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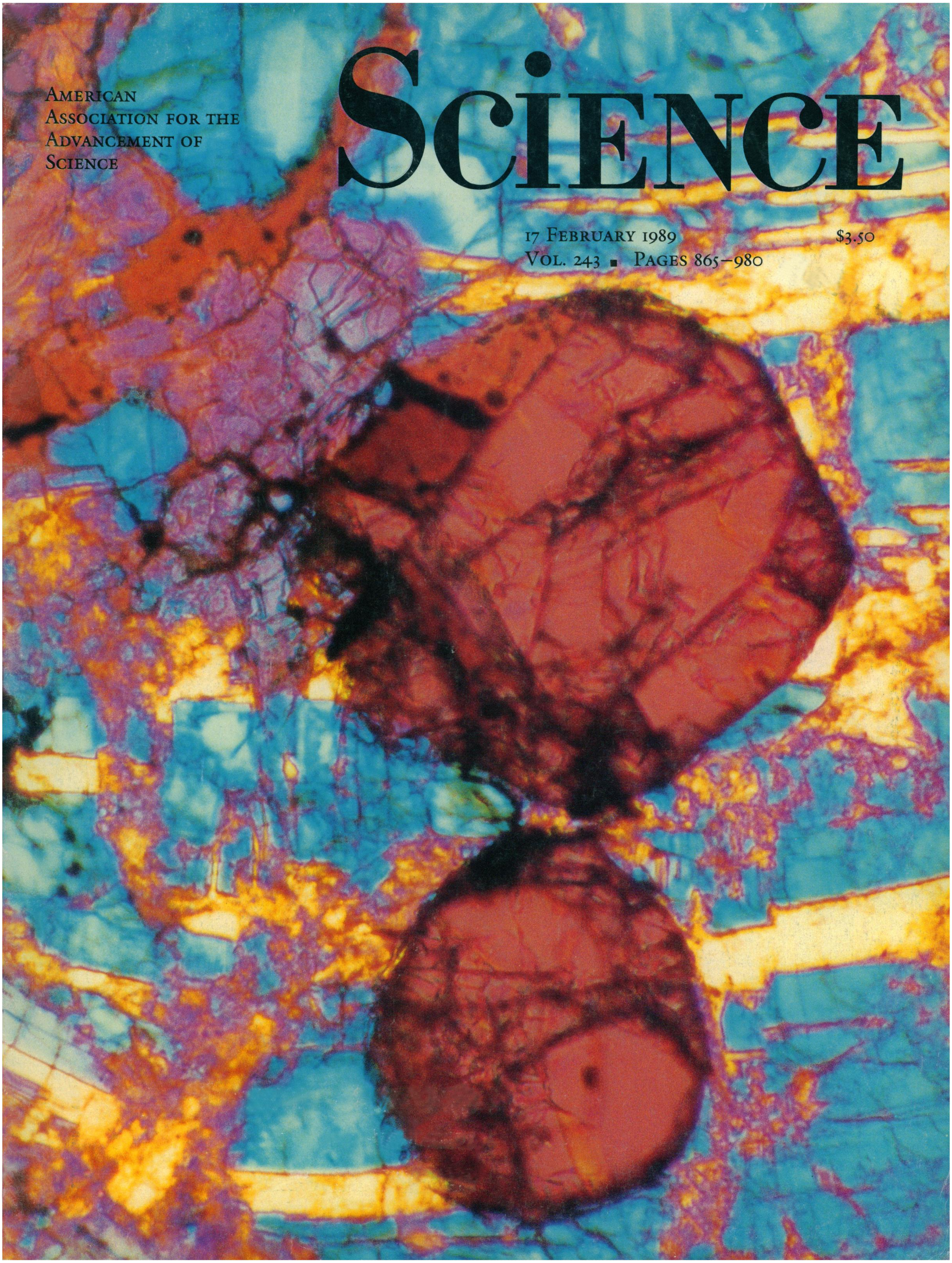

