

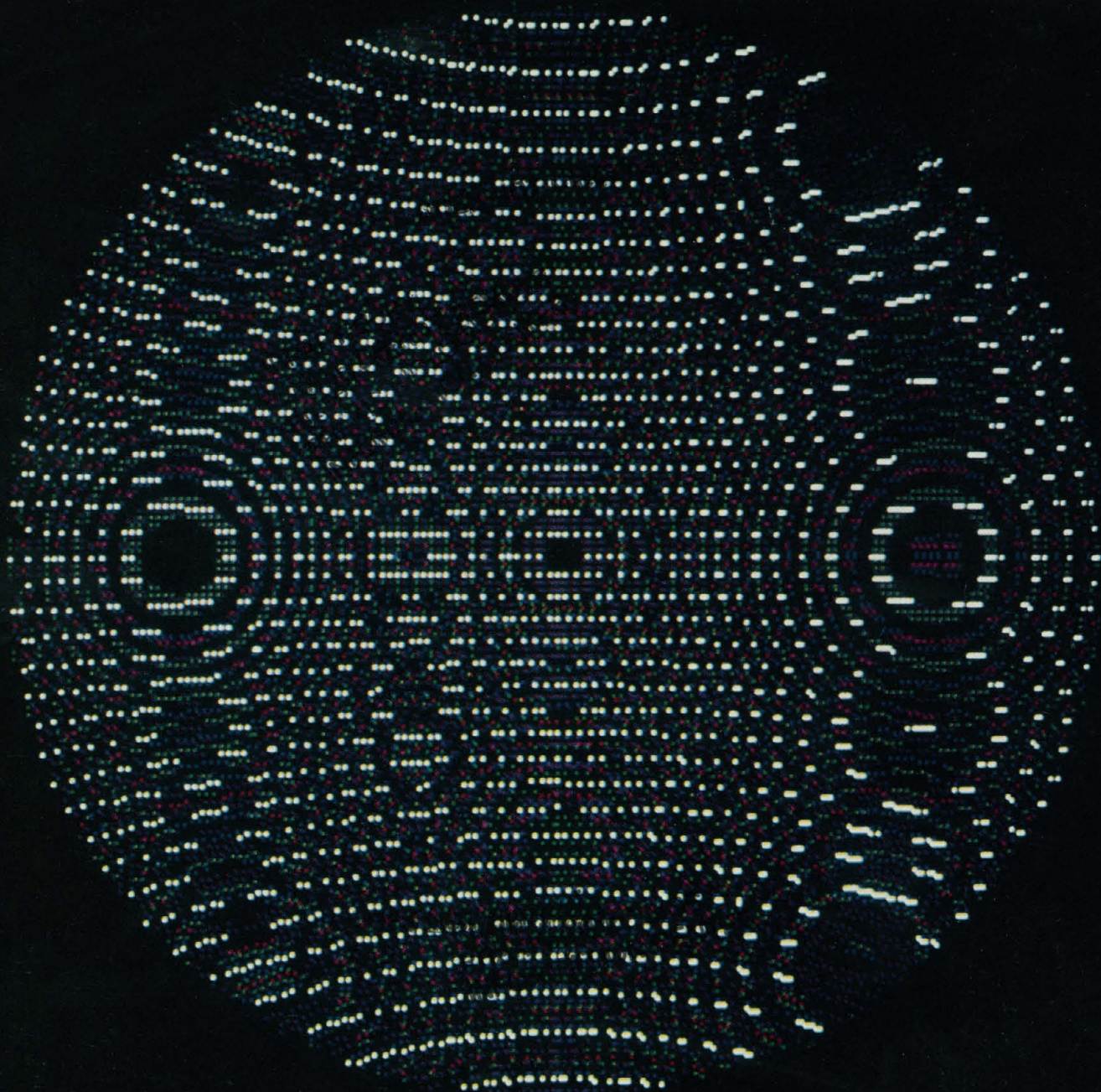
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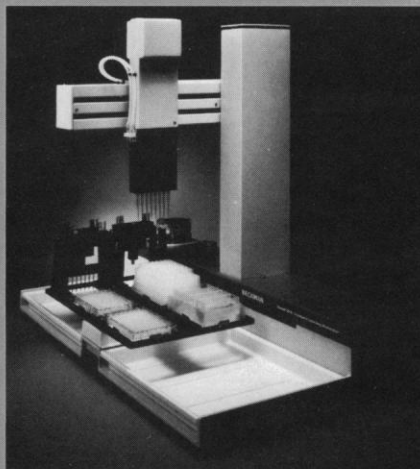
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Indianapolis, Indiana	Embassy Suites	Thursday, December 10, 1987
Somerset, New Jersey	Somerset Marriott	Friday, December 11, 1987
Swedeland, Pennsylvania	King of Prussia Hilton	Monday, January 25, 1988
Bethesda, Maryland	Marriott Pooks Hill	Wednesday, January 27, 1988
Chicago, Illinois	North Shore Hilton	Friday, January 29, 1988

