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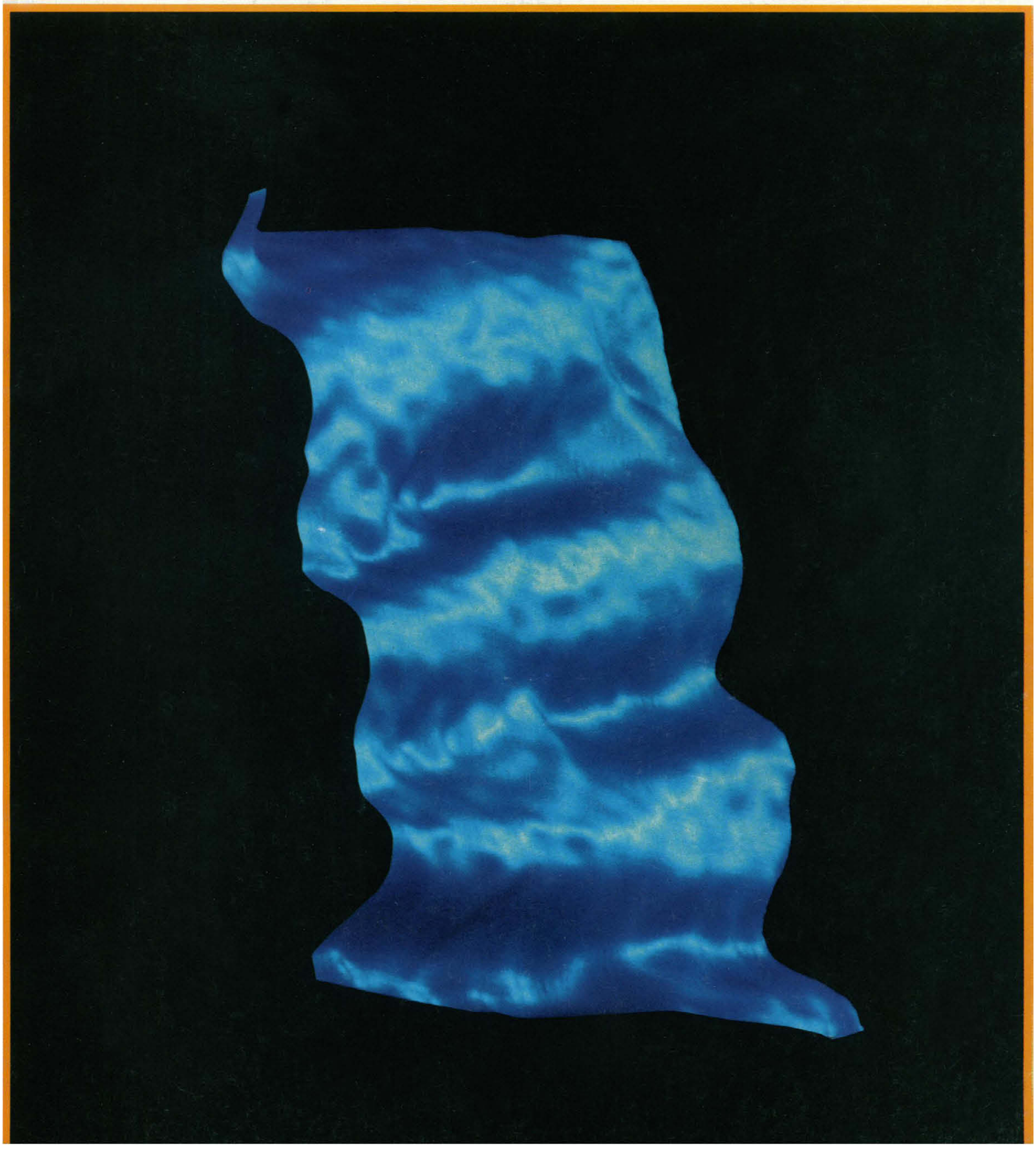

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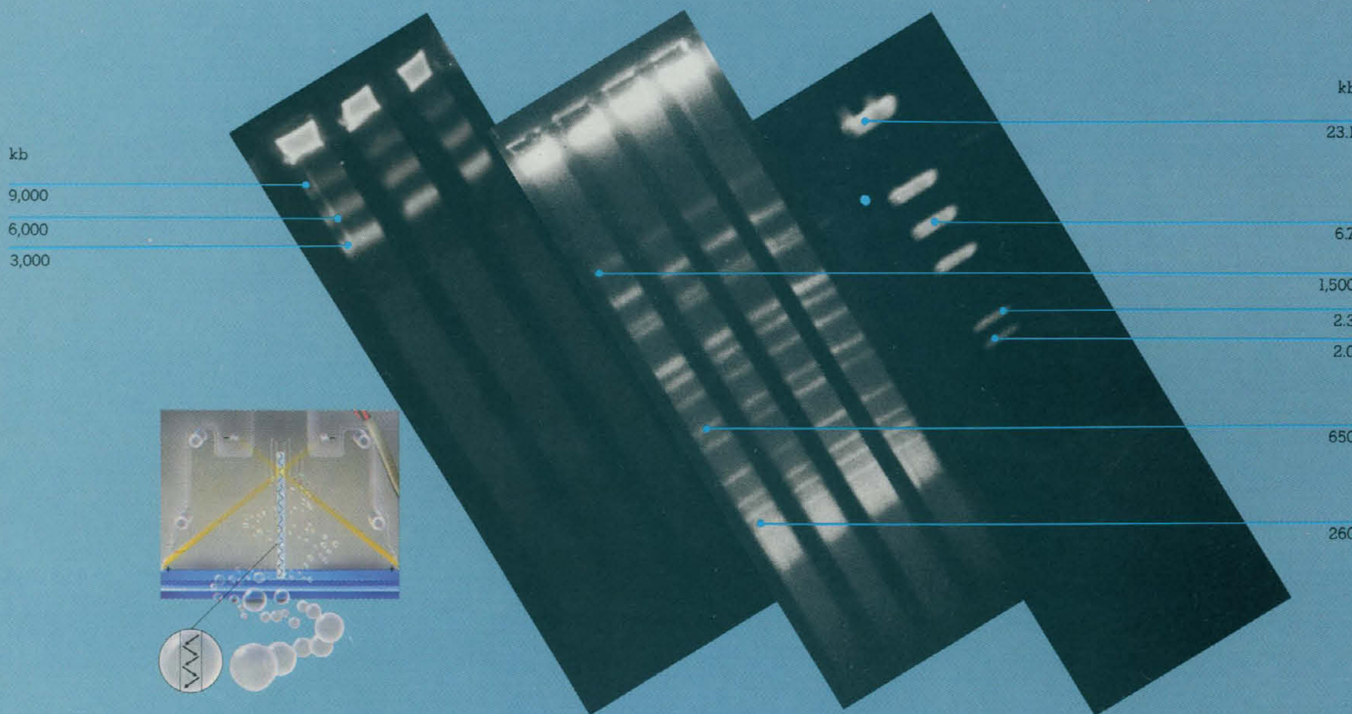