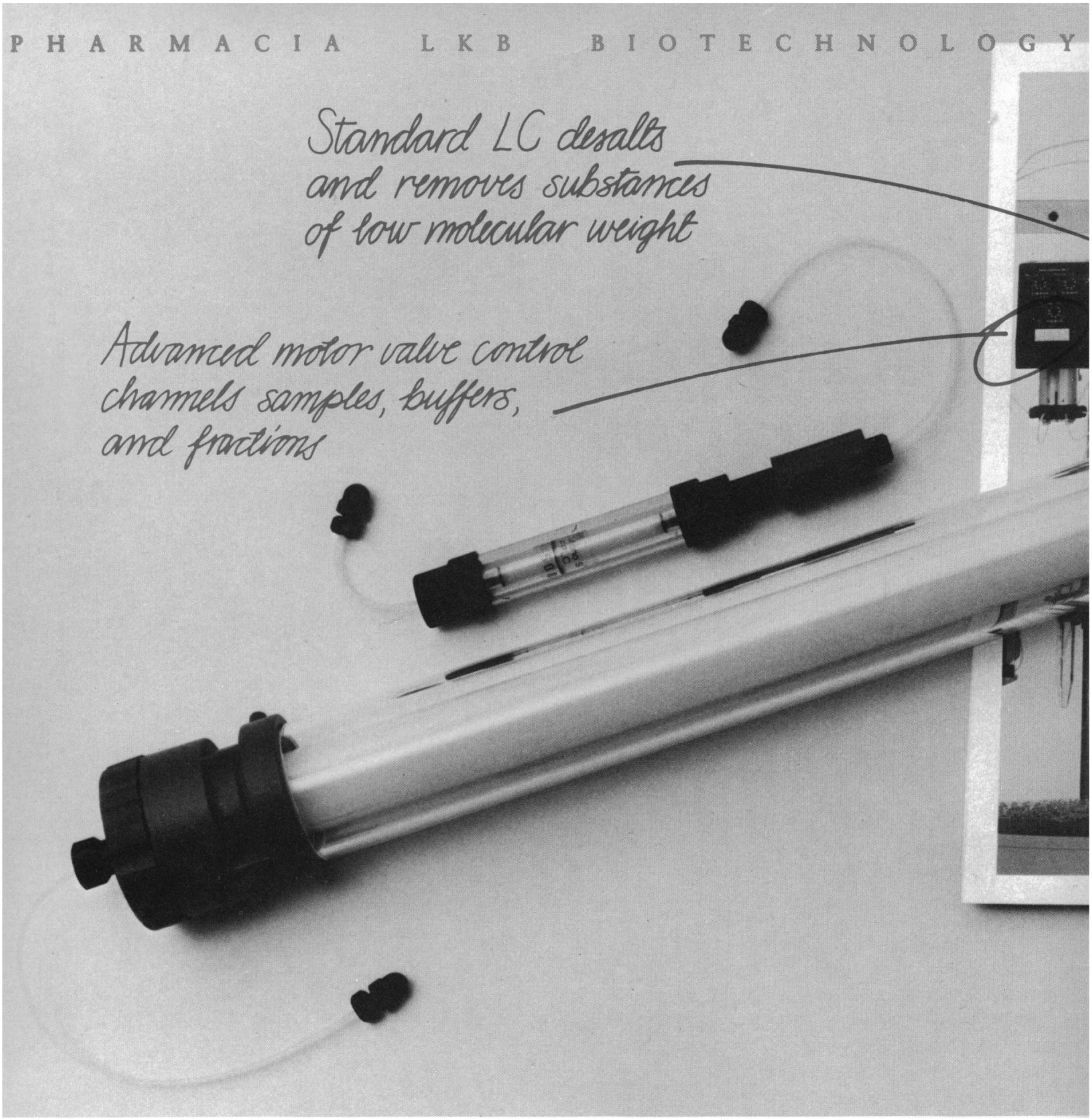

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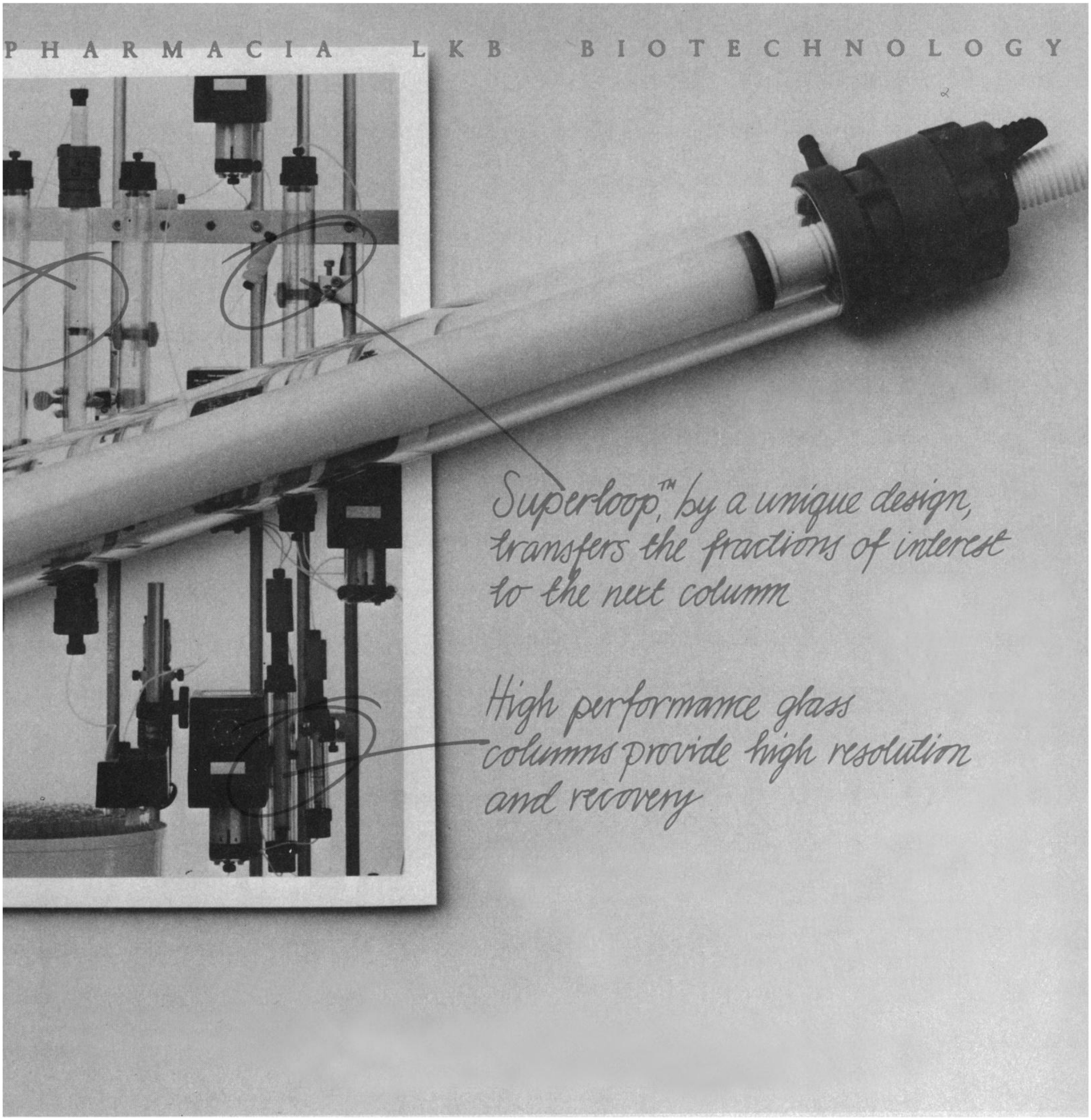
* *"An Automated Multidimensional Chromatography System for the Separation of Proteins," Hans Lindblom and Lars Fågerstam, LC Magazine, Vol. 3, No. 4, April 1985.*