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COVER A computer-simulated field ion microscope image of a yttrium-barium-copper-oxygen high T_c superconductor, assuming uniform visibility of atoms in the orthorhombic unit cell (c-axis vertical). The dots correspond to the various surface atoms—white: copper and oxygen atoms in the unit cell end planes; green: the other copper atoms; purple: the other oxygen atoms; red: yttrium; and blue: barium atoms. See page 176. [Computer graphics by Richard Freemire and original photography by Bessmarie Young, National Bureau of Standards, Gaithersburg, MD 20899]

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This Week in SCIENCE

Ion spectroscopy

KNOWLEDGE of the actions and interactions of charged molecules is important for explaining astrophysical phenomena (how stars and planets form from interstellar dust clouds), organic and physical chemical processes (what influences chemical bonding), and dynamics of biologic systems (how electrons and protons are transferred) (page 157). Although a number of stumbling blocks have hampered the study of charged molecules (they are difficult to obtain in high concentrations and are often a minority in a background of mostly neutral species of molecules that are also absorbing), Saykally reports that the "molecular ion revolution" is well under way with observations of charged molecules in plasmas being made in microwave, infrared, and visible regions of the spectrum. One technique described in detail—velocity modulation spectroscopy that uses tunable infrared laser radiation—has already yielded valuable information about more than 50 cations and anions. The diverse spectroscopic strategies can be used to probe structures, behaviors, and other properties of charged species, and for many ions the predictions of theoretical analyses are finally being confirmed.

Diagnosis of brain dysfunctions

THE diagnosis of learning disabilities, mental retardation, depression, dementia, schizophrenia, alcoholism, and other psychiatric and neurologic disorders is gaining precision through the application of neurometric methods (page 162). John *et al.* describe the neurometric approach by which a 60-second electroencephalographic sample is analyzed with detailed statistical methods. A mathematical profile is produced from which a map can be generated that shows the distribution of the brain's electric activity. A baseline "normal" profile characterizes brain functioning in most "normal" individuals; statistically significant deviations from this signature characterize

brain activity in a high proportion of individuals with clinically defined psychiatric, neurologic, and cognitive disturbances. For many disorders, the extent of the deviation correlates with clinical severity. Neurometric methodology shows that characteristic abnormalities in neurophysiologic processes correspond to distinctive psychiatric categories. Neurometrics is already a valuable adjunct to clinical diagnosis and classification and is expected to improve therapies and the management of a range of central nervous system dysfunctions.

