, a field concerned with understanding health and disease in humans, focuses on health problems in populations rather than in individual patients. Advances in clinical medicine, laboratory science, statistics, and data handling in our basic understanding of the pathogenesis of disease have enabled epidemiologists to better examine causes of disease and to propose more effective strategies for prevention and control. See page 951. [Cover illustration by Alan Kahan, Washington, D.C.; photography by Donna K. Cantor, Washington, D.C.]

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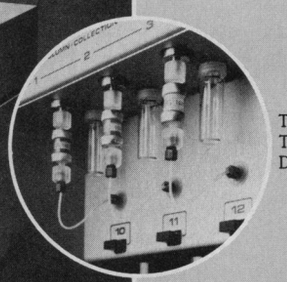

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AIDS epidemic

THE AIDS epidemic is considered the most serious epidemic of the last 50 years (page 955). The disease has been reported in 74 countries, and several million people are thought to be infected with the AIDS virus worldwide. In this special issue on epidemiology (see cover, articles on pages 951–979, and Koshland's editorial, page 921), Quinn *et al.* describe epidemiologic studies carried out in central African countries; the discovery in the early 1980's of Africans with AIDS who were living in Europe suggested that the disease might be endemic in Africa. The earliest evidence for the AIDS virus in Africa was found in serum that had been collected for a hepatitis study in 1959; only in the late 1970's and early 1980's was a marked increase in cases noted. The epidemiologic pattern and the clinical picture are different in Africa from the patterns in the West. Prevention and control of AIDS are costly pursuits that will require a major international effort in developing countries. Some cooperative efforts toward these goals have been initiated by the African Regional Office of the World Health Organization.

Bacterial resistance

PENICILLIN, tetracycline, chloramphenicol, and other antibiotics have been effective for controlling bacterial diseases since the 1940's; however, bacterial strains are emerging at increasing frequencies that are resistant to antibiotics, and epidemics of antibiotic-resistant bacterial infections are becoming more common (page 964). Cohen and Tauxe describe the recent resurgence of diseases caused by resistant strains of *Salmonella*; the problem in some instances has been traced to the routine use of antibiotics for therapy and for improving growth and productivity of animals used for food. The animals' flora, subjected to continuous antibiotic pressures, becomes resistant to the antibiotics, and food contaminated by the bacteria then can cause infections. Epidemiologists can actually trace an organism—sometimes from the original cow, through the slaughterhouse, through the hamburger, to the first victim, and then to secondary victims—by the organism's antibiotic-resistant traits and other features. People being treated with antibiotics are generally the most susceptible to infection by resistant organisms. Recommendations include more prudent selection and use of antimicrobials in animals and more restricted use for therapeutic and prophylactic purposes.

Drug abuse

SOME 20 years ago, the case was made for heroin addiction being a communicable disease: the drug could be considered the infectious agent, the drug user was both host and reservoir, and a drug-using peer was the vector that transmitted the disease (page 970). Epidemiologic methodology has since been applied to analyses of drug abuse in this country. Because drug abuse is illicit, data are not easy to come by. Two periodic surveys (one of high school seniors, the other among household members over age 12) provide data on drug usage; to these data are added reports from drug treatment centers, emergency rooms, and coroners. Kozel and Adams discuss trends in abuse of marijuana, heroin, and cocaine; there are estimated to be 62 million one-time or more marijuana users and 18 million recent users, 400,000 to 600,000 heroin addicts, and 5.8 million recent cocaine users.

Radon in homes

SOIL, stone, and water contain radium that decays to radon, a noble gas, that in turn decays to a series of short-lived isotopes that emit α particles (page 992). These radioactive isotopes cause lung cancer in miners heavily exposed in underground uranium and other types of mines; the contribution of radon to non-occupationally related cases of lung cancer is currently of interest. Radon is trapped in homes and other enclosures; concentrations are higher indoors than outdoors. Nero *et al.* collated and analyzed data on the levels of radon in some single-family homes in the United States and estimated the frequency distribution of radon concentrations in such homes. The arithmetic mean concentration in homes sampled (1.5 picocuries per liter of air) presents a 0.3% lifetime risk of developing lung cancer, or 10,000 cases of radon-induced lung cancer per year in the United States. There may be a million homes with concentrations of radon above 8 picocuries per liter; for residents of these homes, there is an estimated 2% lifetime risk of developing lung cancer. Occasional homes have concentrations of 50 to 100 or more picocuries per liter, where the risk of lung cancer is extraordinarily high. Statistically designed surveys of U.S. homes can test these estimates directly; changes in building codes and other guidelines will be needed to help reduce the risk of radon-induced cancer in the future.

How leeches swim

EXACTLY how sensory input (stroking, pinching, or other strong mechanical stimulation) is converted to motor output (swimming) in the medicinal leech has been determined (page 1002). Four types of neurons were previously known to be involved in the neuronal network. Using staining techniques and intracellular electrical stimulation, Brodfuehrer and Friesen identified the missing link, the trigger neurons (Tr1), and defined their position in the chain of events. When Tr1 cells are activated by sensory neurons that have responded to pressure or pain, they excite swim-gating neurons; these send signals to the oscillator neurons that then excite the motor neurons. The net effect is rhythmic contraction of the dorsal and ventral muscles and a leech that undulates through the water. This is the first complex rhythmic behavior for which every step has been identified from a stimulus to a response.

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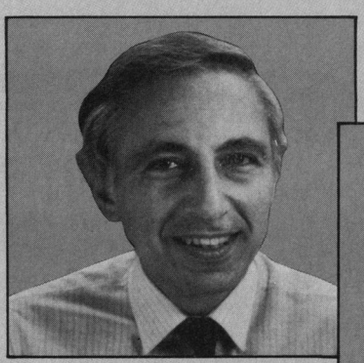
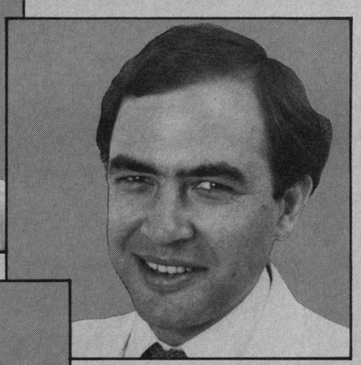


Dr. Robert Gallo
National Cancer Institute



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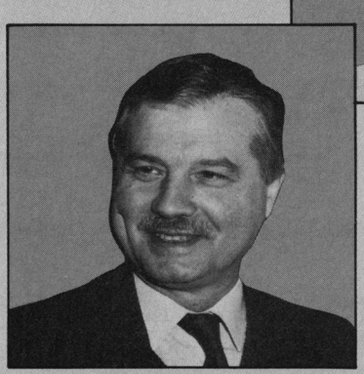

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SCIENCE

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The Epidemiology Issue

The word "epidemic" conjures up a picture of the Black Death sweeping across Europe in the 14th century. That epidemic is estimated to have reduced the population by a fourth and destroyed economies and village life. Ironically, the disease was so devastating that it also stopped wars, lowered rents, and brought some fluidity to an ossified society. Epidemics in the Middle Ages were often facilitated by unsanitary water conditions, insect or animal vectors, and such human contacts as sneezing and sexual intercourse. Improved sanitation has made it possible to protect water supplies. Knowledge of insect and animal vectors and the use of insecticides have vastly reduced the second major route for spreading disease, and human interchange can be localized in the modern world. Thus the threat of another epidemic like the Black Death seems unlikely. Nevertheless, the ancient dangers still exist in much of the developing world, and new varieties of epidemics occur in the developed world. Epidemics may threaten a smaller fraction of the total population than in the past, but the increased world population today means large numbers of people are affected. This issue of *Science* focuses on some recent problems in widespread diseases and modern techniques for combating old enemies.