cation was simply not possible!

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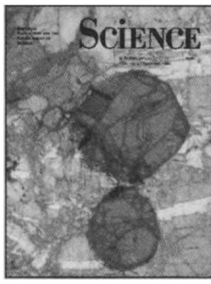

COVER A fragment of lunar cordierite-spinel troctolite from the Apollo 15 mission. Two spinel crystals (reddish brown) and an adjacent grain of cordierite (lavender pink, upper left) are included in twinned plagioclase feldspar (blue and yellow). The crackled textures, offset twin lamellae, and weblike pattern (lavender pink and yellow) of finely crushed feldspar are shock features. (False-color photomicrograph taken in partially cross-polarized light with gypsum accessory plate; long edge of field is 0.53 millimeter.) See page 925. [Photomicrograph by Ursula B. Marvin]

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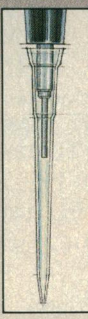

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This Week in SCIENCE

Regulation of bacterial virulence

A consideration of the complex process of bacterial pathogenicity raises a number of interesting issues (page 916). How do pathogens sense their environments and what environmental signals—temperature changes, iron, *p*H, osmolarity, amino acids, and others—do they detect? How do the pathogens produce local and later systemic toxic effects in their hosts? How do the hosts modulate the behavior of pathogens and how have host responses contributed to the evolution of bacterial responses? Finally, what molecular mechanisms regulate these processes and how are the regulators distributed between chromosomal and extrachromosomal elements? Miller *et al.* find that many pathogenic organisms use a two-component regulatory motif for linking environmental stimuli with appropriate virulent responses: a paradigm drawn from studies of a plant pathogen illustrates environmental stimuli inducing sensors in the bacterium, sensors inducing regulators, and regulators generating responses. The regulatory networks that lead to the production of virulence factors appear to be general features of bacterial agents as different as those causing cholera, whooping cough, bubonic plague, dysentery, acute gastroenteritis, and other human diseases. Furthermore, in diverse organisms, some of the protein sequences that participate in virulence regulation have been found to be homologous.

Cordierite on the moon

CORDIERITE is a mineral that, on the earth, is found in aluminum-rich metamorphic rocks. It has now been identified in a sample from the moon (cover) that was collected during the Apollo 15 mission of 1971 when the lander explored the moon's Apennine Mountain region (page 925). Cordierite is a rare mineral not only in lunar samples but also among meteorites. Marvin *et al.* speculate that the cordierite formed from metamorphic recrystallization of magnesium-rich and aluminum-rich rock deep in the lunar crust at a depth of less than 50 kilometers, which is about 10 kilometers above the crust-mantle boundary. The sample was apparently "excavated" by a major impact, perhaps the impact that produced the large Imbrium Basin that is near the collection site. The discovery suggests that rocks rich in magnesium and aluminum, such as spinel cumulates, may be significant components of the deep lunar crust.

HIV-1 protease structure

THE aspartic protease of the human immunodeficiency virus (HIV-1) is a critical enzyme: in its absence, viral particles form improperly and are noninfectious. Thus a drug that would interfere with protease activity might be a powerful blocker of HIV-1 infectivity. Toward this end, a model has been constructed by Weber *et al.* of the structure of the HIV-1 protease (page 928). It is based in part on the recently solved three-dimensional structure of a related protease from another retrovirus, the Rous sarcoma virus: the Rous protease is somewhat larger (124 amino acids) than the HIV-1 protease (99 amino acids), but both are symmetric dimers with a characteristic triplet in the active site and shared biochemical properties. Details of how the site would interact with an inhibitor were drawn from an analysis of rhizopuspepsin—a more complex but related protease—in contact with its inhibitor. This structural information can be used in the design of HIV-1 protease-specific inhibitory drugs.

Photoreceptor cell development

WHAT determines the fate of a developing cell—cell-specific surface receptors, spatially or temporally restricted environmental signals, or other variables? Basler and Hafen have addressed this question with a study of the development of the R7 cell, one of eight photoreceptor cells that is present in each ommatidium (a structural unit) of the fruit fly's compound eye (page 931). The gene *sevenless*, which specifies an R7 surface receptor, was inserted into all cells and thereafter was expressed ubiquitously; yet only the R7 precursors went on to develop into R7 cells. The precursors of the other photoreceptor cells developed into the cell types for which they had originally been programmed. The product of *sevenless* is a protein that spans the cell membrane, and it has both intracellular and extracellular domains. It appears that this protein receptor interacts with a local environmental signal—probably a protein from a neighboring cell—and, upon activation, goes on to specify what the cell's fate will be. Thus it is not enough for the precursor to have the appropriate surface marker; it must also be in the right place at the right time to pick up critical environmental cues concerning its development into an R7 cell.

