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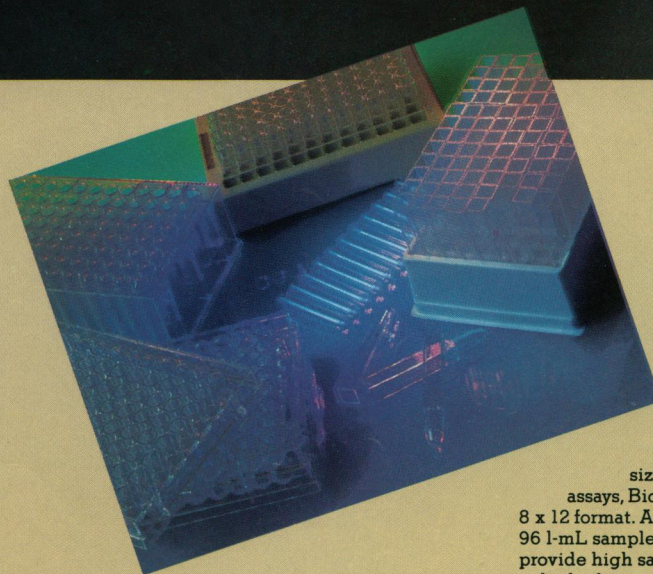
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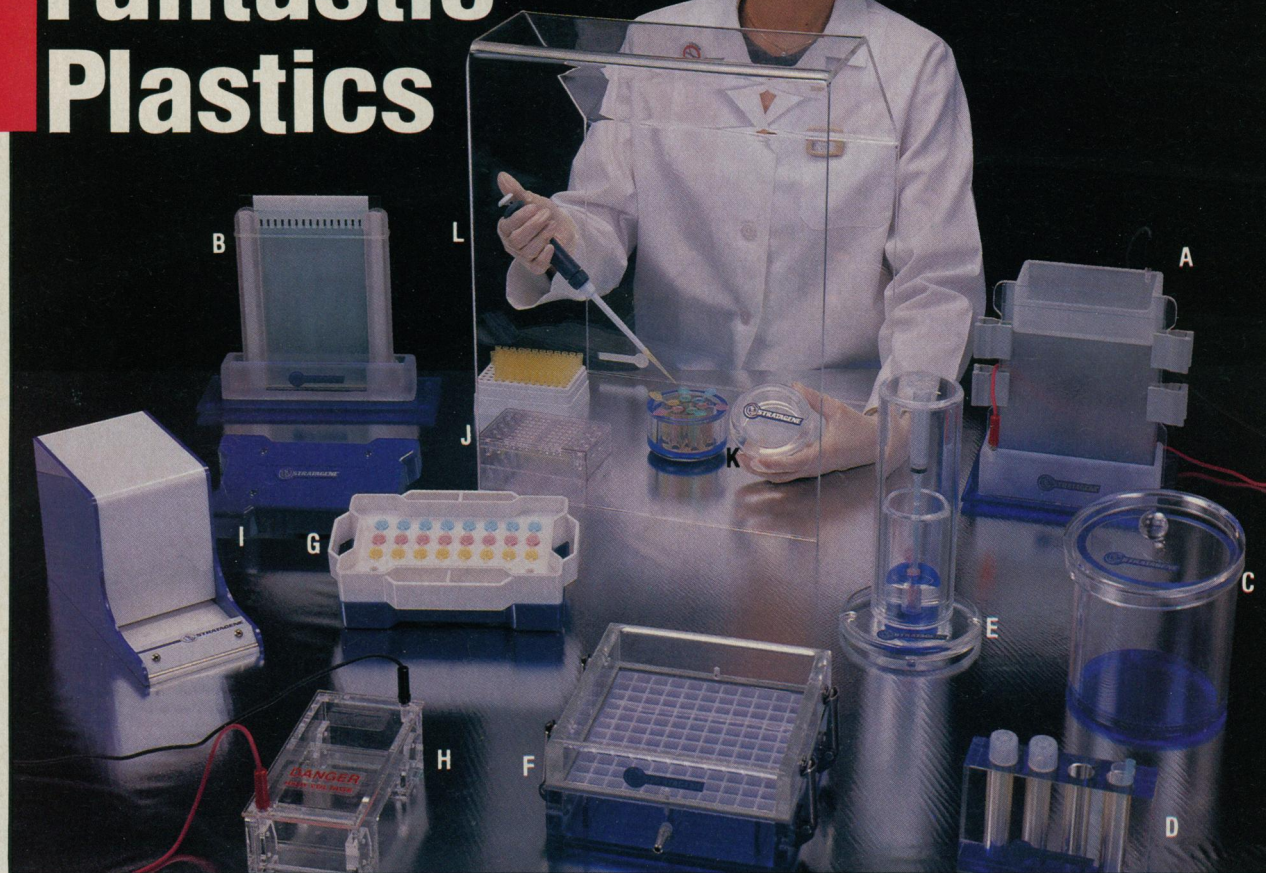
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**COVER** Tin bronze stag, 52.5 centimeters high, excavated from Tomb B at Alaca Höyük, north central Turkey, and now in the Museum of Anatolian Civilizations, Ankara. The stag dates to the mid-third millennium (Anatolian Early Bronze Age), a period characterized by the introduction of bronzes. A source for the tin used in making bronze has been a mystery. Kestel, a mine in the Taurus Mountains of Turkey, may have been that source of tin ore. See page 200.

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## This Week in SCIENCE

### Advance in protein engineering

**T**HE next generation of engineered proteins is at hand: these proteins will contain unnatural amino acids—not the normal 20, but analogs of them that have novel electronic and steric properties. Incorporation of unnatural amino acids into proteins will both extend and refine structural and functional studies of proteins and could lead to the design of new types of proteins (antibodies, enzymes, and others) with unusual properties. Noren *et al.* describe the general biosynthetic strategy that is being used for making these proteins (page 183). Where the new amino acid is to be inserted, the three-base sequence for the normal amino acid in the gene is replaced with a three-base “nonsense” sequence that does not specify any normal amino acid; a special complementary transfer RNA molecule, which recognizes this “nonsense” base sequence, is then loaded with the unnatural amino acid, and it adds the amino acid efficiently and exclusively to the chain. The new *in vitro* procedure, by inserting unnatural amino acids directly into growing protein chains, skirts limitations of chemical syntheses (useful for making only small proteins or peptides) and post-translational modifications (useful for making only certain types of changes in amino acids already in the chain).

### Solar irradiance

**M**EASUREMENTS from space of total solar irradiance and of ultraviolet solar irradiance show that both were decreasing from July 1981 through June 1985, when sunspot activity was on the downswing in solar cycle 21 (page 197). Total solar irradiance depends on competing contributions of dark active regions (sunspots) and bright regions (faculae and plages); sunspots block emissions in the visible range and block less in the ultraviolet. Lean reports that changes in ultraviolet emissions contributed disproportionately to changes in total solar

irradiance: even though only about 1% of the sun's electromagnetic energy is emitted in the (200- to 300-nanometer) ultraviolet range, 19% of the drop in total irradiance was attributable to the decreased ultraviolet irradiance. (At longer ultraviolet wavelengths—300 to 400 nanometers—the contribution to radiative output variation may also be disproportionately high though less.) How radiative output at different wavelengths affects solar irradiance is pertinent to an understanding of the physics of the sun; it also affects atmospheric and climate trends on the earth in different ways depending on whether the emissions are absorbed by the atmosphere (like ultraviolet) or pass through it to reach the earth's surface.

### Bronze Age tin mine in Turkey

**I**N the Bronze Age, alloys of copper and tin were used for making bronze tools and other metal objects (cover). Sources of copper for ancient Anatolia, Syria, and Mesopotamia (roughly Turkey, Syria, Iran, and Iraq today) have been identified in the highlands of Turkey and Iran and in Cyprus and Greece, but a source for the tin has remained a puzzle. Now, Yener *et al.* report on the discovery of an ancient tin mine in the Taurus Mountains of Turkey (page 200). Cassiterite or tinstone, the principal ore of tin, was detected in several streams and subsequently traced back to source mines at Kestel. Mine entrances were located and mining tools found; inside the mines, late Chalcolithic and Early Bronze Age (late fourth to early third millennium B.C.) pottery was recovered along with animal bones, tools, and charcoal used for radiocarbon dating. This discovery may significantly alter interpretations of how the Early Bronze Age metallurgy industry and its associated social and economic structures developed along the eastern Mediterranean: before the tin mine was discovered, all tin was thought to have been imported through Mesopotamia from some distant sources outside the region.