Drosophila gene aids neurogenesis

HOW certain cells of the *Drosophila* central nervous system develop depends on the gene *ushi tarazu* (*ftz*), whose name comes from the Japanese meaning "less than the normal number of segments" (page 170). *Ftz* is a "segmentation" gene that initially functions early in development when the segmented body of the fruitfly takes form; Doe *et al.* show that later, during neurogenesis when undifferentiated ectodermal tissue transforms into highly differentiated nervous tissue, the *ftz* gene undergoes a second period of activity in a subset of cells. (The gene product, a protein, remains in the cell nucleus where it is presumed to be a DNA-binding regulatory substance.) Of seven neurons that were followed and that normally express *ftz*, one showed abnormal axon growth when *ftz* and an associated gene, *eve*, were made dysfunctional. This neuron's unorthodox development and altered identity—it acquired characteristics of a different neuron—appear to be directly associated with the lost expression of *ftz*, a gene that thus may have a regulatory role not only in segmentation but also in neurogenesis.

Superconducting layers

IN field ion micrographs of high-temperature superconducting ceramics, more or less parallel rows of

spots are seen across much of the image (page 176). A nonsuperconducting phase of the same type of material lacks such rows. The parallel rows extend (as the sample is evaporated) to depths of at least several hundred atomic layers. These superconductors have two major phases: the orthorhombic phase predominates and has been associated with the property of superconductivity; the tetragonal phase predominates in similar nonsuperconducting materials. Melmed *et al.* associate the rows in the micrographs with the orthorhombic phase and interpret these layers as the end planes of Cu-O atoms of the unit cell (cover). The Cu-O planes evaporate differently in superconducting and nonsuperconducting phases, and it may be along these planes that superconductivity occurs.

Tracking AIDS

NINETY-THREE cases of AIDS were reported from Belle Glade, Florida, between July 1982 and August 1987; seven individuals (8%) appeared to have no identifiable risk factors for the disease (page 193). The high number of cases and the high percentage not fitting a known risk category (nationally that average is 3%) suggested that a previously unrecognized risk factor—most likely an environmental one—might be involved in transmission. Belle Glade is an inland agricultural community to which thousands of migrant workers (American blacks, British West Indians, Haitians, and Hispanics) come each year to harvest sugar cane and other crops. Castro *et al.* conducted detailed seroepidemiologic analyses and extensive personal interviews throughout the community. No unusual modes of transmission of the human immunodeficiency virus were found: most was through needle sharing by intravenous drug users and through heterosexual and homosexual contact. There was no evidence that insects or other local industry or other life-style factors promoted transmission. Incomplete information may account for many AIDS cases for which no known risk factors can be identified.

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Materials Science

Materials science is currently one of the most vital areas of research and development. This was evident in Boston in early December at the annual meeting of the Materials Research Society. A broad spectrum of topics was treated in 18 symposia, including those on superconductors, advanced processes for microelectronics, plasma deposition of diamonds, and catalysts.

The 90 K superconductors have captured attention around the world. Thirty percent of the 260 papers or posters on the topic were furnished by contributors from 22 countries. There have been few times in human history when a scientific finding has been replicated by so many investigators so rapidly in so many places. Many different preparative procedures were mentioned, and the products examined by a variety of instruments. Two impediments to some large-scale applications remain. Thin films of oxides such as $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ can carry up to 10^6 amperes per square centimeter. But superconductivity vanishes when a substantial magnetic field is present. A second impediment is the difficulty of forming a flexible wire from the superconductors. Bell Laboratories announced a substantial advance (see Research News, 18 Dec., p. 1649). By melting the oxide and cooling it in a controlled way, they obtained a product that can carry $1,000 \text{ A/cm}^2$ in a magnetic field of 10,000 or more gauss. Many applications will require 10 to 100 times greater currents in larger magnetic fields. The Bell Labs people are optimistic that they can make further progress.