Bacterial adherence and invasion

INTRACELLULAR pathogens such as *Salmonella* species communicate with target cells that they will invade. The *Salmonella* first adheres reversibly, then irreversibly, to host epithelial cells; later they reside in and multiply in the cells and may then penetrate through the cells to produce such diseases as typhoid and salmonellosis. The early communication of host and pathogen is triggered by glycoproteins on the surface of the epithelial cell; the pathogens respond by synthesizing several new proteins and by adhering more stably to the cell. In the experiments of Finlay *et al.*, organisms in two *Salmonella* species were shown to adhere to cells, synthesize RNA and protein, and then invade the cells; mutants that could not make the new proteins also could not adhere stably or invade (page 940). The newly formed proteins are virulence factors, and they may be important not only for the invasion but perhaps also for the successful adaptation of the bacteria to intracellular life. This system is probably an example of a two-component regulatory motif.

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The Arctic: A Key to World Climate

The Arctic is part of a great global heat engine. Changes in the arctic atmosphere, ocean, sea ice, and permafrost are early precursors to climate change elsewhere. In the past, those changes have been drastic. Only 18,000 years ago, virtually all of Canada and some of the United States were covered by a thick layer of ice.

At the recent AAAS Annual Meeting, a symposium brought together some of the leading research scientists active in studies of resources and climate.* In one of the sessions, speakers reviewed information about the evolution of the arctic climate.

A principal impression that could be drawn from the symposium was that the current hypothesis concerning effects of greenhouse gases on arctic behavior is probably simplistic and may be quite wrong. The public has been told repeatedly that a result of increased greenhouse gases would be a substantial rise in sea level due to melting of polar ice. A related statement frequently made is that the increase in polar temperatures would be substantially greater than those of global averages. For example, one estimate is that an average rise of 2°C would be accompanied by a 10°C increase in the Arctic. That estimate may or may not adequately take into account climatic feedback mechanisms. At the symposium this point was raised implicitly by John T. Andrews, who stated that the Greenland Ice Sheet and the Laurentide Ice Sheet advanced during a period of warm water influx into Baffin Bay at the end of the last interglaciation.

The vapor pressure of water is quite sensitive to temperature. Condensing moisture in the form of snow provides a surface cover that highly reflects solar energy leading to a regional cooling. The albedo (reflectivity) of ordinary soil is about 0.1. The albedo of snow is about 0.8. At present, some of the arctic land areas that have averaged annual temperatures of about −14°C receive only 10 centimeters of total H_2O per year. Most of the time the surface is bare and is a good absorber of solar heat. Were more precipitation to occur, the total heat absorbed by the surface would decrease. With greater moisture in the air, there would be more clouds. The net effects of these are controversial. Some say that more clouds would reflect more energy away from the earth. Others point out that added moisture would enhance a greenhouse effect in the Arctic. In any event, the factors controlling arctic climate are complex.

One of the obstacles to confidence in predicting the future of the arctic climate is an imperfect knowledge of the past. We know that 70 million years ago, the climate was mild and the Arctic Ocean was ice-free. Sediments formed about 5 million years ago contained glacially related materials. We know little about what happened in the long interval, and knowledge concerning more recent events is sketchy. No long cores have been obtained from the Arctic Ocean. The impediment is the perennial ice sheet that covers most of that ocean. The thickness is usually about 3 to 4 meters, and the sheet tends to keep moving. At the geographic North Pole, the depth of the ocean is about 3500 meters.

Our best source of evidence concerning the last million years is found in near-shore sediments, and particularly on fossil-bearing terraces. Molluscan fossils are particularly useful. Different molluscan species have different temperature affinities. In addition, they contain partially hydrolyzed proteins. The degree of racemization of isoleucine is a function of times and temperatures. The shells also contain strontium as a trace element which provides a dating potential. The ratio of ^{87}Sr to ^{86}Sr in seawater has changed monotonically over the last several million years. For events during the past 40,000 years ^{14}C dating can be applied. Other types of fossils are being studied and additional dating methods employed. Measurements of ratios of ^{18}O to ^{16}O in ice are useful in determining temperatures at which atmospheric moisture was converted into ice. Oxygen isotope ratios of shells reveal temperatures present during their formation.

The importance of understanding the past, present, and future of the arctic climate requires that support for such activities have a top priority. Desirable efforts include more studies of fossils, an international program of deep drilling in the Arctic, more weather monitoring, and additional satellite surveillance of the polar region.—PHILIP H. ABELSON

*"The Arctic: A New Key to World Climate and Resources," organized by P. W. Barnes and K. A. Kvenvold of the U.S. Geological Survey, Menlo Park, CA, and held on 19 January 1989 in San Francisco, CA.