### Widespread losses in colorectal cancers

**A** large amount of genetic material is missing in some colorectal cancer cells; where the losses are greatest, the prognosis for patients is poorest (page 207). Vogelstein *et al.* have catalogued these losses in paired specimens of colorectal carcinoma tissue and adjacent normal colon mucosa. Numerous probes tracked which arms of the chromosomes were lost and which retained. All chromosomal arms surveyed were lost in at least some tumors; the most common losses (from more than 75% of the tumors) occurred within arms 17p and 18q. Some of these genetic changes might merely be consequences of tumor development whereas others may be causal: if, for example, tumor suppressor genes were lost, then tumor cell proliferation might proceed unchecked.

### Specific loss in colorectal cancers

**O**NE gene on human chromosome 17 encodes the transformation-associated protein p53; the gene has been localized to a region of the chromosome that is regularly deleted in human colorectal cancer cells (see above) (page 217). Most of the tumors lose one copy of chromosome 17p; the other allele remains in the cell and shows no gross abnormalities in structure or expression. However, in each of two closely studied examples, the remaining 17p allele was found to have a single base-pair mutation. The clinical data of Baker *et al.*, together with data from experimental tumors in mice, suggest that p53 may be a tumor suppressor gene. Tumors can develop either when both copies of suppressor genes are deleted or when one copy is deleted and the remaining allele is rendered dysfunctional by a mutation. The deletion of gene p53 appears to be a late event in the multistep process that accompanies tumor development and may be coincident with the transition from benign to malignant tumor growth.

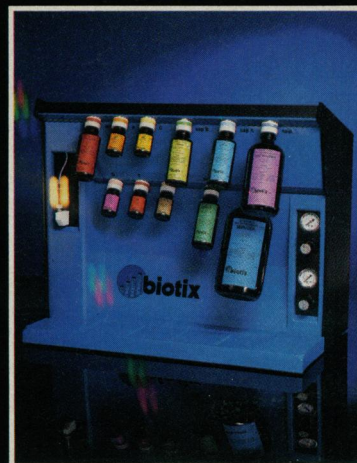


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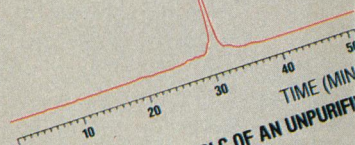
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|               | 0.1uMOLE                   | .5uMOLE  | 1.0uMOLE  |
| 25 mers       | .51-.82                    | 2.1-2.45 | 5.2-5.5   |
| 50 mers       | .95-1.4                    | 3.3-4.3  | 6.7-7.5   |
| 75 mers       | 1.0-1.2                    | 3.3-3.9  | 10.5-12.1 |
| 100 mers      | 1.3-1.72                   |          |           |
| 125 mers      | 1.73-1.84                  |          |           |
| 150 mers      | 1.86-2.3                   |          |           |

\*Optical density units (O.D.) were measured at 260nm on a spectrophotometer. One O.D. unit represents 33 micrograms of single stranded DNA.  
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## World Food Research

**T**he drought of 1988 resulted in sharply decreased yields in the United States and raised concerns about future global supplies of grains. Prospects differ from time to time and from country to country. For part of the world, advances in crop productivity have led in average years to unwanted surpluses. In other regions, especially much of sub-Saharan Africa, production has not kept pace with growth of population.

Great efforts to create new and better cultivars are being made in many countries and are likely to continue for a long time. At present, by far the major effects on production have been achieved through plant selection and breeding. Ultimately powerful techniques of molecular biology will have an impact on the effectiveness of conventional methods of crop improvement.

Enormous resources of biological diversity are available to those engaged in plant breeding. Substantial efforts have been made to collect the thousands of wild varieties of commercially important plants. Specimens have been obtained and are being safeguarded that were found in many ecological niches. In general, the plants native to a particular environment have adapted to it. Their DNA often differs somewhat from plants of the same species growing elsewhere. Some of the characteristics found in plants include sensitivity or tolerance to temperature, to length of day, to soil pH, to drought, to excess moisture, to salinity, and to pests. Through plant breeding it is possible to improve yields while breeding for success in adverse environments.

Plant breeding is being conducted in many countries. The beneficial effects of agricultural experiment stations are being amplified by international networking that facilitates exchange of information and breeding stock. The Consultative Group on International Agricultural Research (CGIAR) has been particularly effective. Two of its centers had crucial roles in the Green Revolution involving wheat and rice. With time, the number of centers has been increased from 2 to 13, and many other cultivars are being improved such as cassava, potatoes, and beans.

A major potential contributor to additional food supplies of many less developed countries (LDCs) would be increases in the production of maize. This grain is grown in more diverse areas of the world than any other major crop. It is grown in the humid tropics near sea level, at high elevations in the tropics, and throughout the temperate zone. In the developing world about half the crop is consumed directly by humans. An improvement in the productivity of maize in the LDCs or an expansion in the area of the land on which it could be grown would substantially ease the food problems of many countries. Two of the International Agricultural Research Centers are devoting substantial efforts to these objectives—the International Maize and Wheat Improvement Center in Mexico and the International Institute for Tropical Agriculture in Nigeria. These centers cooperate in maize improvement with scientists in about 100 countries, some of which have extensive national programs. A notable example is Brazil, which has recently announced the release of high-yielding maize that can be grown in the toxic high-aluminum soils of the vast Cerrado plateau. Large areas in Africa with similar aluminum toxicity might also be candidates for related cultivars.

In the advanced countries, efforts of government-sponsored research, much of it at universities, are supplemented by the seed companies. The magnitude of their efforts is substantial. For example, Pioneer Hi-Bred International, Inc., headquartered in Des Moines, Iowa, has 25 maize breeding stations in the United States and Canada. A typical station has 20,000 rows of nursery devoted to development of new inbred lines destined to be parents of hybrid seeds. In addition to the breeding nursery each station has a total of 12,000 to 20,000 test plots of 1 to 10 acres in 10 or more locations to evaluate yields and agronomic behavior. The experimenters are seeking maize hybrids that have stable performance across a number of environments. To identify an elite commercial maize hybrid, testing spans four or more years, with each successive year's testing more rigorous.

This discussion has merely sampled part of the vast global efforts to increase the production of food. The machinery that is in place is our best hope for adequate future supplies in the event of unpredictable vicissitudes of changes in climates.

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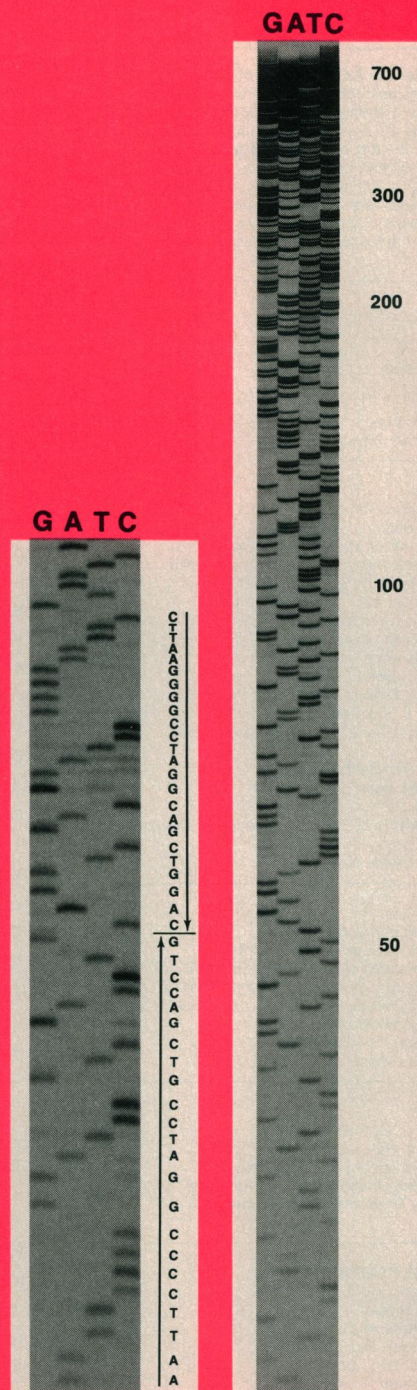
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**Figure 1**

**Figure 2**

**Figure 1.** Sequence of M13mp7 — This well-known vector contains a large, G/C rich region of dyad symmetry. *Taq* DNA polymerase and 7-deaza-dGTP generate an easily-readable sequence of this region.

