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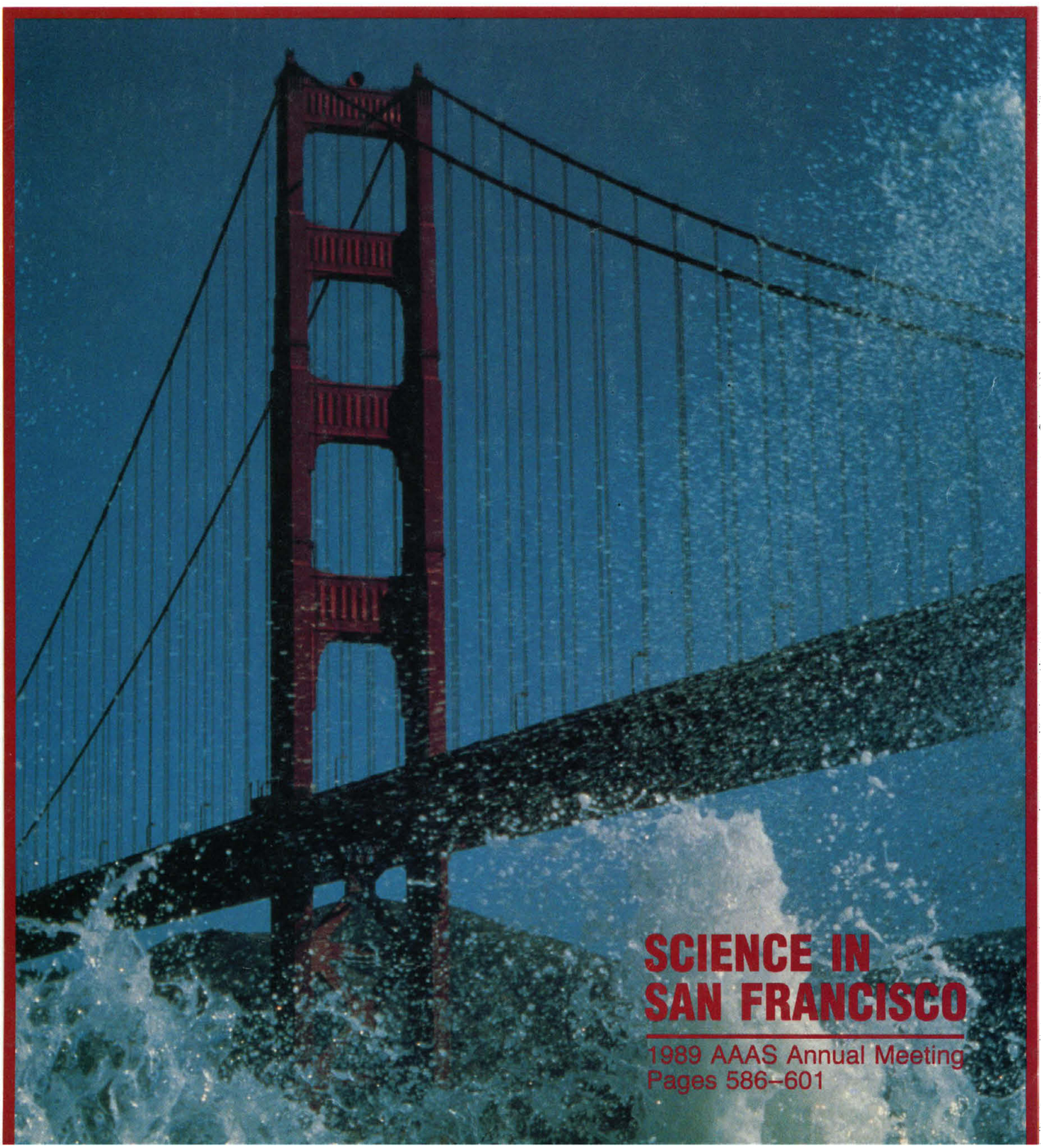