In the first article, Roger Glass discusses the basis of the new epidemiology, now defined more broadly to include all the major causes of death. In the traditional way of accounting for leading causes of death in the United States, heart disease and cancer are in first and second place, with practically no other cause in the same quantitative category. However, if one looks only at the causes of premature death ("premature" meaning any death before age 65), the list becomes unintentional injuries, cancer, heart disease, and violence (suicide and homicide), in that order.

AIDS is an epidemic in the classical tradition, affecting only a small fraction of the population at present, but growing steadily. It is already a major health problem, and it clearly figures in the premature death category. In this country its transmission has been identified predominantly with homosexual males and drug users, but Quinn, Mann, Curran, and Piot point out that, in Africa, AIDS is linked predominantly to heterosexual practices. The reasons for the difference are significant and may be important in helping prevent the spread of this quite terrifying disease.

A modern twist on an ancient battle is the emergence of drug-resistant bacteria. As one strategy in the unending warfare between the species, humans abandoned boiled water and developed antibiotic missiles. The bacteria then initiated a strategic defense based on an impenetrable—or almost impenetrable—shield of antibiotic resistance. As described by Cohen and Tauxe, this battle has been complicated by the widespread use of antibiotics in food animals, which has, in turn, led to new strains of *Salmonella* now resistant to the drugs needed to treat human infection.

Drug abuse would not have been considered a disease in ancient times, but the current widespread use and increasing number of innocent victims clearly justify study in epidemiologic terms. Kozel and Adams report that peak marijuana use among high school seniors occurred in 1978 when the perception of risk was low (35 percent saw great risk from regular use). Use in 1985 has declined significantly when the perceived risk has risen to 70 percent. Thus education campaigns can diminish drug abuse.

Classical epidemics exist today in the less wealthy tropical countries. Malaria is endemic—annual acute cases numbering about 100 million—in areas inhabited by 365 million people. Controlling it and the less prevalent leishmaniasis is hampered by difficulties in culturing the organism and laborious diagnoses. Wirth and her co-authors describe the development of DNA probes, which make it possible to diagnose directly from lesion tissue, a great advance.

The evolution of the science of epidemiology is probably no more dramatically illustrated than by comparing the topics in this issue with those that might have been funded by a Disease Control Foundation in the Middle Ages. They would illustrate how far we have come, not only in saving lives, but also in elevating the human spirit because the ravages of the Middle Ages generated mysticism, xenophobia, and prejudice. We have our problems today, but at least we are not burning witches to stop the spread of disease.

—DANIEL E. KOSHLAND, JR.

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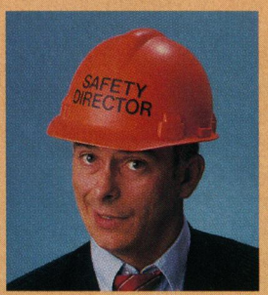

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begins in Washington, D.C., with events (or nonevents) that transpired in Foggy Bottom in the late winter of 1984. The mystery is not what happened, but why.

Several U.S. government agencies were formally invited to join the Vinogradov Expedition at least 1 year before the ship left port at Nakhodka (Vladivostok, U.S.S.R.), on 15 June 1986, but they failed to act on the invitation. At least one U.S. Geological Survey marine geologist received a personal invitation but was denied permission to attend by the USGS. It was he who started the chain of communications that led to my invitation to participate. In my search for travel funds, inquiries at two National Oceanic and Atmospheric Administration offices, the Minerals Management Service, and the Manganese Crust Project Office in Honolulu, and elsewhere brought the same response: "Vinogradov Expedition? Never heard of it!" The story was the same at the International Programs Office of the National Science Foundation.

As a geologist committed to and involved in international scientific cooperation since my tour with Harry Truman's Point Four Program in the Philippines in the 1950's I deplore what appears to be a hidden bottleneck somewhere in Washington, D.C., that results in the failure of international scientific projects and can even prevent usually cognizant government agencies from knowing that opportunities exist. I hope that this letter will arouse righteous indignation in the right quarters and that this bottleneck can be broken. Where are the champions of international scientific cooperation who believe in the role of scientists as forces for good in a world sadly in need of goodwill on all sides? Let us not miss golden opportunities like the Vinogradov Expedition again.

RONALD K. SOREM
Department of Geology,
Washington State University,
Pullman, WA 99164-2812

Symbiosis

Once again, and with customary wit and eloquence, Daniel E. Koshland, Jr., has, for the most part, put biological allusion to effective use in his analysis of science policy, in this case concerning the sources and sinks of university research funds (Editorial, 31 Oct., p. 525). However, in the interest of clarifying terminology, some comment on the sense in which he uses the word "symbiosis" is in order. As any ecologist worth his or her salt will, of course, recall, "symbiosis" refers to an intimate association between (usually) two organisms, frequently involving the acquisition of food, and encompasses three major types of interaction: "commensalism," in which one partner gains while the other neither benefits nor loses in the relationship; "mutualism," in which both partners benefit; and "parasitism," in which one partner benefits at the expense of the other. Therefore, the phrase "The shift from symbiosis to parasitism . . ." is not only imprecise but constitutes a redundancy, since parasitism *is* a symbiosis. In keeping with the overall sense of the essay, "mutualism" would seem to be meant here rather than "symbiosis." This misappropriation of the latter, more general term appears to be rather widespread in both popular and professional publications.

THOMAS W. CULLINEY
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Basic Energy Research

Mark Crawford, in his News & Comment article "R&D budgets: Congress leaves a parting gift" (31 Oct., p. 536), shows that "Most basic research programs have emerged from the agonizing budget drama in good shape." Included in those cited is the budget for the Basic Energy Sciences program of the Department of Energy, as follows: "Basic energy research expenditures also are rising—to $536.67 million, $33 million above the level recommended by the House Appropriations Committee and far above the $441.3 million recommended by the Administration."