**Figure 2.** Sequence of M13mp18 — Note that sequence ranges from close to the primer to more than 800 bases, with uniform band intensities. This sequence was run using 7-deaza-dGTP.



other countries are an important contribution to total deposition. This scientific consensus, in turn, was influential in the decision by 19 European nations to reduce SO<sub>2</sub> emissions by 30% (2).

Such reduction in regional SO<sub>2</sub> emissions is an example of the sort of approach that I suggested as being based on considerations other than detailed SRRs. Although I do not denigrate the use of SRRs to develop acid deposition control strategies, neither am I willing to whitewash their present uncertainties.

STEPHEN E. SCHWARTZ  
Brookhaven National Laboratory,  
Upton, NY 11973

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1. A. Eliassen and J. Saltbones, *Atmos. Environ.* 17, 1457 (1983); A. Eliassen, *ibid.* 12, 479 (1978); Ø. Hov et al., *Evaluation of Atmospheric Processes Leading to Acid Deposition in Europe* (Air Pollution Research Report 10, Commission of the European Communities, Paris, 1987).
2. L. Hordijk, *Atmos. Environ.* 20, 2053 (1986).

#### Fund-Raising and NIH

I would like to clarify a recent article by Constance Holden (News and Comment,

24 Feb., p. 1000) that did not give a clear representation of the highly overblown "controversy" concerning the fund-raising activities of the foundation I founded and its role in the administration of a grant from Bristol-Myers. The foundation was formed in June 1988 for the initial purpose of administering the Bristol-Myers grant that I was awarded in April 1988, since I was informed by my division director that the National Cancer Institute did not want to be involved in the administration of the grant. I was *never* informed at the time of my inquiry of any government regulations or policy specifically designed to administer an extramural grant, such as a Cooperative Research and Development Agreement (CRADA), of which I was informed 8 months after my initial inquiry and 6 months after the foundation was formed. In fact, the benefactor of the grant did not feel that a CRADA was appropriate for the grant, since the research that was being funded was based on my own proposal and did not have commercial potential. My serving on the foundation and my acceptance of a small management fee (which Bristol-Myers did not object to) for the expenditure of my own time outside of my official duties *was* approved verbally in September 1988, and in writing in October

1988, by the assistant director of NCI, Elliott Stonehill. The backtracking by the NCI to cover *their* administrative oversight by stating in January 1989 (10 months after the grant award) that my request for administering the grant via my foundation had been denied only occurred *after* the disclosure that I was trying to raise additional funds for the foundation via direct mail solicitation by the Watson & Hughey Co. Although this company has received a lot of "bad press" lately, it is simply not true that they have misrepresented themselves or the foundation in the mailings, which in fact, have been approved by the U.S. Postal Service. As stated by Holden, National Institutes of Health officials acknowledge that there is no official policy regarding this type of activity. Neither is there a policy regarding the founding and administration of non-profit foundations, of which there are several at NIH, while being in the employ of the federal government. If the appropriate officials at NCI had done their homework when the grant was awarded, this entire incident would have been avoided.

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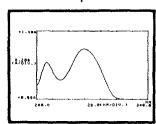
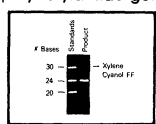
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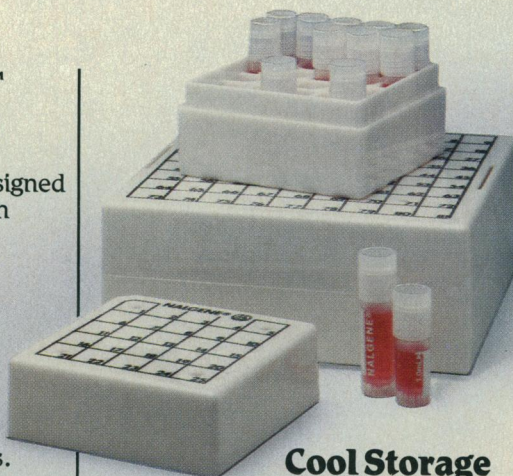
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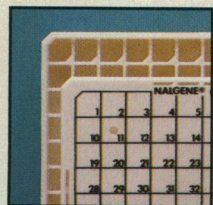
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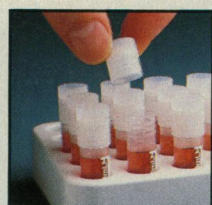
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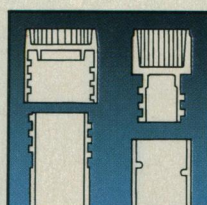
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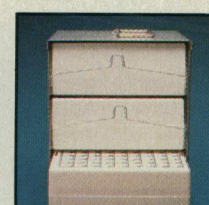
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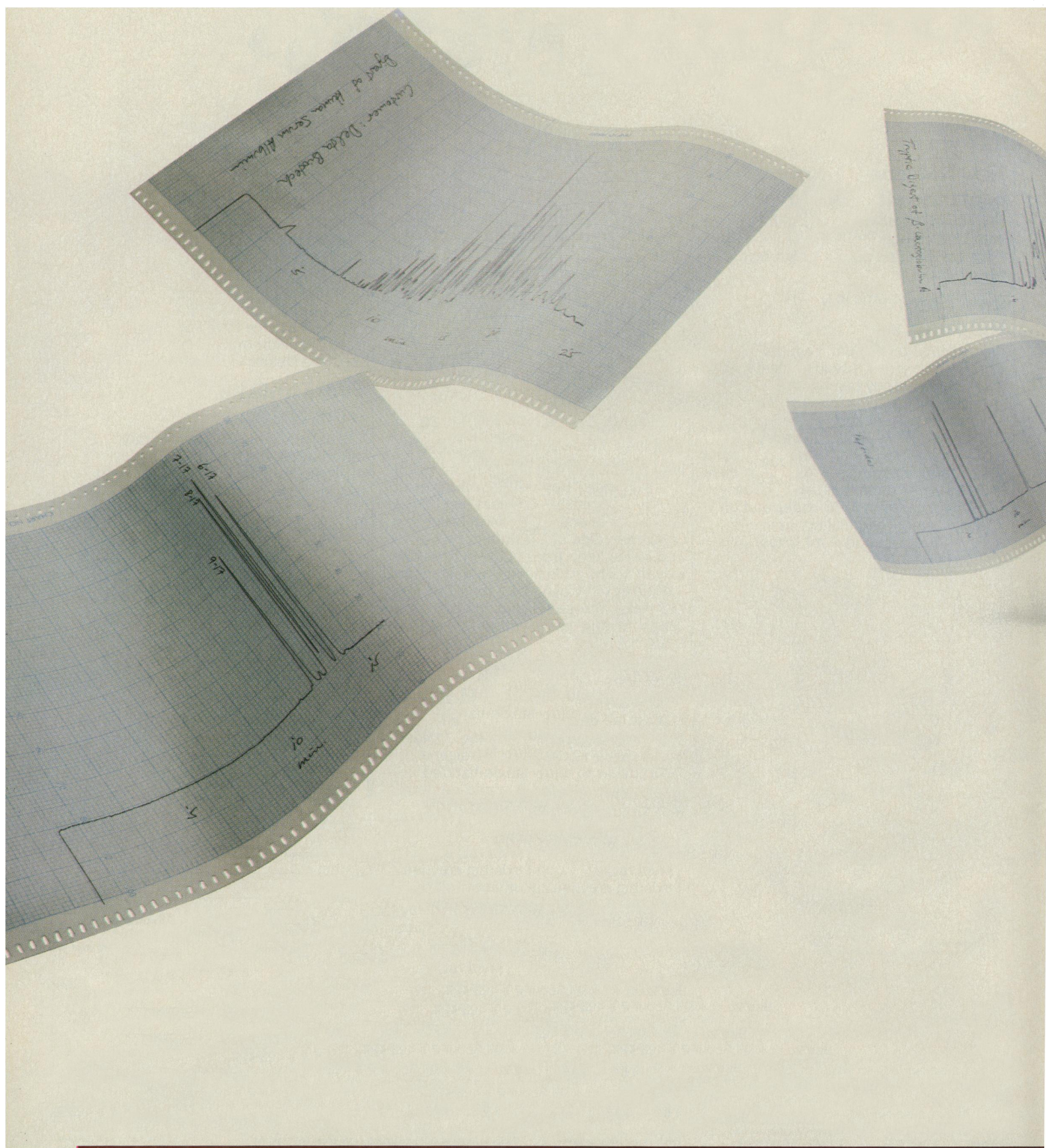
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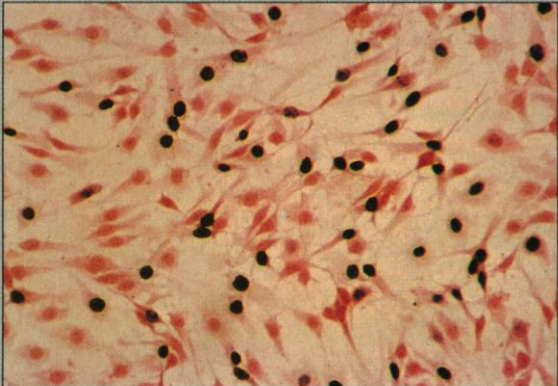
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1) Gratzner *et al*, *Science*, **218**, p.474, 1982