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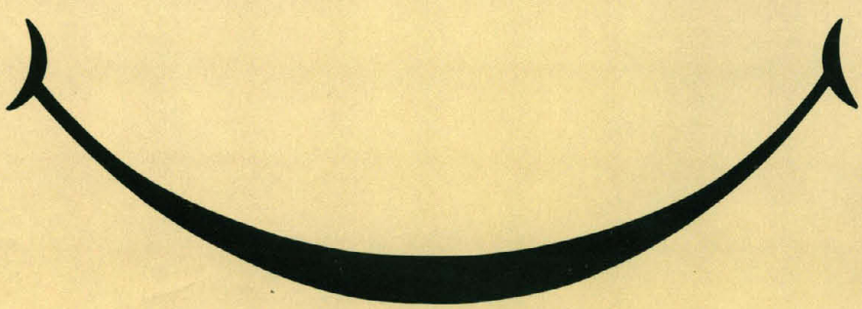

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COVER Golden Gate Bridge, San Francisco, CA. For details of the 1989 AAAS Annual Meeting, 14–19 January 1989, see pages 586–601. [Photograph courtesy of San Francisco Visitors Bureau, San Francisco, CA]

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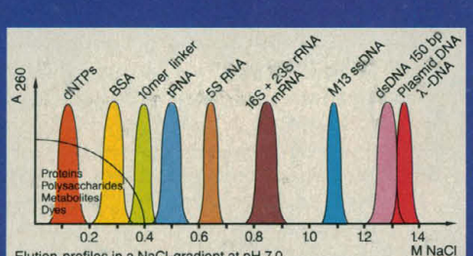

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Arctic ozone depletion

THE North Pole and the South Pole are distinguished by surface topographies, temperatures, atmospheric dynamics, and other differences, yet similar photochemical reactions of halogens appear to be occurring above each; the reactions, which lead to the catalytic destruction of ozone, take place on the icy surfaces of polar stratospheric clouds that can form at temperatures below −80°C. Solomon *et al.* report that the nighttime buildup of chlorine dioxide (a proxy for free radicals involved in ozone loss) is consistent with the occurrence of heterogeneous chemical reactions on Arctic polar stratospheric clouds (page 550). Arctic stratospheric nitrogen dioxide abundances, which directly affect chlorine dioxide, were also measured and were among the lowest that have been recorded at any latitude during any season (Mount *et al.* on page 555). Ozone and several trace gases have also been measured directly in the lower stratosphere at northern mid-latitudes (37°N to 61°N) with instruments mounted on a NASA aircraft (Brune *et al.* on page 558). The loss of ozone above the Arctic is small compared with depletion over Antarctica, but continued anthropogenic release of chlorofluorocarbons and decreases in stratospheric temperatures as a result of carbon dioxide emissions could result in further depletion; the consequences to life on the earth of additional ozone depletion at the North Pole might be substantial because of the relative closeness of population centers and farmlands.

Amino acid detection

SUBATTOMOLE (an attomole is 10^{-18} mole) quantities of amino acids can now be detected with a combination of capillary zone electrophoresis and laser-induced fluorescence (page 562). The new high-sensitivity, high-efficiency separation improves detection of amino acids derivatized with fluorescein isothiocyanate by six orders of magnitude and enhances detection of a fluorescent tag by four orders of magnitude over what was previously possible with state-of-the-art technologies. Of 18 amino acids in a mixture, 14 were resolved in 25 minutes, and it is anticipated that buffer conditions will be found for separating the four types of residues—phenylalanine, histidine, valine, and proline—that coelute. Cheng and Dovichi point out that, if a miniaturized solid-phase sequenator can be developed that will produce amino acids in volumes that match the requirements of the new apparatus, it will at long last be possible to sequence many proteins that are available in only trace amounts.

Xeroderma pigmentosum

XERODERMA pigmentosum is an inherited disease: the skin and eyes of affected individuals are especially vulnerable to sunlight, the incidence of skin cancers is high, neurologic problems abound, and frequently the disease is fatal. Cells of patients with xeroderma pigmentosum are known to be defective in their ability to repair damaged DNA. Using probes made of physically altered DNA molecules in a gel electrophoresis binding assay, Chu and Chang found that a nuclear protein is missing in cell extracts from "group E cells" of patients with xeroderma pigmentosum (page 564); the nuclear protein is present in normal cells, can bind to damaged DNA, and appears to be instrumental in DNA repair. Because repair is crucial to the maintenance of all cells, further study of the protein will be important not only for understanding the genetic and biochemical bases of xeroderma pigmentosum but also for understanding the ongoing processes by which DNA is repaired in cells.