Information processing is becoming the largest industry in the world. Further rapid progress in microelectronics seems guaranteed. During the past 3 years, there has been a 400 percent increase in the density of memory bits, and the practical limit recedes as a result of the ingenuity of scientists and engineers. Excimer lasers employing XeCl, KrF, or ArF are being used to make experimental chips having features with dimensions as small as 0.5 micrometer. The use of molecular-beam epitaxy continues to grow, permitting the construction of complex sandwiches of differing materials with layers a few atoms thick. Ion beams of oxygen with energies of the order of 200 kiloelectron volts are being employed to form an insulating layer of SiO_2 within a silicon wafer. A beam of cobalt can yield an internal conducting layer of cobalt silicide within silicon.

The large-scale synthesis of diamonds has long been a goal of industry. Diamonds are employed extensively in machine tools, and were synthesis of diamonds easy, they might be used with advantage as semiconductors. Diamonds and graphite are both forms of pure carbon, but it is graphite that is stable thermodynamically. In the 1950s, scientists and engineers at General Electric were able to produce diamonds in an apparatus capable of 5500°C and pressures of 2.8 million pounds per square inch. Now diamonds are being produced using plasma in a partial vacuum. The Russian Deriagin was a pioneer, but his papers were largely ignored. From 1983 on, however, there has been intense activity in Japan and recently in the United States. When a mixture of CH_4 and H_2 is introduced into a plasma, highly active and metastable forms of carbon and carbon-hydrogen entities are produced. When these metastable forms are adsorbed on a surface whose temperature is about 900°C , the carbon atoms form a crystalline structure. Sometimes the structure will be that of diamond, sometimes graphite. When a large fraction of the gas in the plasma is hydrogen, copious amounts of atomic hydrogen are made which reacts about a hundredfold faster with graphite than with diamonds. Thus nearly pure diamonds are the net product.

Industrial catalysts take many forms, one of which is a cave-like structure present in zeolites. Once process molecules enter the caves, they encounter active sites that catalyze reactions. In the past, the size of the opening in zeolites limited the kind of molecule that could be processed. At the meeting, new structures having larger openings were described. These included pillared micas and a zeolite type of structure formed predominantly from alumina and P_2O_5 .

At Boston many more topics were treated than those touched on above. A 564-page book devoted to the program and abstracts and of presentations provides a further indication of the international character and broad scope of the program.

—PHILIP H. ABELSON

*The Materials Research Society, *Final Program and Abstracts*, Boston, MA, 30 November to 5 December 1987.

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A full MAS program will include other techniques and applications utilizing focussed beams.

The **commercial exhibition** will feature a large range of instrumentation, accessories, supplies and publications for electron microscopy, electron probe analysis and specimen preparation. Demonstrations will be offered on the state-of-the-art microscopes. It is anticipated that more than 100 companies will participate.

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Scientific Organization: B.A. Cooke (UK)

Endocrinology Under 35
Florence, Italy / May 23-25
Scientific Organization: M. Maggi (I) and C.J. Johnston (USA)

Platelets and Vascular Occlusion
Rome, Italy / June 1-3
Scientific Organization: G.A. FitzGerald (USA) and C. Patrono (I)

Advances in Biotechnology of Membrane Ion Transport
L'Aquila, Italy / September 19-20
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Scientific Organization: G.B. Rossi (I), F. Takaku (J) and S. Waxman (USA)