2) Campana *et al*, *J. Immunol. Methods*, **107**, p.79, 1988



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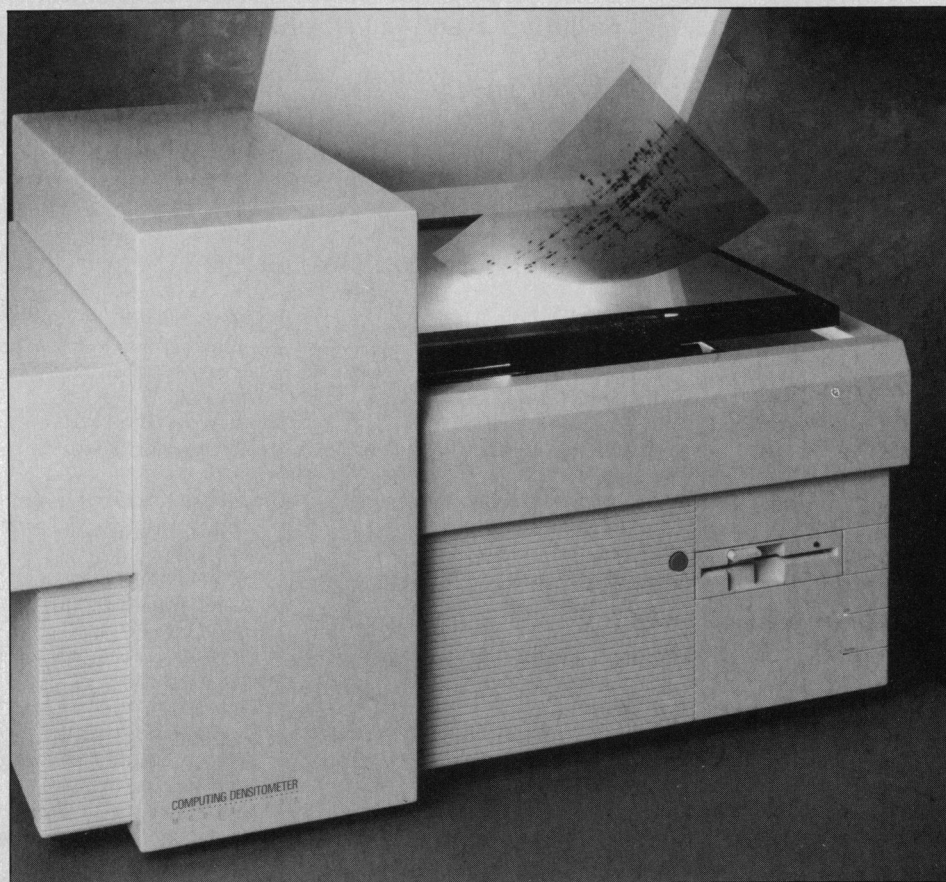
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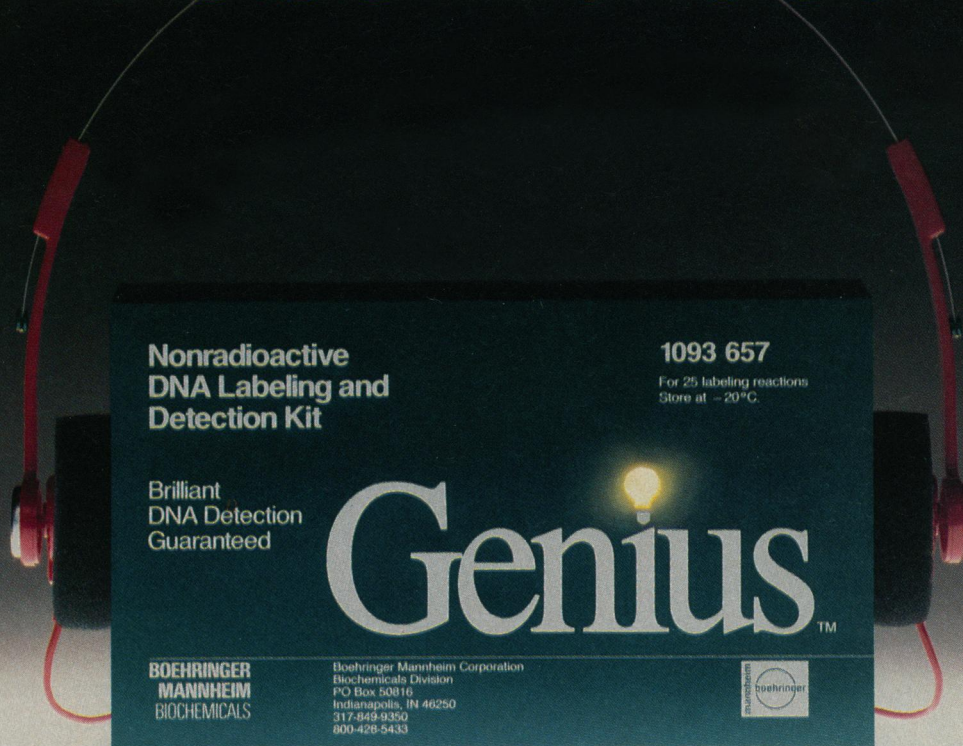
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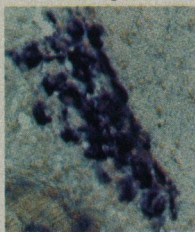
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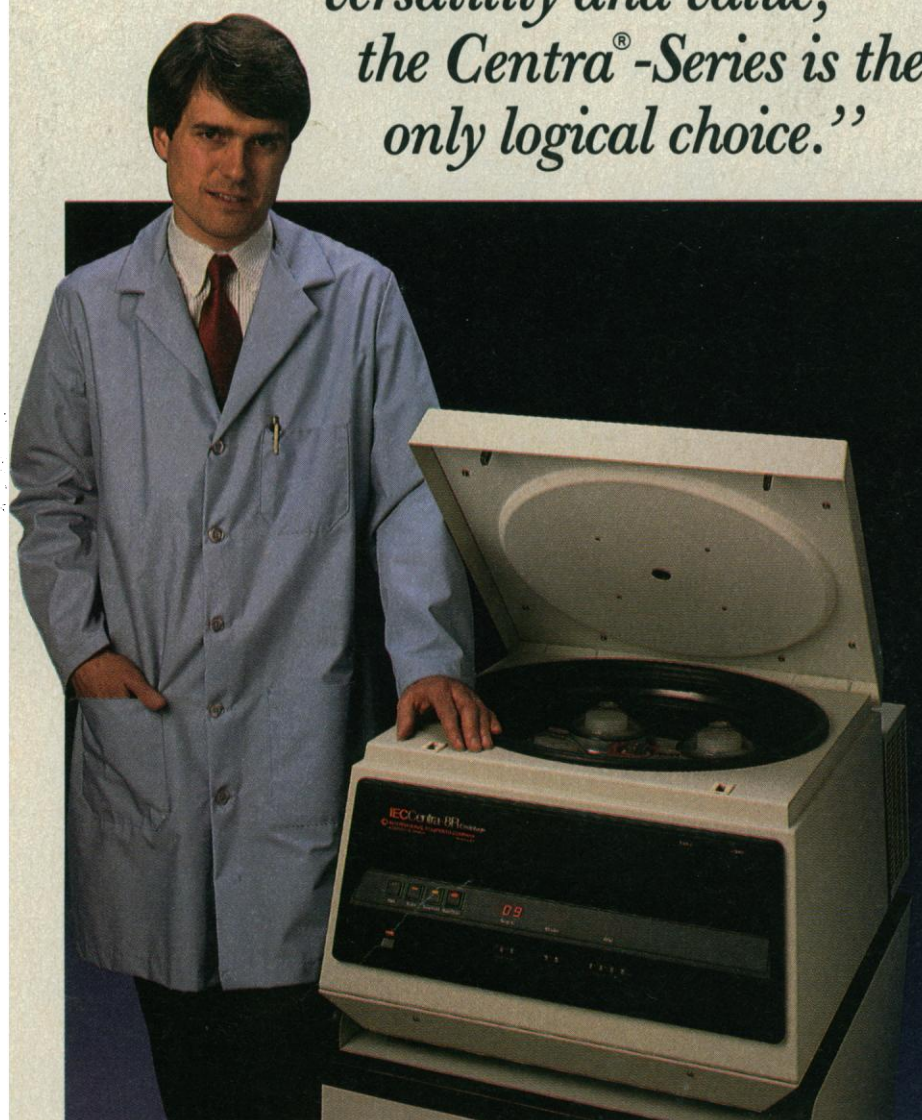