Sex determination in reptiles

HYBRIDIZATION studies indicate that reptiles have a gene that is homologous to the mammalian gene *ZFY*. In mammals, this gene resides in the region of the Y chromosome that causes male development, and it is thought to be the testis-determining factor. Bull *et al.* report that no differences were found in the distribution or expression of *ZFY* among male and female reptiles, including lizards, snakes, turtles, geckos, and alligators (page 567). This contrasts with hybridization studies in placental mammals: *ZFY* probes reveal two bands associated with the Y chromosome and one associated with the X chromosome. *ZFY* also did not hybridize differently to reptiles whose sex was determined by sex chromosomes and reptiles whose sex was determined by the temperature at which the eggs hatched. Thus, it is likely that the reptilian homologs of *ZFY* reside on chromosomes other than the sex chromosomes. The sexual development of reptiles that have and lack sex chromosomes may be similar in both being dependent on the expression of *ZFY* and the actions of its product.

Mineralocorticoid receptors

A SOLUTION has been found for a long-standing puzzle in endocrinology (page 583). Mineralocorticoids and glucocorticoids are adrenal steroids; they play a part in the body's response to stress, the metabolism of minerals and glycogen, and various activities of the immune and nervous systems. In vitro studies have indicated that a number of tissues have receptors to which these steroids bind with equal affinity, yet, in vivo, not all of these tissues are actually targets of mineralocorticoid actions. Funder *et al.* show that binding specificity in mineralocorticoid target tissues is conferred through the intervention of an enzyme that alters the glucocorticoids but not mineralocorticoids. Although circulating levels of glucocorticoids are much higher, the enzyme converts glucocorticoids to analogs that cannot bind to the receptors. The highest amounts of the enzymes are present in precisely those tissues that are targets for mineralocorticoid actions—kidney, parotid, and colon—and not in the heart and hippocampus, two nontarget but receptor-bearing tissues.

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Improving U.S. Capabilities in Technology

Many components determine a nation's ability to function in global competition in technology. An important factor is the number and quality of physical scientists and engineers. Recent reports by the Office of Technology Assessment and the National Academy of Engineering (NAE)* indicate that this country could improve its capabilities substantially by investments of federal funds in support of graduate education and lifelong training. The need for constructive action is especially apparent for engineering. Today the majority of graduate students in U.S. engineering departments are foreign citizens. About 60 percent of assistant professors under 35 years of age are foreign-born. Another noteworthy phenomenon is that practice of some branches of engineering is changing rapidly. The NAE report suggests that the half-life of an engineer's skills in 1986 is 2.5 years in software engineering, 5 years in electrical engineering, and 7.5 years in mechanical engineering. With the practice of engineering changing so rapidly there is need for lifelong learning.

About 90 percent of individuals obtaining a baccalaureate degree in engineering in the United States are citizens. However, only 41 percent of the small number of Ph.D.'s are native-born Americans. The typical holder of a baccalaureate degree finds employment in industry at an annual salary on the order of $30,000. Fewer and fewer U.S. citizens are willing to forego such salaries in favor of several years of graduate student poverty and expense (sometimes including debt) that will yield a few thousand dollars more in annual starting salary. In the meantime, other members of the same age cohort may have received substantial boosts in pay.

Training foreign citizens here in graduate school is not all bad. Some remain in this country and are valued for their contributions. But most have temporary visas that require them to return to their native lands. The tendency of faculties of engineering schools toward becoming dominated by those steeped in foreign cultures is of some concern. Would-be women engineers have complained of attitudes of some of their professors. Others have stated that the lectures of foreign-born instructors are difficult to follow. Another troublesome phenomenon is the tendency of U.S. companies to contract part of their engineering in Korea, India, and other countries abroad. As the flow of foreign engineering Ph.D.'s back to their homelands continues, we may find ourselves at increasing comparative disadvantage.