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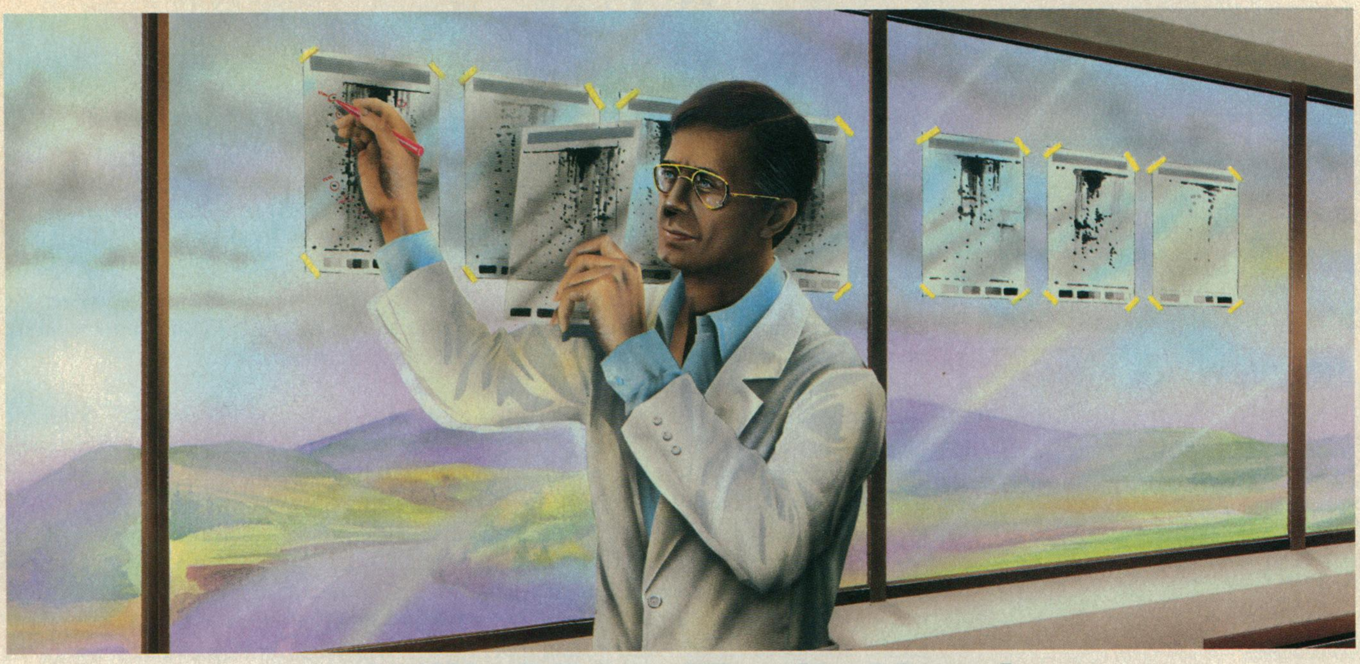

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of stishovite. Little is known about the effects of impurities and load rate on the formation of this high-pressure polymorph of quartz, but equilibrium-phase relations indicating a transition at 90 kilobars do not rule out volcanic processes. The retrogressive failure of the gravitationally stable north slope at Mount St. Helens is an indication that shock disruption was brought about by a preceding explosion at depth. This was confirmed by the far-field signature of the seismic event some 10 seconds earlier. This earthquake had azimuthal uniformity in P-wave polarity and depressed S-wave amplitude. The fact that P-wave first arrivals were up indicates that decompressive volcanic "explosions" are as mythical as those K/T impact sites whose abundance on the earth exceeds, for some people, that of volcanoes. The throw velocity of the north slope indicates that pressures some 5 kilometers beneath Mount St. Helens were many hundreds of kilobars.

Kerr appears to interpret the steadied progress and cautionary presentation of the work of Neville Carter and his colleagues (who have joined the decade-long debate in just the past couple of years) as an indication of doubt that multiple-shock lamellae will ever be found in association with volcanic activity. He might have reported instead the caution of the volcanic proponents that the annealing temperatures of magmas would mean that they are not a source of shocked minerals: such things must come from the surrounding country rock. Further, he does not not inform the reader that the Manson crater does not coincide with the K/T event (*1*); nor does he reveal that multiple lamellae have been reported in mafic breccia dykes (*2*) and that coesite, another high-pressure polymorph of quartz, has been found in purely tectonic settings, such as the Caledonides, the Urals, and the Alps, indicating endogenous pressures above 30 kilobars (*3*). Finally, Kerr does not discuss the fact that the decline of the dinosaurs took place over millions of years, which would call for a rather slow-landing meteor.

That iridium and shocked minerals may have a connection with mass extinctions is perhaps the most important scientific discovery of the decade, and the initial suggestion of an impact as causal is certainly an educated guess that has been extremely valuable in stimulating much effort in astronomy, astrophysics, and paleontology. But in some quarters this interesting guess has not been allowed the natural scientific evolution that would have at least retained for it some glory as the progenitor of more advanced thinking. Instead, it appears to have been immediately accorded the deity of something that also seems as rare as the unicorns to which Kerr alludes, a "death star." Why so many people have attached their wagons to this star will provide much material for behavioral scientists, historians, and others for decades to come.

ALAN RICE
Department of Physics,
University of Colorado, Denver, CO 80204

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Erratum: Leslie Roberts' article "A corrosive fight over California's toxics law" (News & Comment, 20 Jan., p. 306) incorrectly states that chloroform is used to chlorinate drinking water. Chloroform is formed during the chlorination process.

Erratum: Because of a transmission error, the West German government's position on Europe's genome program was incorrectly stated in David Dickson's News & Comment article "Genome project gets rough ride in Europe" (3 Feb., p. 599). The Bundestag has given its qualified approval to the program. It has not endorsed the views of a parliamentary committee that opposes the effort, as the article stated.