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An authoritative examination of strategic nuclear arms control verification. Addresses principles and tasks of verification, technology and monitoring, compliance issues, and future verification needs. 1985; 249 pp.; softcover \$18.75 (\$15.00 for AAAS members); AAAS #85-31.

**1986 Colloquium Reader—Science and Security: The Future of Arms Control.** Edited by W. Thomas Wander, Richard A. Scribner, and Kenneth N. Luongo. More than 40 essays by leading experts. Examines key issues in arms control and national security. 1986; 205 pp.; softcover \$8.00 (\$6.40 for AAAS members); AAAS #86-16.

**1986 Colloquium Proceedings—Science and Security: The Future of Arms Control.** Edited by W. Thomas Wander and Kenneth N. Luongo. The edited proceedings from the first Annual AAAS Science, Arms Control, and National Security Colloquium. 1987; 326 pp.; softcover \$15.00 (\$12.00 for AAAS members); AAAS #87-17.

**The Strategic Defense Initiative: Some Arms Control Implications.** By Richard A. Scribner and Jeffrey Boutwell. A concise overview of topical SDI issues. 1987 (2nd ed.); 44 pp.; softcover \$2.50 (\$2.00 for AAAS members); AAAS #87-5.

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**Fear of Cheating, Fear of Spying: A Videotape and Companion Guide.** Prepared by Richard A. Scribner and Shelley Alpern. This 40-minute videotape addresses the politics and technology of nuclear arms control verification with a special emphasis on the current compliance controversy. 1986; \$60.00 for VHS or Beta, \$75.00 for U-matic (please specify format); AAAS #86-10.

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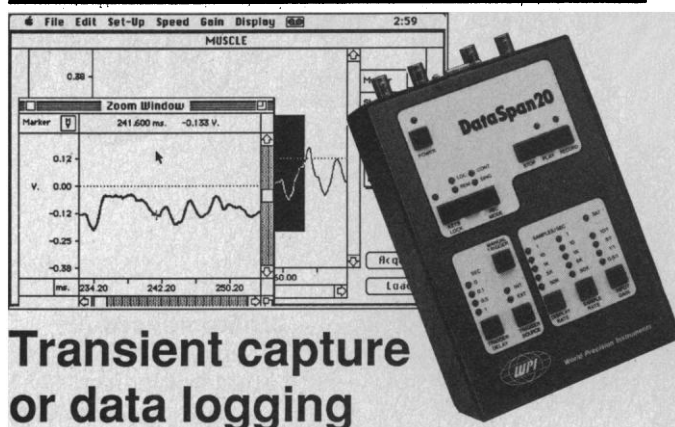
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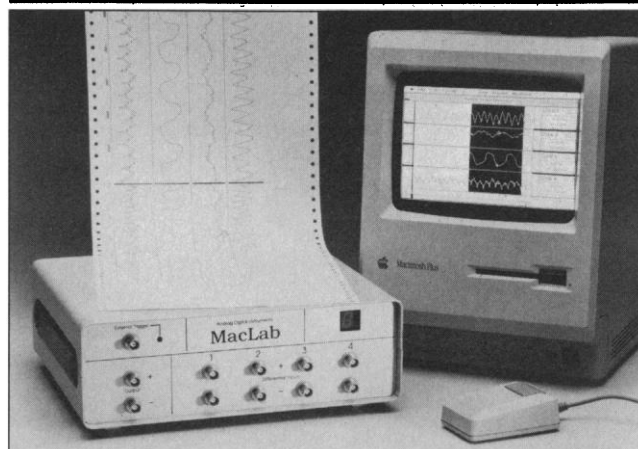


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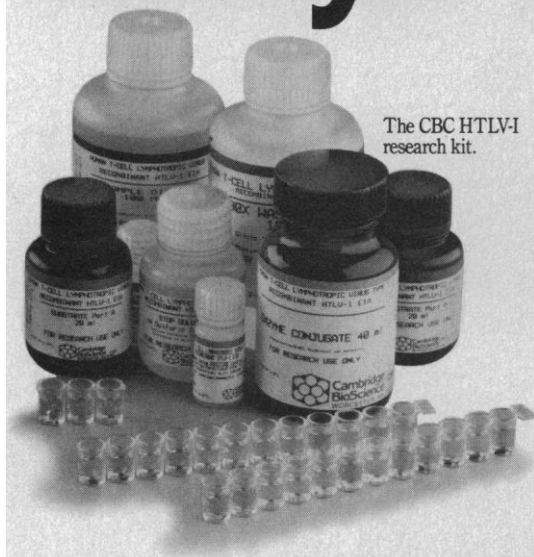
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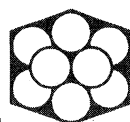
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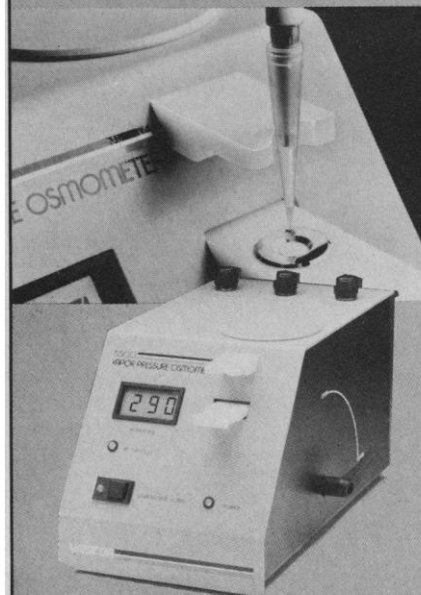
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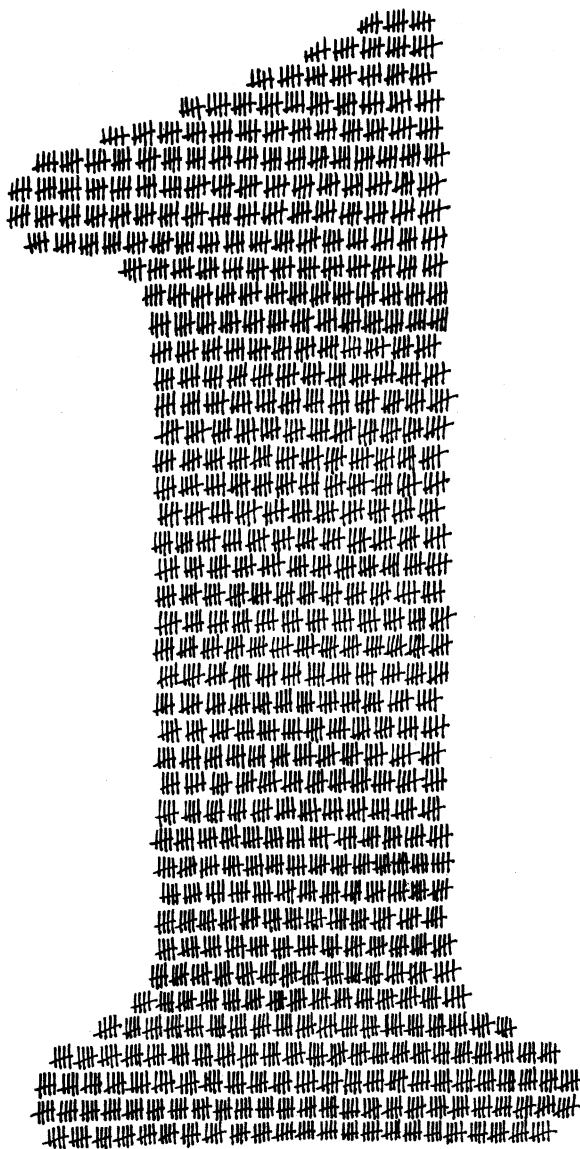
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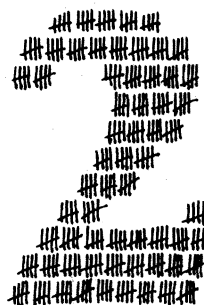