Much of the new knowledge that leads to technological innovation comes from the physical sciences and their applications in research in such areas as materials science. The annual number of Ph.D.'s in chemistry and physics totals only about 3000. Part of the reason for this small yield is federal policies with respect to graduate student support. Full-time physical science graduate students with federal support at Ph.D.-granting universities in 1986 totaled only 3500. In contrast, in the life sciences 18,000 received full-time federal support. Were the federal government to devote several hundred million dollars annually to graduate fellowships in the physical sciences and in engineering, a substantial change would likely occur in the flow of Ph.D.'s and eventually in our competitiveness. The situation would be further improved if some of the fellowships were made available under a rubric similar to the Congressional Awards for Science and Engineering proposed by Doug Walgren (D–PA).†

Some major companies have substantial programs for continuing training of their employees and have found them effective. Charles W. Hoover, Jr., of Bell Laboratories has provided an example of payoff for continuing education. A fivefold increase in productivity of the design engineering staff on circuit board design over a 10-year period resulted from application of training and computer-aided design facilities. Post-university training is often goal-oriented and is usually not very feasible for either personnel of small companies or faculties of universities. Exploratory programs aimed at devising the best procedures for retraining mature scientists and engineers merit federal support. An upgrading of our existing work force could be the fastest and most humane way of improving our capabilities in physical sciences and technology.—PHILIP H. ABELSON

*Office of Technology Assessment, "Educating scientists and engineers" (Government Printing Office, Washington, DC, June 1988); National Academy of Engineering, "Focus on the future" (Washington, DC, 1988). †D. Walgren, "A proposal to Congress and the nation" (editorial), *Am. Sci.* **76**, 428 (1988).

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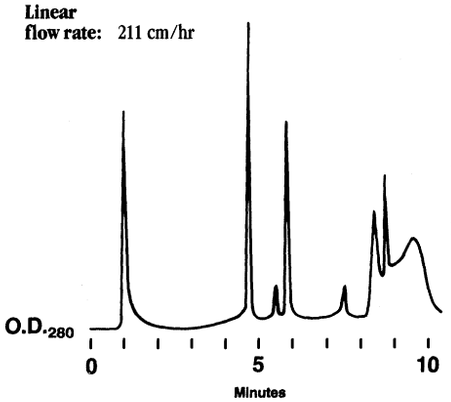

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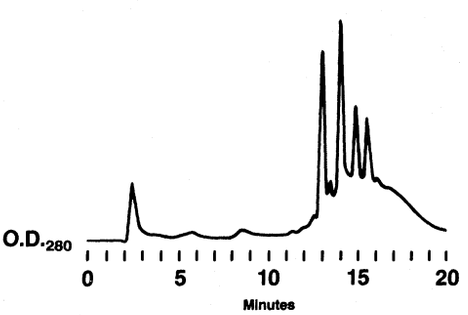