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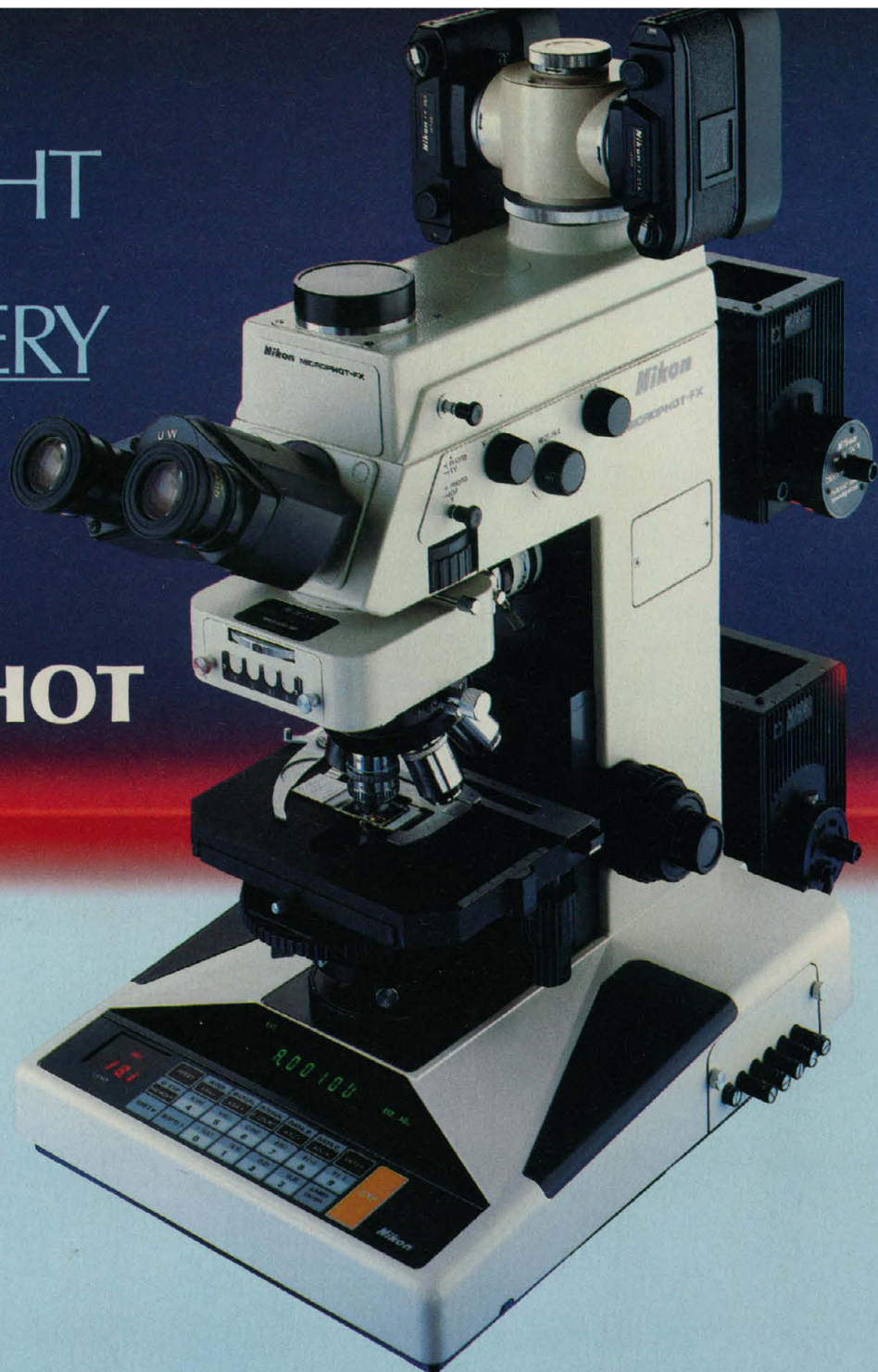
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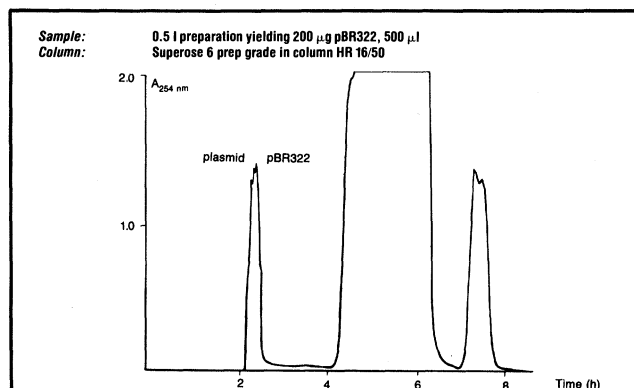
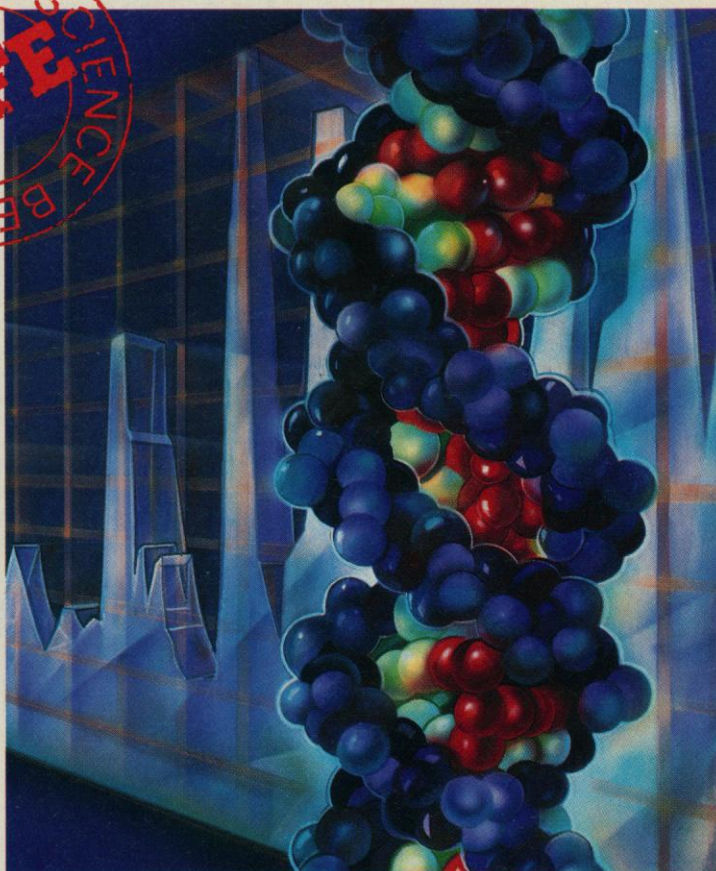