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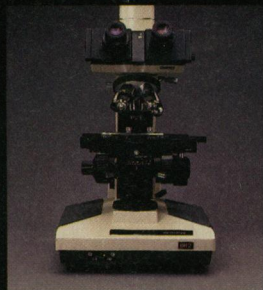
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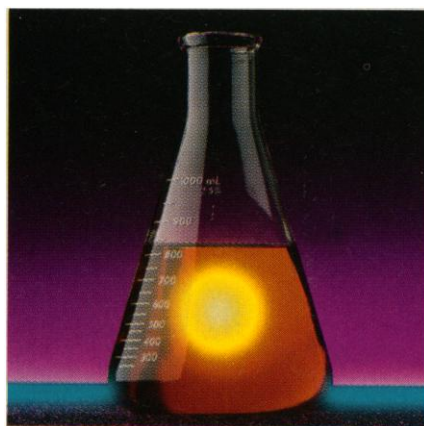


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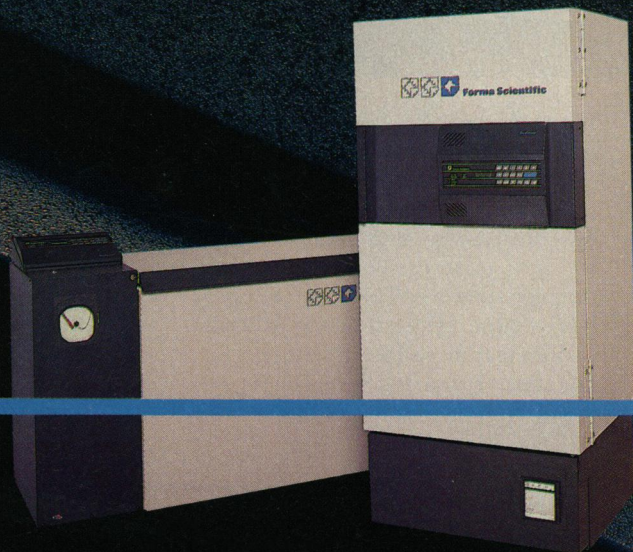
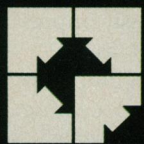


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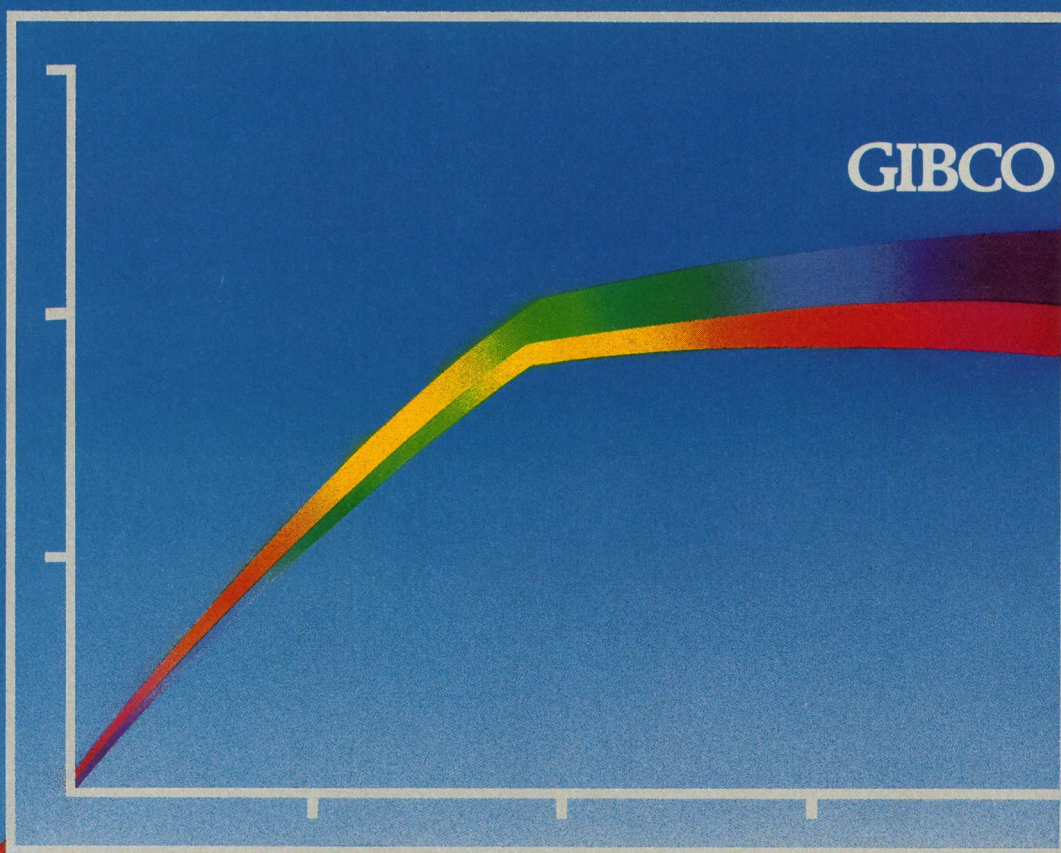
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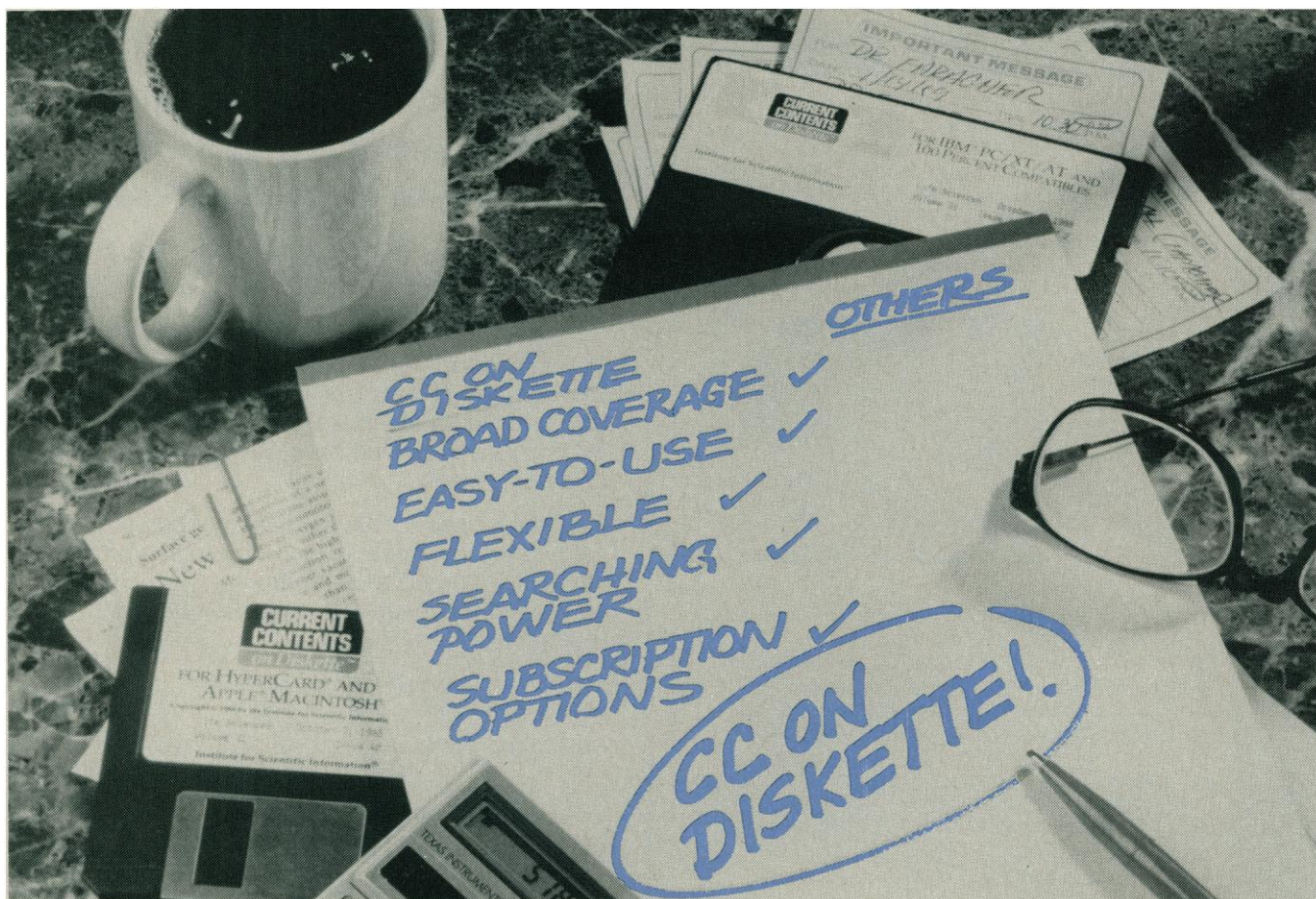
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## The Reconstruction of Disturbed Arid Lands: An Ecological Approach