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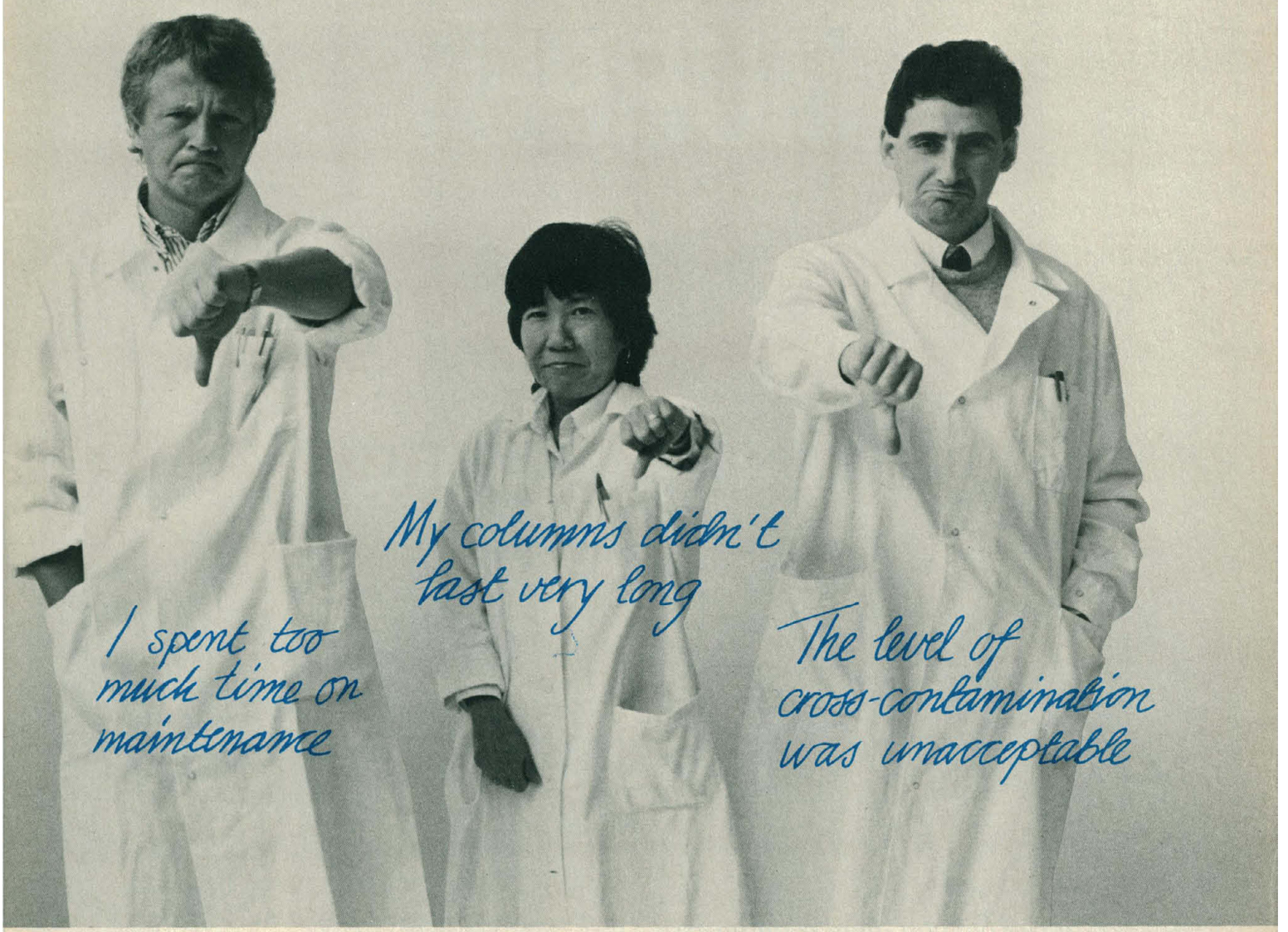

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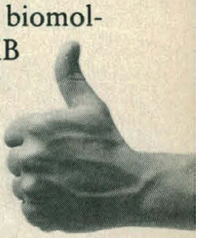