Referring only to the budget bottom lines without attention to the internal details can be misleading. In its final action on the Basic Energy Sciences budget, Congress provided $102 million for projects, mainly university buildings, not requested by the Administration; reduced Administration requested items by $6.7 million; and specified the expenditure of an additional $11.4 million for purposes not included in the Administration's request.

The net result is not a program of research being increased by 22% compared to that proposed by the Administration, as could be inferred by the budget totals cited in the article. Nonetheless, we are pleased that in most aspects the Administration's proposed program is intact and funded so as to allow a strong program to go forward.

DONALD K. STEVENS
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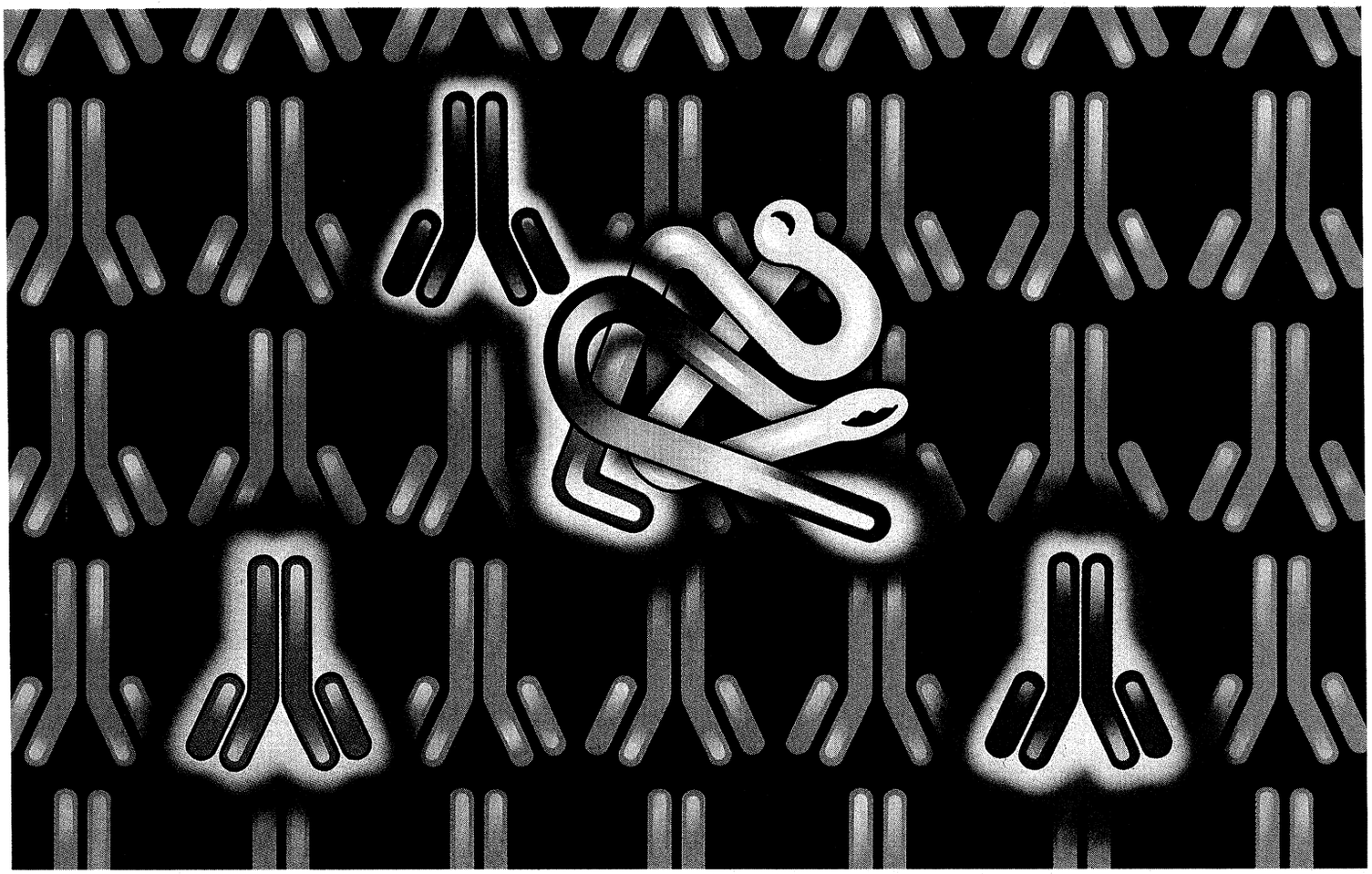

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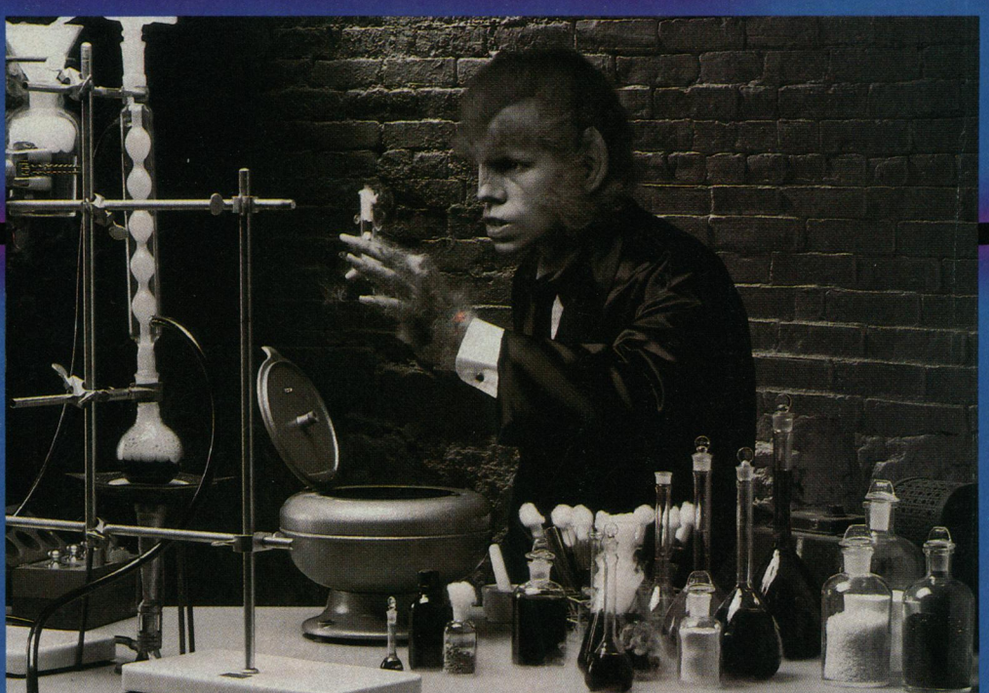

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Of Mice

A Story Of New Technology And How You Can Apply It For Better Laboratory Animal-Research Management

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Until now, each technological advancement has been applied to laboratory management in a stand-alone, discrete fashion. At Bio Medic Data Systems, we understand the importance of applying technology in an integrated fashion to help you solve your most pressing management problems.