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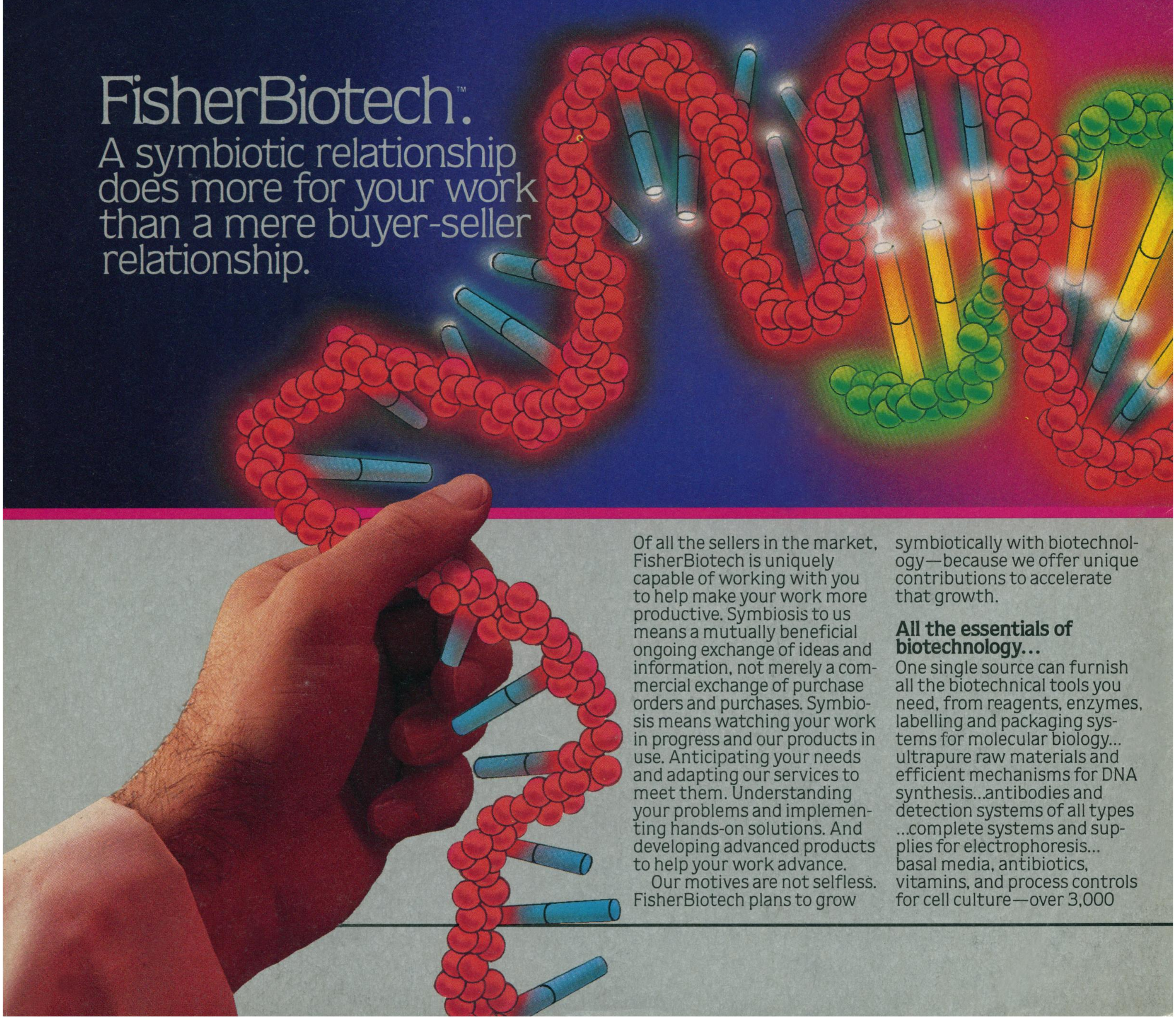

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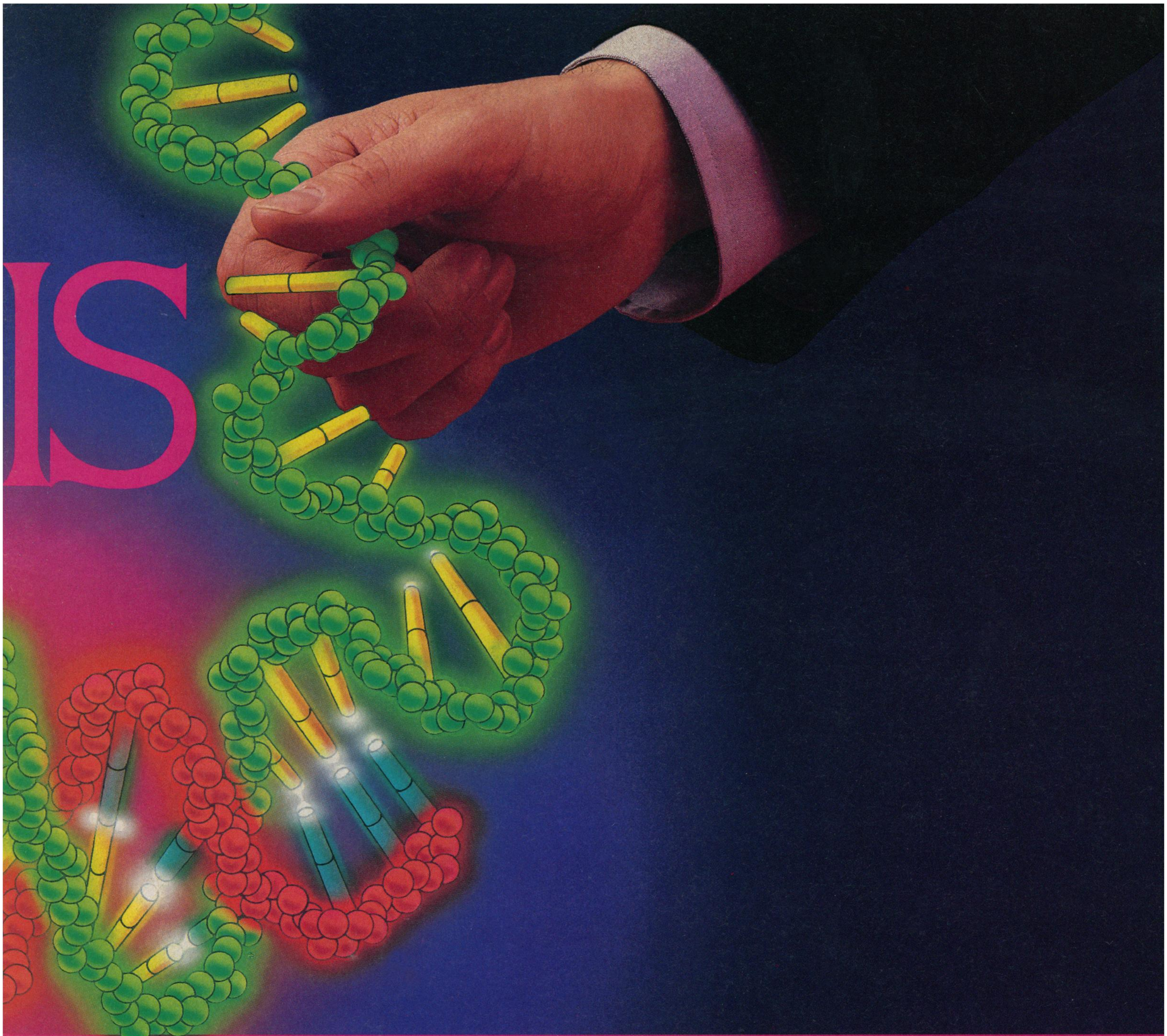