Edited by Edith B. Allen, *Systems Ecology Research Group, San Diego State University*

In recent years, ecological considerations have played an important role in the reconstruction of arid and semiarid lands that have been disturbed by grazing, fire, wood harvesting, drought, mining, or other causes.

This book uses a multidisciplinary approach in discussing the structure and functioning of a variety of native and self-perpetuating ecosystems as well as the diverse methods used in the revegetation process.

\$38.50; AAAS members \$30.80 (include membership number from *Science*). 268 pp., 1988. AAAS Selected Symposium 109.

**Order from:** Westview Press, Dept. AAAS, 5500 Central Avenue, Boulder, CO 80301. (Add \$2.50 postage and handling for the first copy, 75 cents for each additional copy; allow 4-6 weeks for delivery.)

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**ANNOUNCING** . . . a limited, competitive travel grant program for U.S. scientists interested in participating in the VI Inter-Congress of the Pacific Science Association, Chile, 7-10 August 1989. Inquiries and applications should be sent to:

Mrs. Mary Martha Treichel  
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**Deadline for applications: June 30, 1989**

## Biotechnology and the New Agricultural Revolution

Edited by Joseph J. Molnar and Henry Kinnucan, *Auburn University*

The world's food and fiber production has been permanently altered by new ways to manipulate the characteristics of plants, animals, and microbes. These innovations have raised important questions regarding ownership of intellectual property, safety and environmental impact, and ways to regulate the new technology.

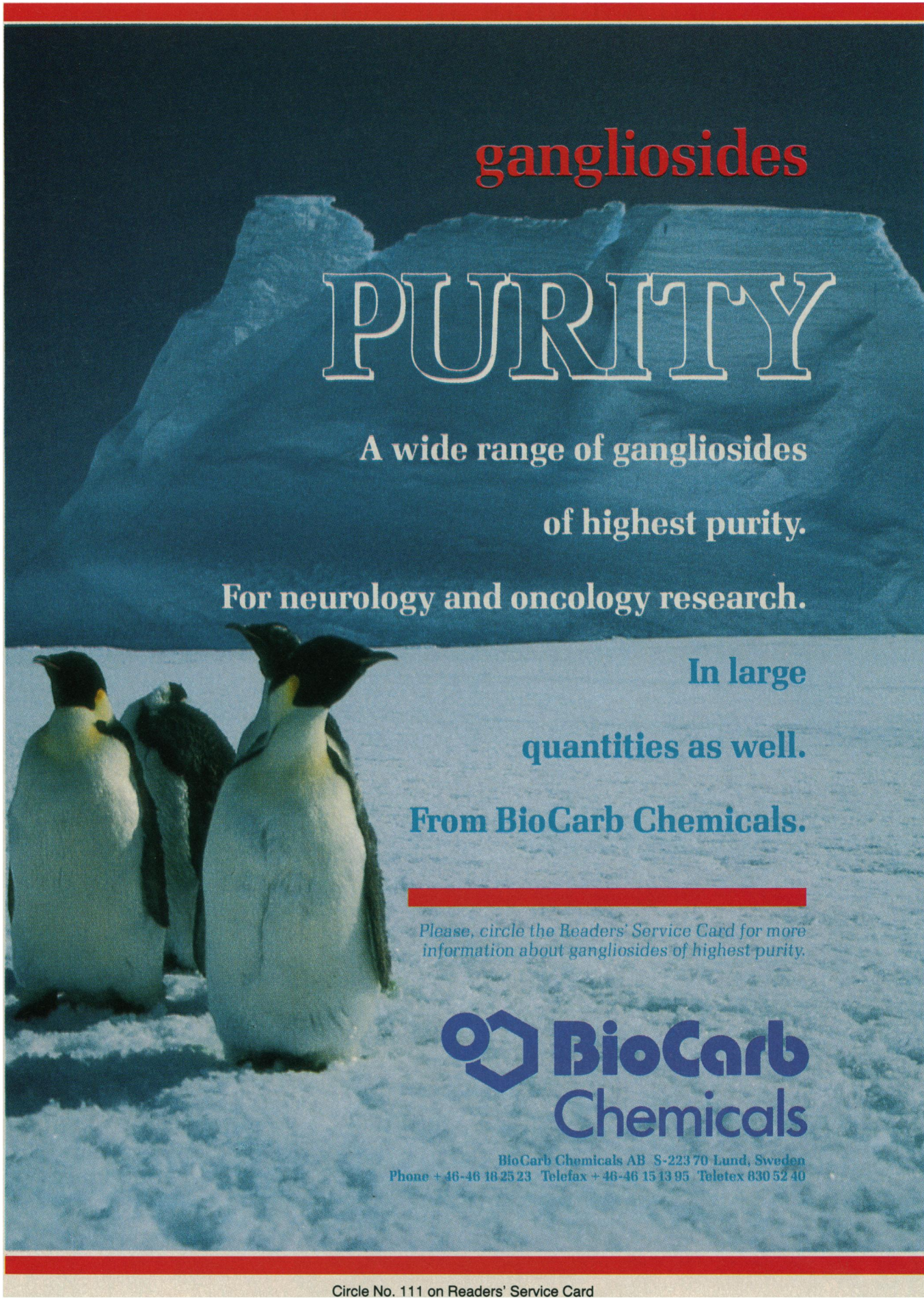
This book examines the impact of biotechnology on agricultural institutions, agribusiness, and farmers. It also presents new perspectives on our concept of life origins and explores the social consequences of this "Green Revolution."

\$27.50; AAAS members \$22.00 (include membership number from *Science*). 288 pp., 1989. AAAS Selected Symposium 108.