Introducing A New Company You've Known For Years

Bio Medic Data Systems is part of the Bio Medic family of companies including Lab Products, Inc. For more than 17 years, we've been the industry leader in providing innovative and dependable products to animal-research laboratories. Bio Medic Data Systems is now introducing two new product lines that will fulfill the promise of central laboratory automation.

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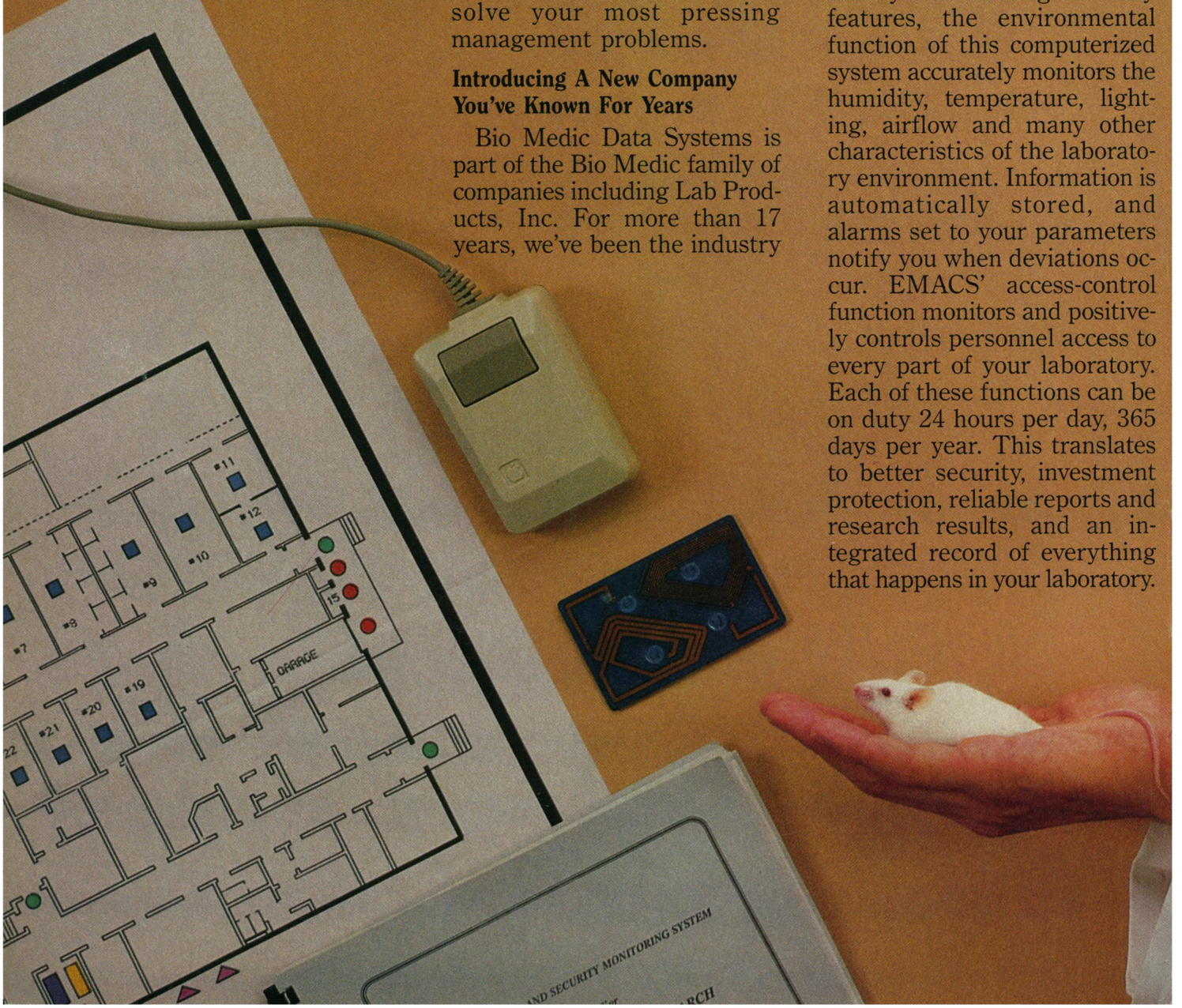
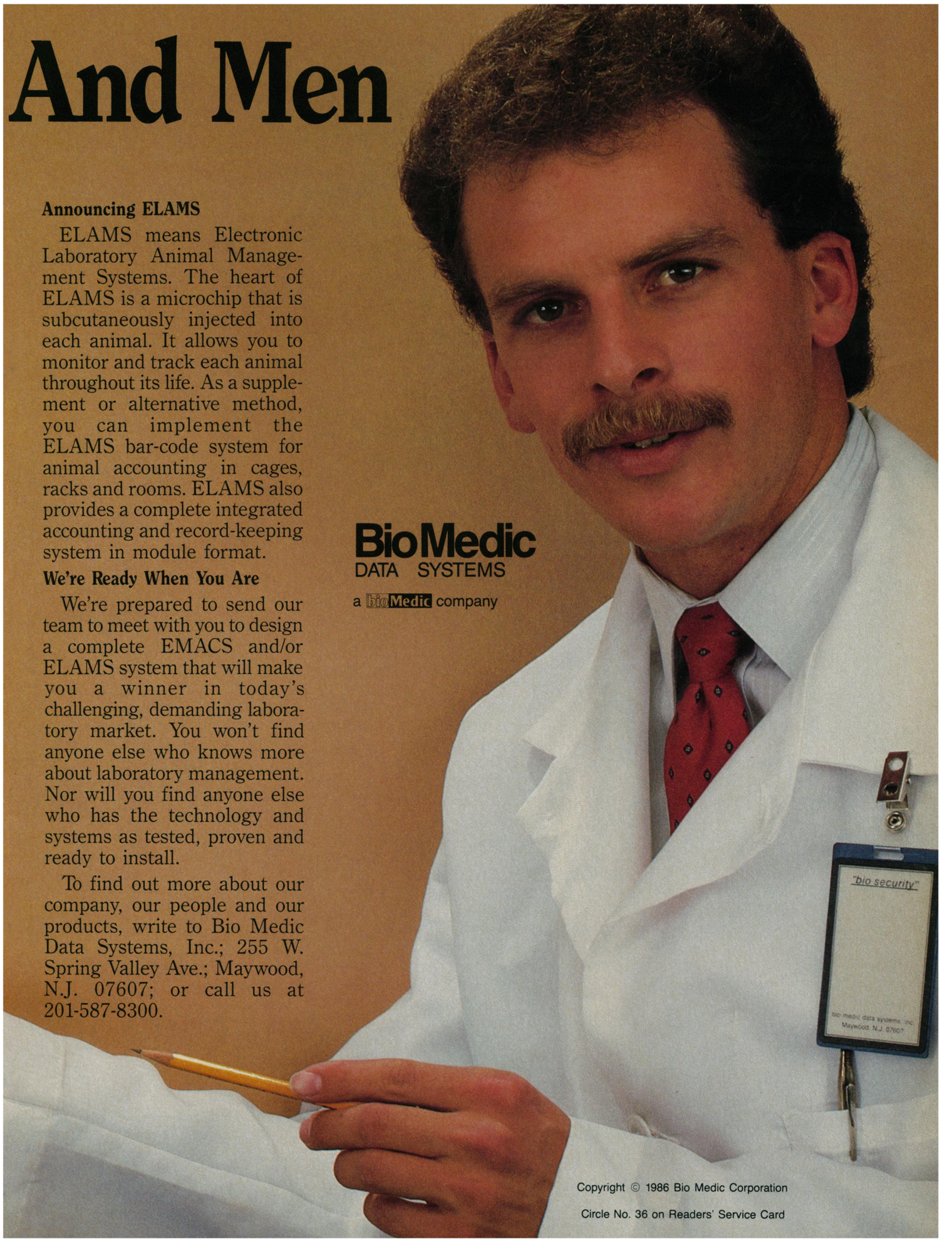
EMACS means Environmental Monitoring and Access Control System. Among its many features, the environmental function of this computerized system accurately monitors the humidity, temperature, lighting, airflow and many other characteristics of the laboratory environment. Information is automatically stored, and alarms set to your parameters notify you when deviations occur. EMACS' access-control function monitors and positively controls personnel access to every part of your laboratory. Each of these functions can be on duty 24 hours per day, 365 days per year. This translates to better security, investment protection, reliable reports and research results, and an integrated record of everything that happens in your laboratory.