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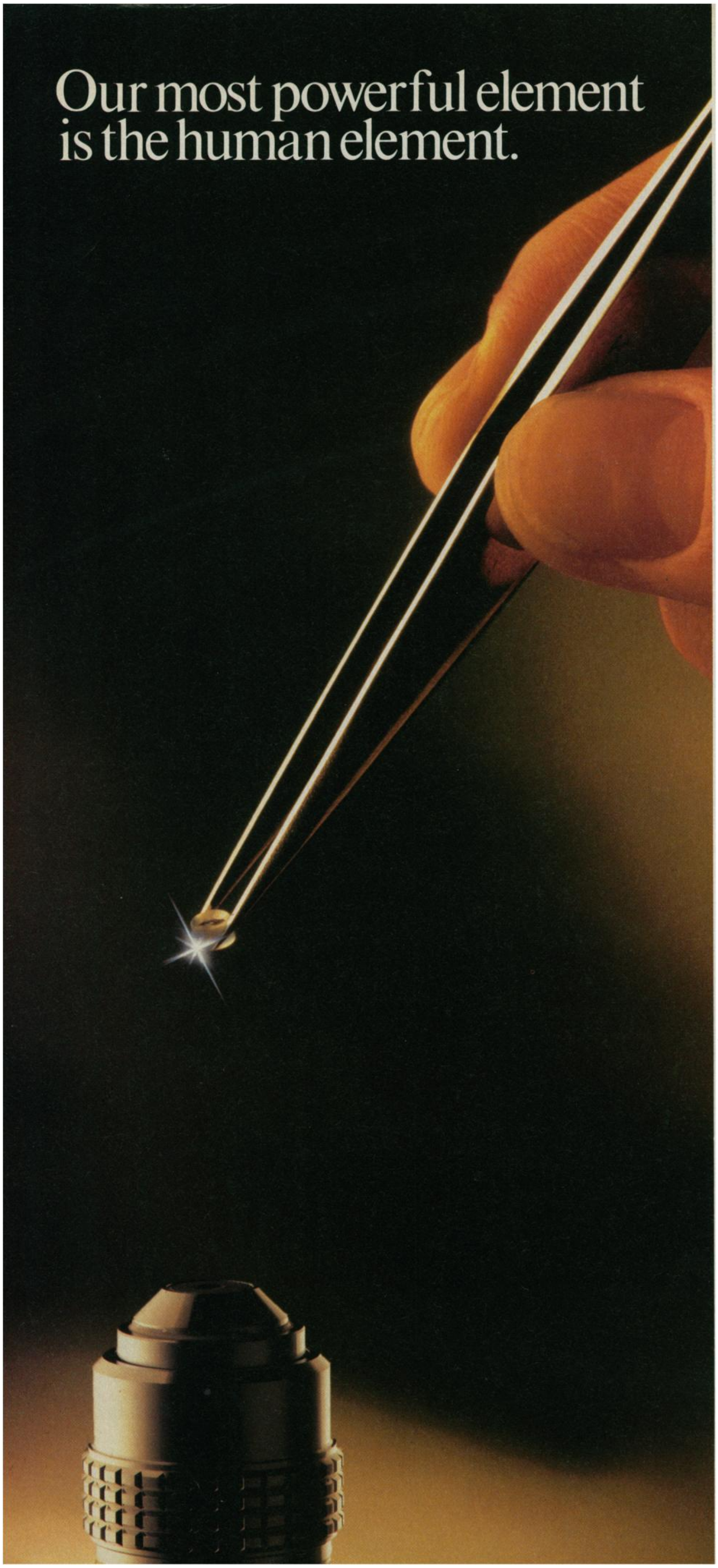