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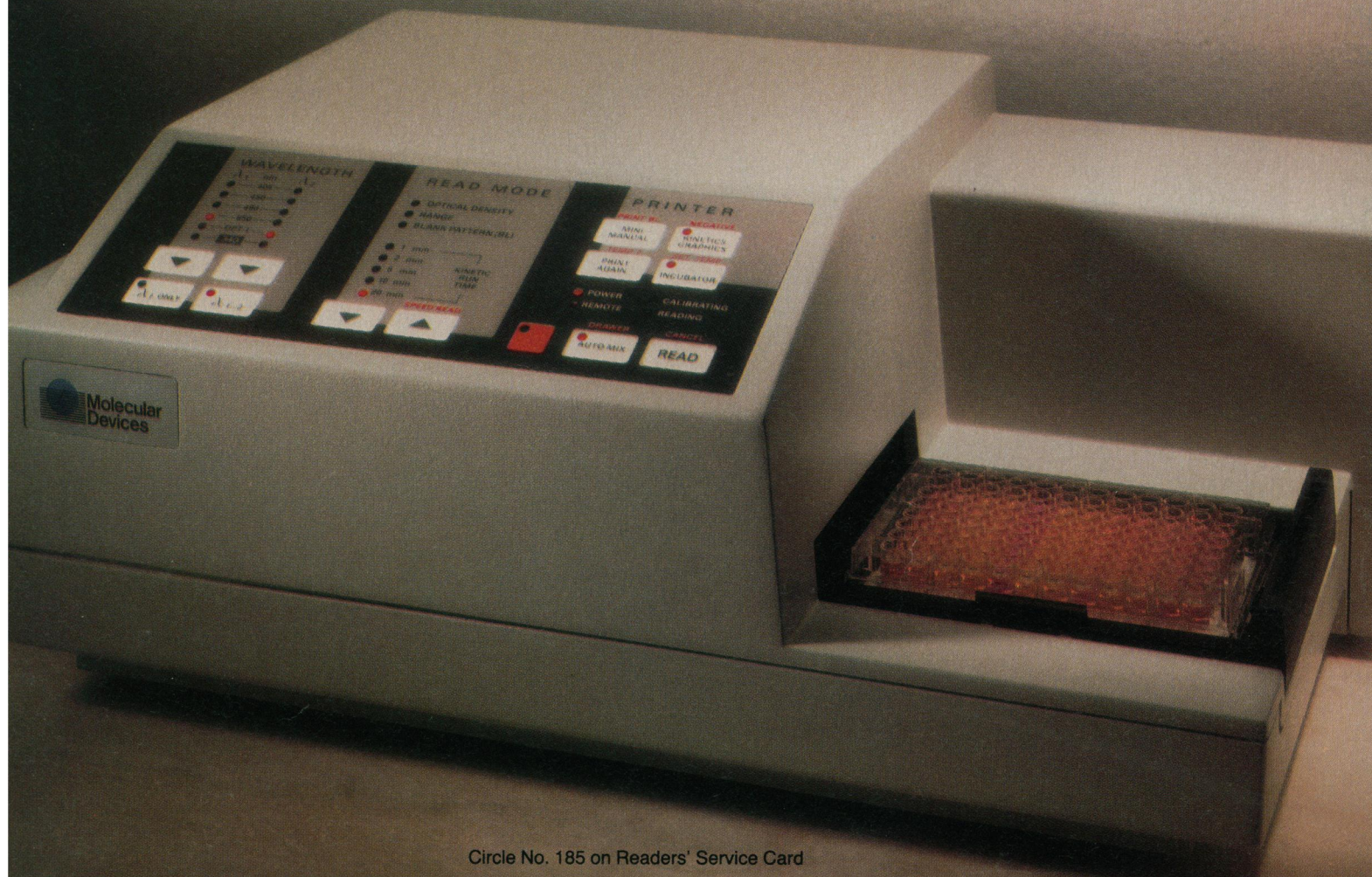
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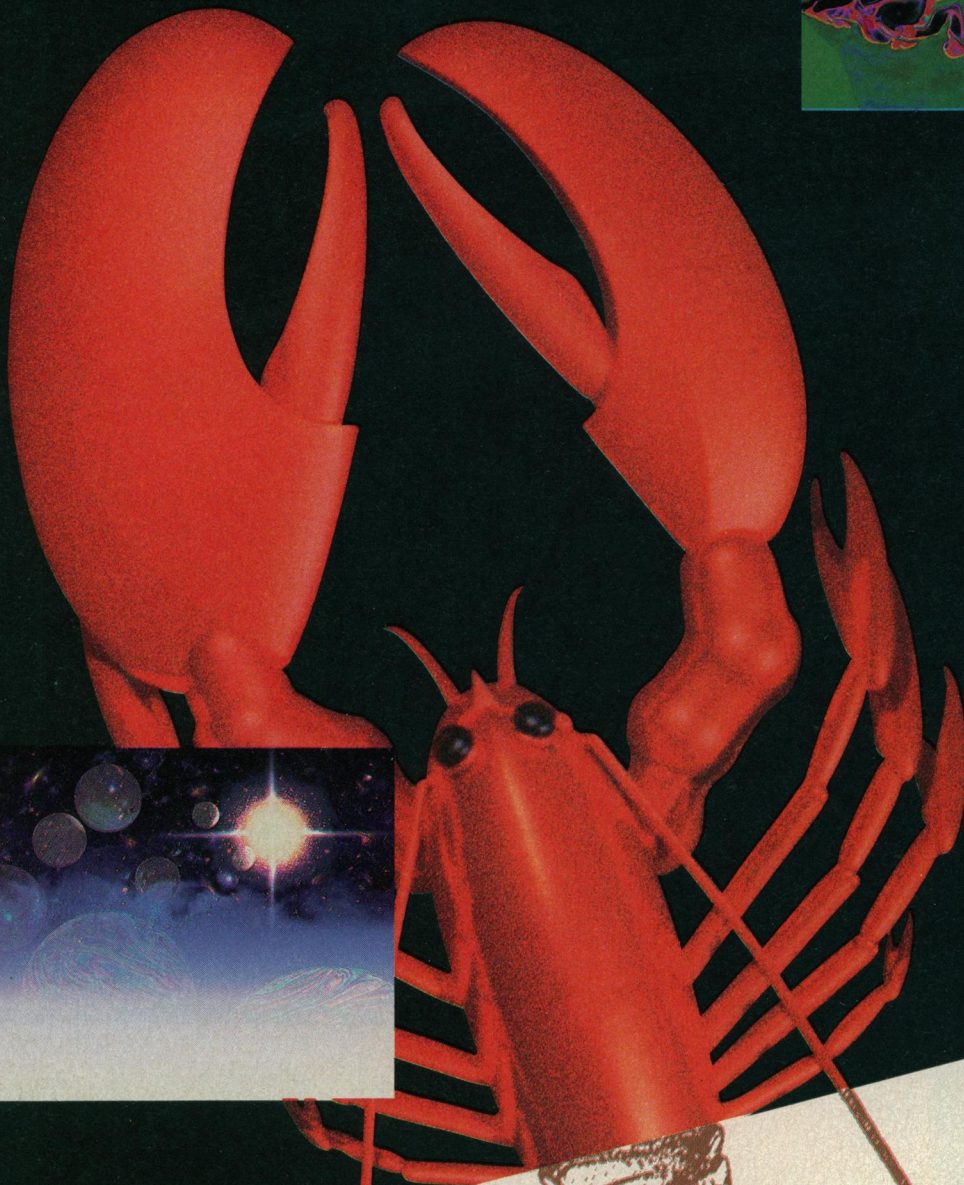
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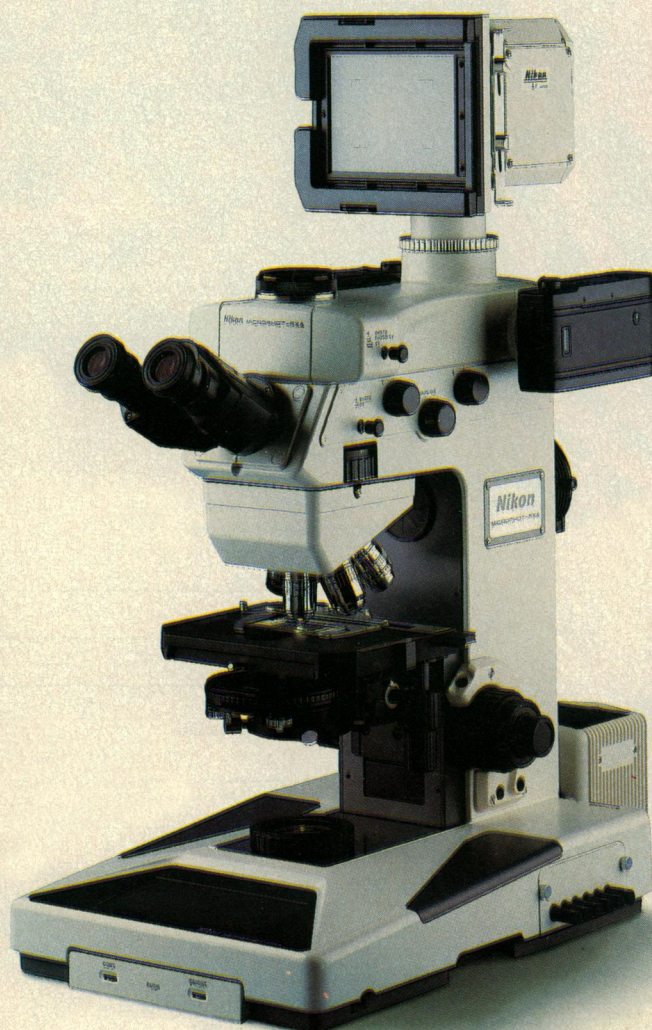
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