And Men



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ELAMS means Electronic Laboratory Animal Management Systems. The heart of ELAMS is a microchip that is subcutaneously injected into each animal. It allows you to monitor and track each animal throughout its life. As a supplement or alternative method, you can implement the ELAMS bar-code system for animal accounting in cages, racks and rooms. ELAMS also provides a complete integrated accounting and record-keeping system in module format.

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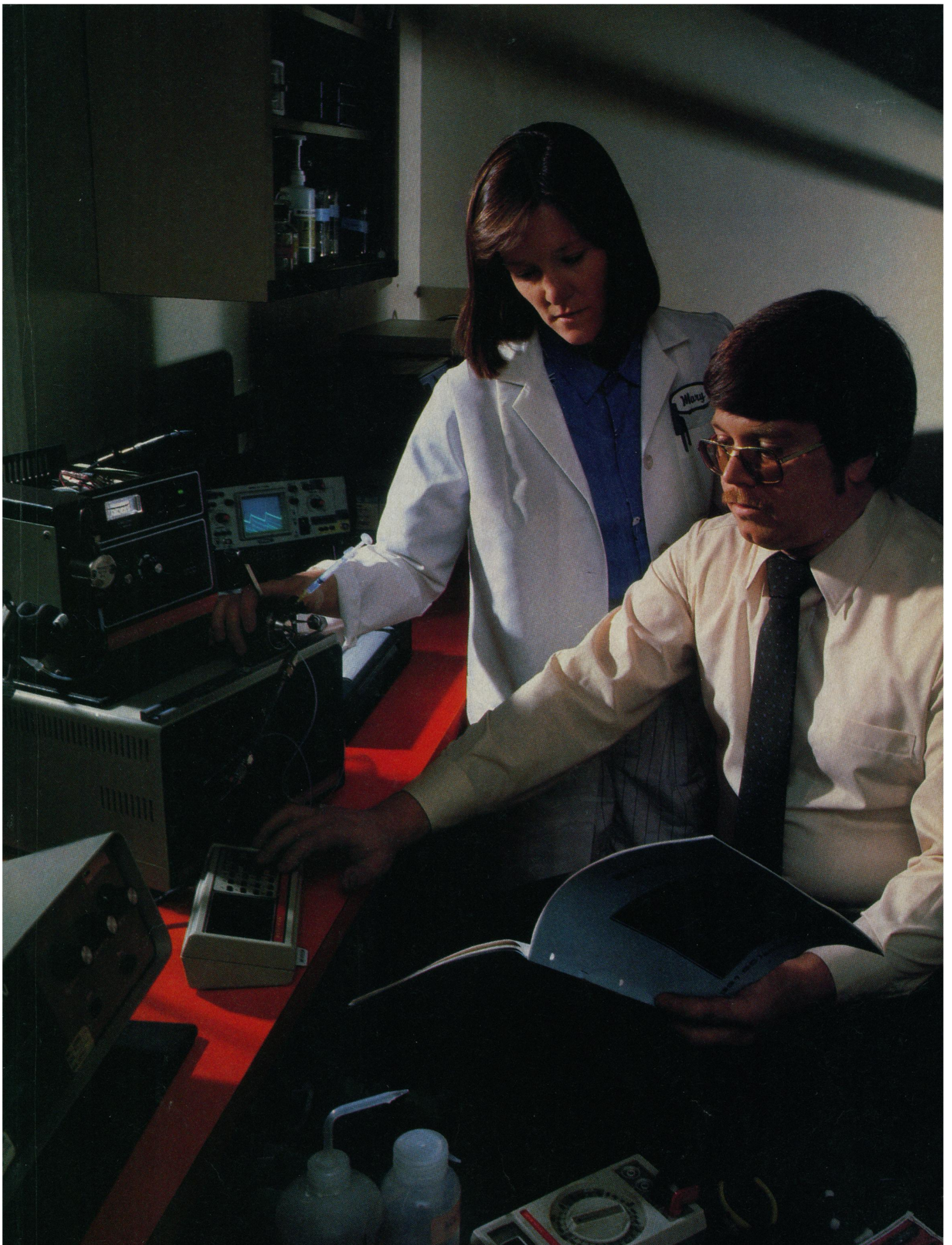
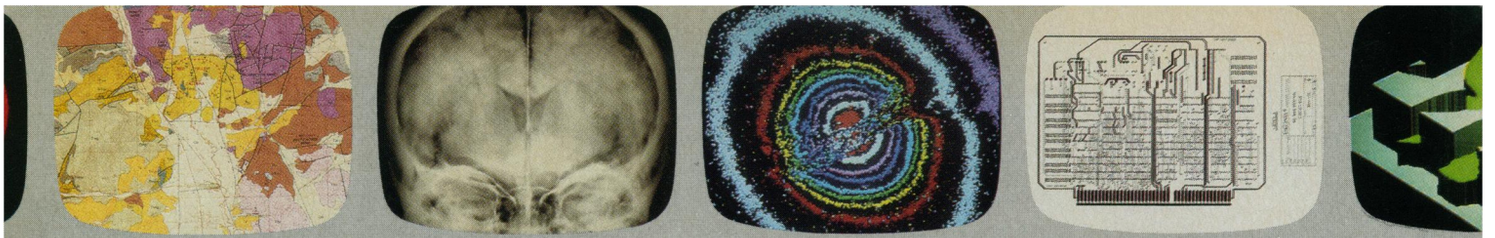
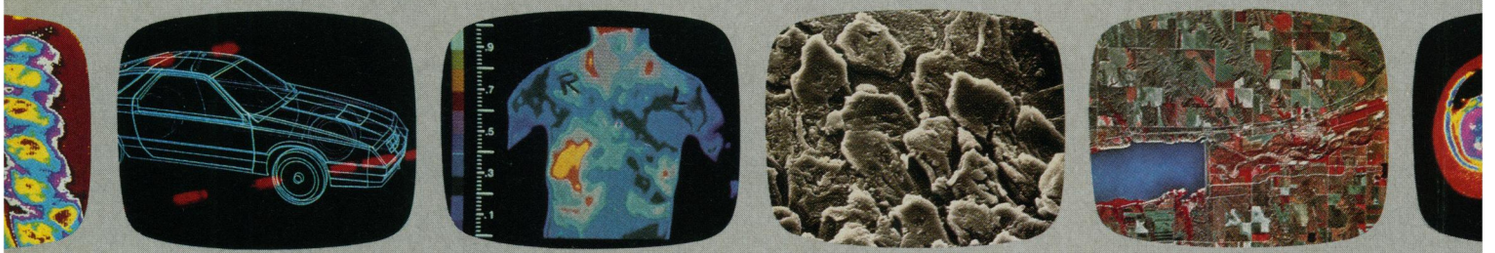