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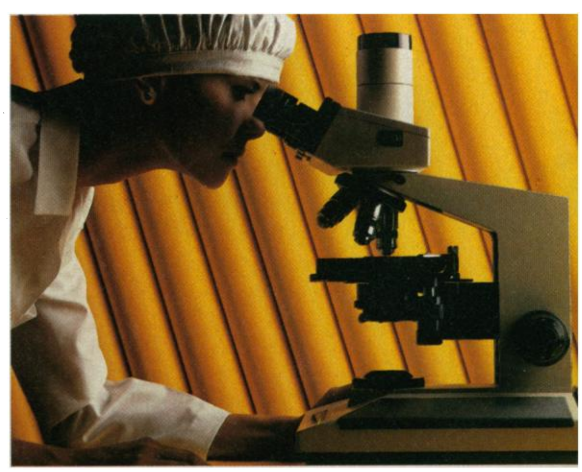

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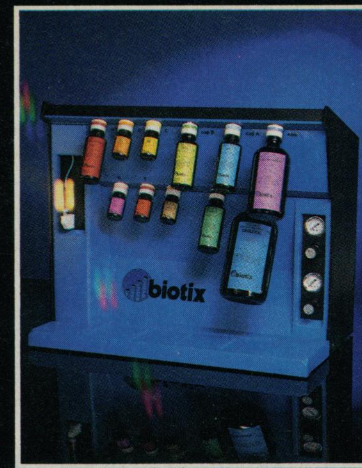

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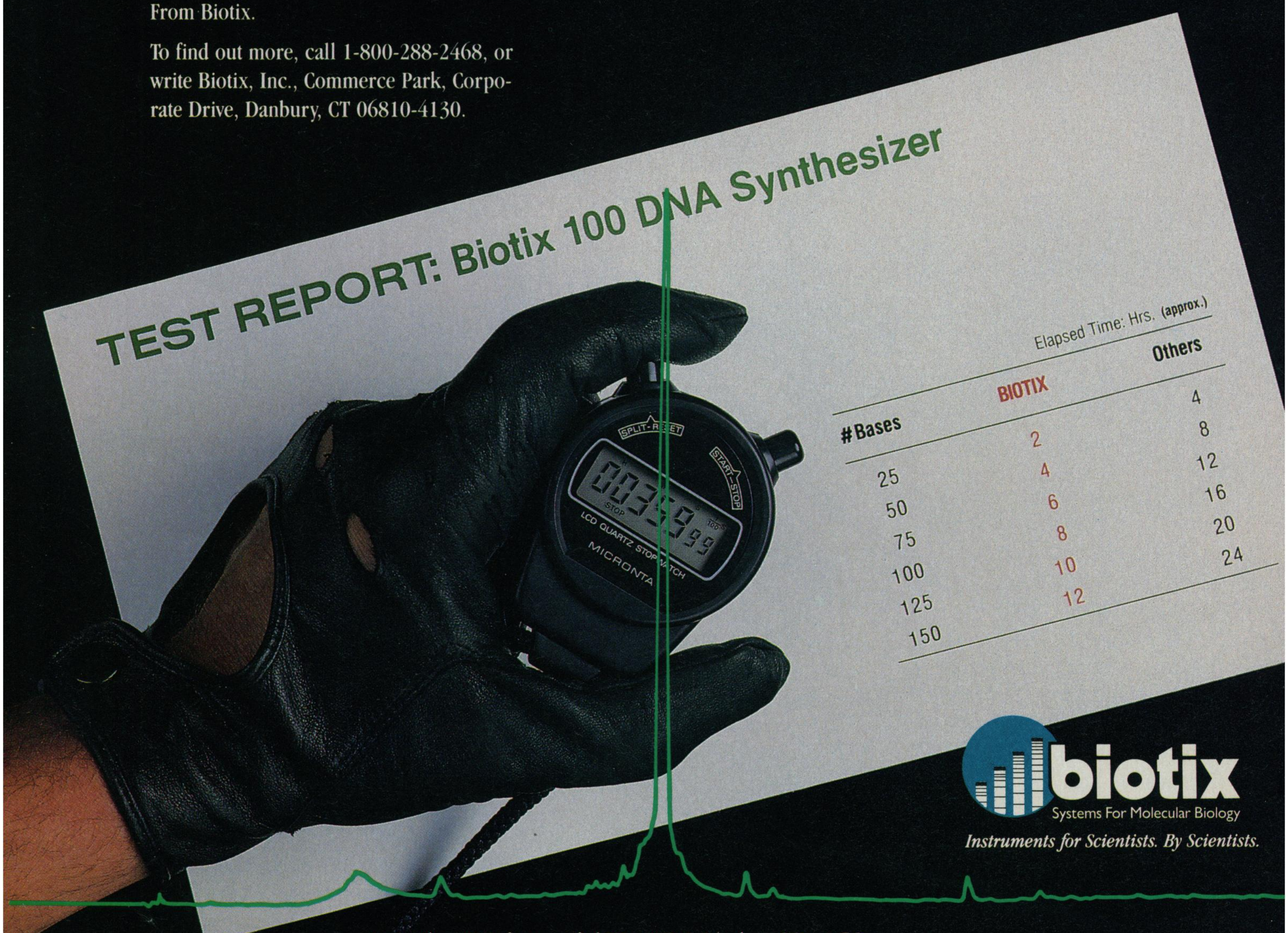

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150	12	24

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Systems For Molecular Biology

Instruments for Scientists. By Scientists.

Reverse Phase HPLC of an unpurified 25mer VYDAC, C-4 column, 2.5mm × 7.5cm
Gradient: 0% — 30% B in 30 minutes, Solvent A: 0.1m TEA, Solvent B: acetonitrile

Circle No. 229 on Readers' Service Card