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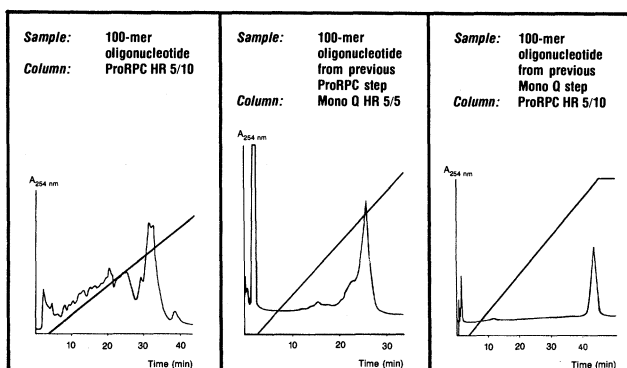
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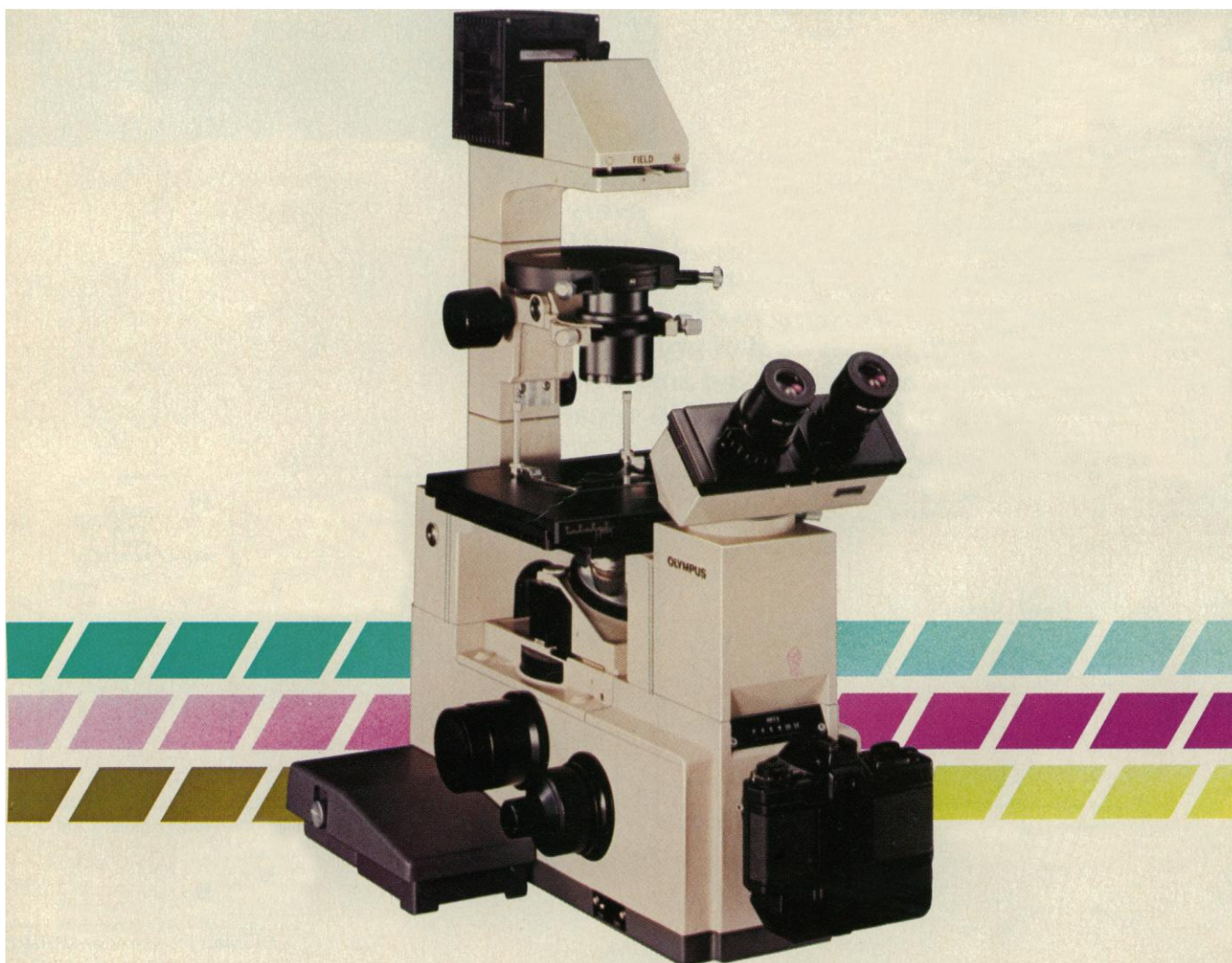
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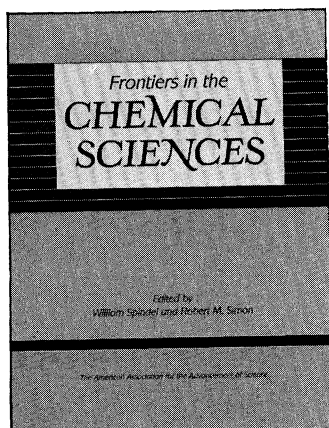
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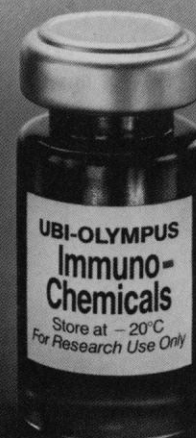
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