Mary





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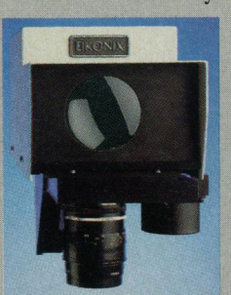

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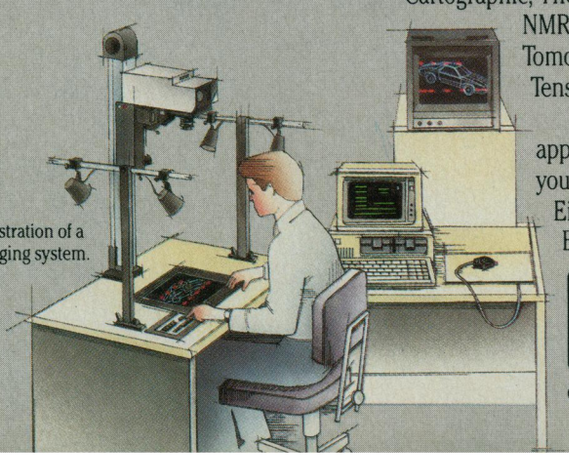

Illustration of a typical imaging system.

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"There is an enormous area in here, where man will start to try, with simple organic chemistry, to mimic antibodies, and I think Baker has now done that."

—**Fred Regnier** to the 1986 Pittsburgh Conference

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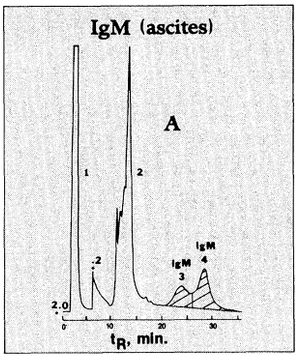
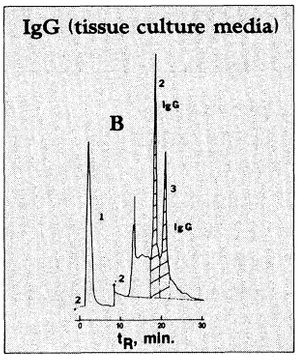
A technological advance for immunoglobulin purification.

The separation of antibodies derived from double producing hybridomas shown below, is an example of ABx ™ resolving power.





ANALYTICAL CONDITIONS:

Column:	Bakerbond ABx,™ 4.6 x 250 mm, 5 micron
Mobile Phase:	A=10mM KH_2PO_4, pH 6.0 B=500mM KH_2PO_4, pH 6.8
Gradient:	0% B to 50% B over 60 min.
Flow Rate:	1mL/min.
Pressure:	1,000 PSI
Detection:	UV at 280nm; AUFS: see +
Peaks	1. Albumins, transferrin 2. Weakly bound proteins 3. IgM 4. IgM
Sample:	Mouse ascites fluid 0.5 mL
IgM Purity:	Greater than 95%

Separation of Monoclonal Antibodies from Double-Producing Hybridomas

ANALYTICAL CONDITIONS:

Column:	Bakerbond ABx,™ 4.6 x 250 mm, 5 micron
Mobile Phase:	A=10mM MES, pH 6.0 B=250mM KH_2PO_4, pH 6.8
Gradient:	0% B for 10 min. Step gradient to 20% B 20% B to 50% B over 60 min.
Flow Rate:	1 mL/min.
Pressure:	1,000 PSI
Detection:	UV at 280 nm; AUFS: see +
Peaks:	1. Albumins, transferrin 2. IgG 3. IgG
Sample:	Tissue Culture Media 0.5 mL
Purity:	2. greater than 95% 3. greater than 95%

+ Peak 1 of non-retained proteins represents 90-95% of all non-immunoglobulin proteins. Detector sensitivity for all other retained peaks has been increased ten-fold to emphasize retained proteins and monoclonal antibodies.