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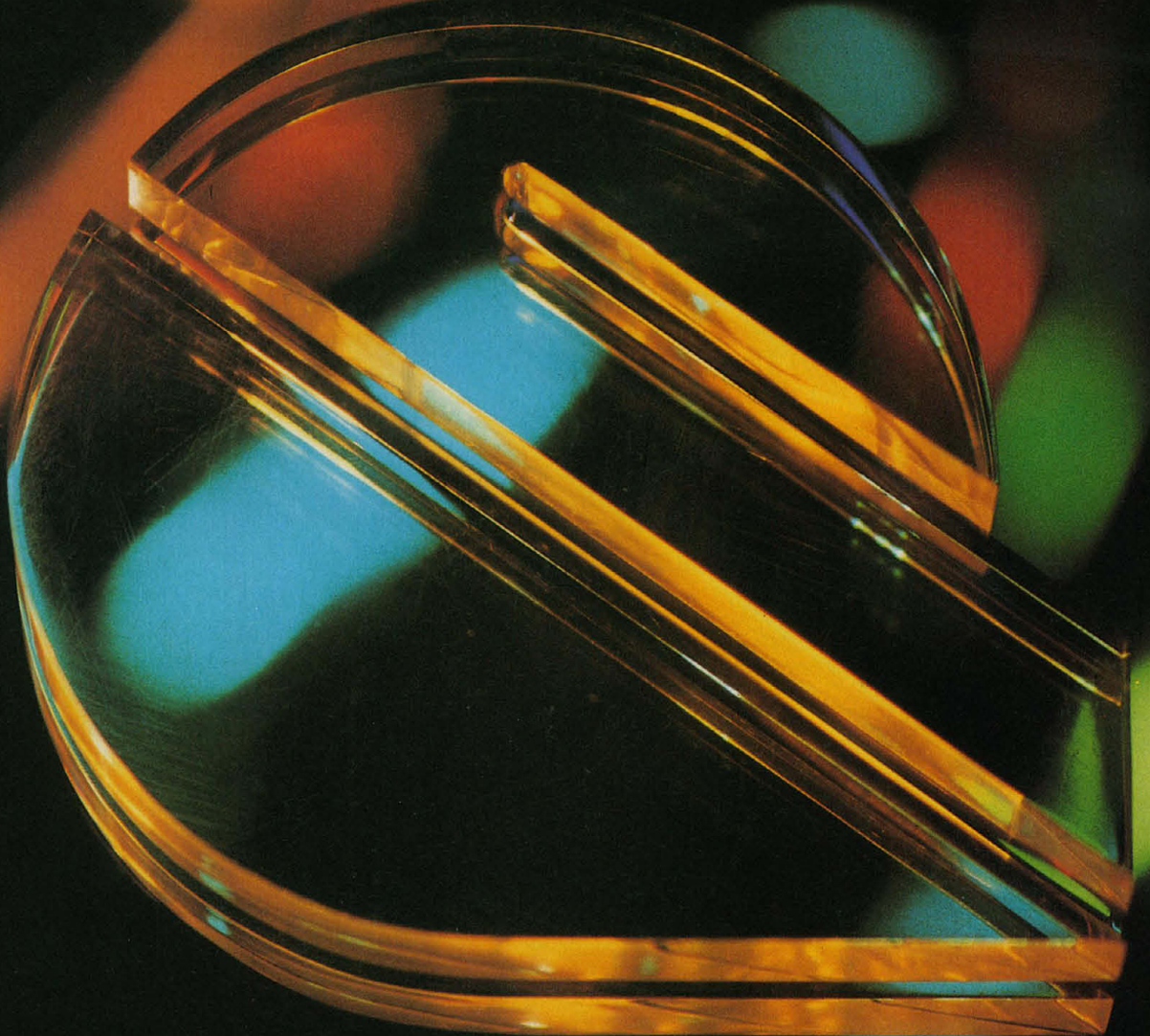

Some of the international meetings scheduled for 1989 are:

Unexplained Infertility: Basic and Clinical Aspects
Rome, Italy/March 7-8
Scientific Organization: G. Benagiano (I), K.J. Catt (USA) and G. Spera (I)

Symposium on the Pathogenesis and Control of Viral Infections
Beijing, Republic of China/April 24-26
Scientific Organization: F. Aiuti (I), Z. Zonghan (PRC) and S. Guoxian (PRC)

8th Workshop on Development and Function of the Reproductive Organs
Touraine, France/May 23-25
Scientific Organization: N. Josso (F)

1st International Congress on G.I.F.T.: from Basics to Clinics
Rapallo, Italy/June 8-10
Scientific Organization: R.H. Asch (USA) and L. De Cecco (I)

Membrane Technology in Clinical Pathology, Biochemistry and Pharmacology
L'Aquila, Italy/June 19-23
Scientific Organization: R. Verna (I), R.P. Blumenthal (USA), J.A. Hannover (USA) and R.P. Garay (F)

Cardiovascular and Neurological Function and Ovarian Secretions
Dubrovnik, Jugoslavia
Aug. 31-Sept. 1
Scientific Organization: F. Naftolin (USA)

Establishment of a Successful Human Pregnancy
Cambridge, U.K./September 21-23
Scientific Organization: R.G. Edwards (UK)

Developmental Endocrinology
Geneva, Switzerland/October 23-24
Scientific Organization: P.C. Sizonenko (CH) and M. Aubert (CH)

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