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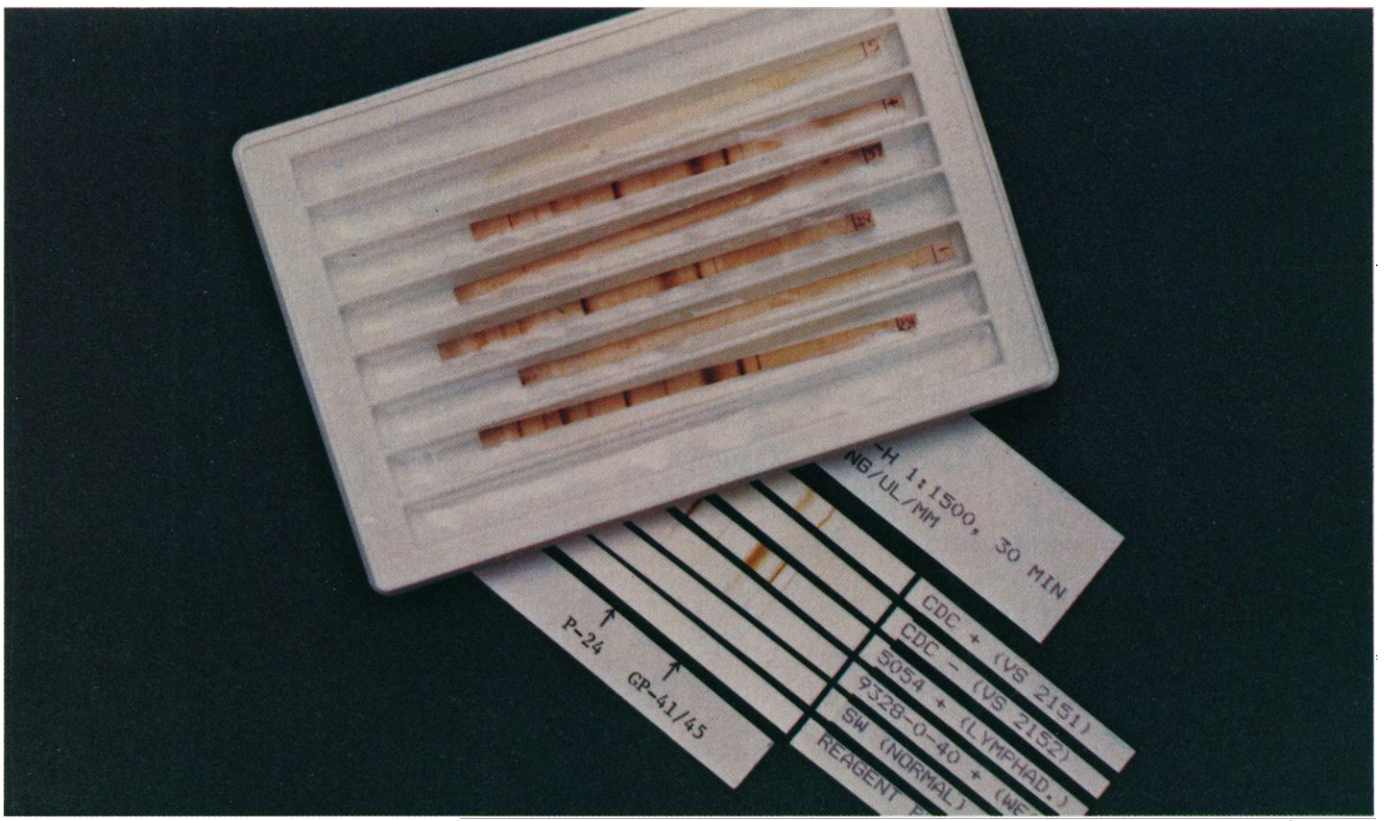
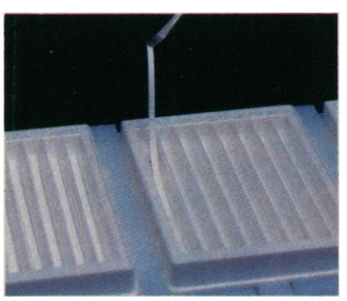
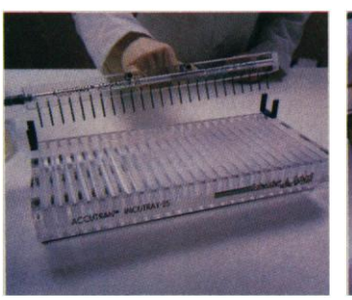
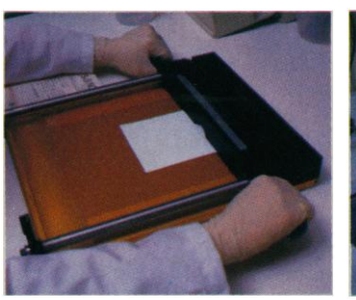




Disposable incubation trays—non-protein-binding surface; minimal volumes needed to cover small strips.



Incutray and Aspirator-25—for incubating/processing larger strips.



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Versatile laser devices that can pinpoint targets for laser-homing weapons, conventional artillery, and naval gunfire are being delivered to the U.S. Marine Corps. Modular Universal Laser Equipment (MULE) can designate targets for all laser-guided weapons, including Laser Maverick, Hellfire, laser-guided bombs, and cannon-launched laser-guided projectiles. MULE is a portable tripod-mounted unit that consists of three modules: a laser designator/rangefinder, an instrument that finds true north, and a stabilized tracking tripod. The designator/rangefinder can be detached from the tripod and aimed by hand. The tripod displays range, azimuth, and angle of elevation of targets. MULE can combine azimuth, elevation, and range information into a digital message that can be sent to an automatic tactical fire control center. MULE is in production at Hughes Aircraft Company.

NATO will upgrade its air defense network with eight long-range radars for four of its member nations. The new radars are NATO versions of the HR-3000, a new generation derivative of the Hughes Air Defense Radar (HADR) operating in West Germany, Malaysia, and Norway. The radar is fully transportable and can be set up and torn down in hours. It also has better electronic counter-counter measures, improved capability for rejecting clutter, and a faster rotating antenna to accommodate NATO's requirement for a higher data rate. The radars will be installed in Turkey, Greece, and Italy, where they will be integrated into the Hughes-developed NATO Air Defense Ground Environment (NADGE) system, and in Portugal, where one will be integrated into a national air defense system.

Over 100,000 TV channels are now being carried to cable television subscribers in the U.S. by means of Hughes' AML microwave systems. AML (Amplitude Modulated Link) was developed as a way to deliver multichannel television programming to cable TV hub sites, much as a trunk cable does. An AML system can carry up to 80 TV channels simultaneously. At least half of the nation's cable subscribers in over 1,500 communities receive TV programming by this technique. AML microwave equipment is used in more than 500 cable TV systems in the U.S., Canada, Mexico, Belgium, Switzerland, Austria, Denmark, Finland, and Argentina.

An AMRAAM air-to-air missile can be fully tested in only one minute with a sophisticated test station. A typical station consists of 17 bays of state-of-the-art computer-controlled instrumentation and is designed for use in the development lab, military depot, or factory. Due to the thermal time limitation of the missile hardware, it examines all of the missile's functions in about 60 seconds—digital, analog, radio frequency, telemetry, and built-in-test capabilities. The central computer saves all information and analyzes it after the test is completed. The test stations are part of a full-scale development contract the U.S. Air Force awarded to Hughes for the Advanced Medium-Range Air-to-Air Missile. Each station can be expanded into a diagnostic station to pinpoint problem areas down to the smallest replaceable assembly and tell which repair should be made.

Support Systems in Southern California designs, develops, and manufactures some of the most sophisticated training simulators and a wide array of automatic and manual test systems. In addition, field engineering and technical support of a wide range of electronic systems keep Hughes' systems operating at top efficiency worldwide. Opportunities are available for a variety of engineers qualified by degree or extensive work experience. They include systems engineers, radar engineers, and software and hardware design engineers. Please send your resume to Lowell Anderson, Professional Employment, Dept S2, Hughes Aircraft Company, P.O. Box 9399, Long Beach, CA 90801-0463. Equal opportunity employer. U.S. citizenship required.

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KEYNOTE ADDRESS (Sunday p.m.) Stephen Goff, Columbia University, Alexander Rich, M.I.T.

ACQUIRED IMMUNE DEFICIENCY SYNDROME (AIDS)

Chairman: Erling Norrby, Karolinska Institutet, Stockholm, Sweden

(Monday a.m.)

IMMUNOPATHOPHYSIOLOGY OF AIDS
Luke Montagnier, Paris

HTLV-III AND OTHER FACTORS IN THE ORIGIN OF AIDS AND ASSOCIATED MALIGNANCIES
Robert C. Gallo, Bethesda

IMMUNOLOGIC AND MOLECULAR FEATURES OF HIV INFECTION
Jay A. Levy, San Francisco

MOLECULAR BIOLOGY OF IMMUNOSUPPRESSIVE RETROVIRUS
Simon Wain-Hobson, Paris

DEFINING THE VIRAL GENES FOR HTLV-III REPLICATION AND CYTOPATHOGENICITY
Flossie Wong-Staal, Bethesda

(Monday p.m.)

MOLECULAR BIOLOGY OF THE AIDS VIRUS
William Haseltine, Boston

RELATIVE IMMUNOGENICITY OF HTLV-III, HTLV-IV, AND STLV-III PROTEINS
Myron Essex, Boston

ENVELOPE PROPERTIES OF HIV
Robin Weiss, London

TARGETS FOR IMMUNE ATTACK IN RETRO VIRUSES ASSOCIATED WITH AIDS
Dani P. Bolognesi, Durham

USE OF VACCINIA VECTORS TO STUDY EXPRESSION AND IMMUNOGENICITY OF RETROVIRAL PROTEINS
Bernard Moss, Bethesda

DNA PROGRAM

CHROMATIN (Monday p.m.)
Chairman, Gary Felsenfeld

TRANSCRIPTION (Tuesday a.m.)
Chairman, George Khoury

INTRACELLULAR PROTEIN TARGETING (Tuesday p.m.)
Chairman, Harvey Lodish

NEUROBIOLOGY (Wednesday a.m.)
Chairman, James L. Roberts

DEVELOPMENTAL BIOLOGY (Wednesday p.m.)
Chairman, Peter Gruss

HYBRIDOMA PROGRAM

TRANSGENIC MICE AS TOOL IN IMMUNOLOGY (Tuesday a.m.)
Chairman, Davor Solter

ANTI-IDIOTYPE VACCINES (Tuesday p.m.)
Chairman, J. Donald Capra

THE USE OF HYBRIDOMAS IN DETERMINING CYTOKINE STRUCTURES AND FUNCTIONS (Wednesday a.m.)
Chairman, Robert Schreiber

ANTI-CARBOHYDRATE MAB'S IN THE STUDY OF GLYCOLIPID-MEDIATED CELLULAR EFFECTS (Wednesday a.m.)
Chairman, Jan Thurin

SUMMARY
Chairman, Joseph Davie

Working Group Meetings will meet in closed sessions. The consensus reached by working groups will be presented to the whole Congress.

IMMUNOTHERAPY
Chairman, Michael Mastrangelo

IMMUNODIAGNOSIS
Chairman, Edgar Haber

POSTER SESSION AND EXHIBITS

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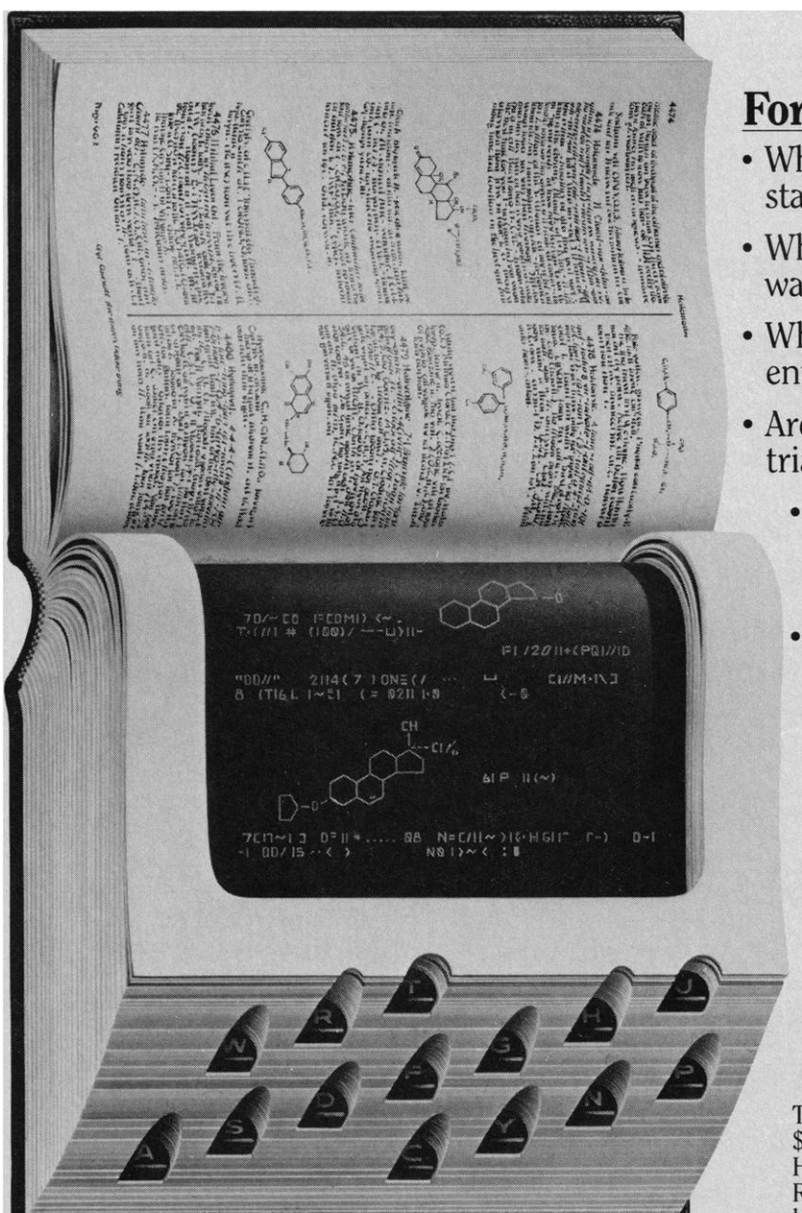

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- Which piperidines are addictive substances?
- Which diuretics have uv maxima at wavelengths between 265 and 280 nm?
- Which anti-inflammatories are patented by Merck?
- Are there any herbicides that contain triazine rings?
- Are there citations for the determination of benzodiazepines in blood or urine?
- What are some trademarks for the new tranquilizer, buspirone? It is not described in the printed 10th edition; can it be found online?

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