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Fig. 1. 9000 kb separation achieved using GeneLine with whole chromosomes of Schizosaccharomyces pombe.

Fig. 2. High-resolution lanes produced using GeneLine with whole chromosomes of the yeast Saccharomyces cerevisiae.

Fig. 3. Separation down to 2 kb using GeneLine with a HindIII *digest of lambda phage DNA.*

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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 A scanning tunneling microscope image of a platinum-carbon replica of the ripple phase of dimyristoylphosphatidylcholine bilayers in water. The replicated surface can be best seen by turning the image 90° counterclockwise. Large ripples are spaced approximately 12 nanometers apart and are about 4.5 nanometers in amplitude. The image was taken by using a NanoScope II digital STM at 1 nanoampere and 20 millivolts bias. See page 1013. [J. Zasadzinski *et al.*, University of California, Santa Barbara, CA 93106]

Reports

Book Reviews

Products & Materials

Macroscopic quantum mechanics

A macroscopic system—a superconducting circuit containing a large number of electrons—demonstrates that quantum mechanical behavior is not restricted to the microscopic level but also occurs macroscopically (page 992). At a Josephson tunnel junction, which consists of two superconductors separated by a thin insulating barrier, a supercurrent can flow with zero resistance as pairs of electrons tunnel through the barrier. However, when the current goes above a critical value, a voltage develops across the junction. Experiments by Clarke *et al.* explored conditions required for this transition from the zero-voltage to the nonzero-voltage state. The results are fully consistent with predictions based on quantum mechanics. This discovery should facilitate development of superconducting circuits and studies of other quantum mechanical phenomena, some of which may not even have been observed at the microscopic level.

Split messenger, one polypeptide

MOLECULAR biology dogma has it that ribosomes read messenger RNA molecules that contain only exons (coding sequences) (page 1005). The messenger is assembled from interspersed exons and introns (noncoding sequences) on the DNA, but the introns do not get incorporated into the messenger, or, if they do, they are removed before the message is translated into protein. However, the messenger RNA for gene *60* of the bacteriophage T4 provides a challenge to the dogma: a 50-nucleotide intron sequence persists as an "interruption" in this messenger and a corresponding sequence is not found in the protein that the gene encodes. Huang *et al.* propose from extensive analyses of gene, messenger, and protein and from studies of gene expression in various systems that when the messenger is read by the ribosome, the molecule folds in a hairpin-like configuration such that the interruption is bypassed during translation; the protein produced corresponds to the sequence in the messenger minus the 50-nucleotide interruption. The unorthodox cellular mechanism that makes it possible for the ribosome to bypass the interruption may confer added refinement to the translation process.

Biomembrane surface exploration

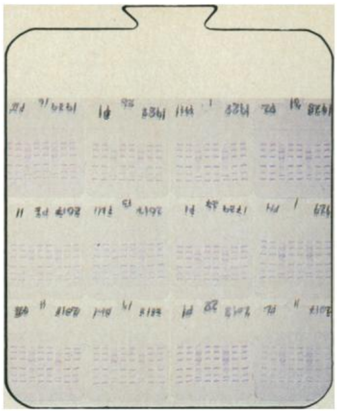
SCANNING tunneling microscopy is a technique for exploring surface topography; it has been coupled to freeze fracturing by Zasadzinski *et al.* for obtaining images of contours of a biologic specimen (page 1013). A phospholipid membrane was quick-frozen and fractured; replicas were made along the fracture surface (the hydrocarbon interior of the phospholipid bilayer) with mixtures of platinum and carbon. The metal replicas are rigid and highly conductive, whereas the original hydrated phospholipid membrane was fluid and nonconducting. (Easy deformation and lack of conduction have been major drawbacks to the elucidation of the contours of biologic materials.) Three-dimensional images of the bilayer's ripple phase (where regular intrabilayer corrugations occur) were made at high resolution (cover). The details revealed enrich descriptions of the ripple phase and confirm earlier experimental and theoretical work. This technology will be useful for probing contours of diverse biomaterials and other structured fluids, liquid crystals, and nonconducting materials.

New superconductor

STUDIES of a new high-temperature superconductor identify its formula as $Bi_2Sr_{3-x}Ca_xCu_2O_{8+y}$ (page 1015). Subramanian *et al.* prepared the new materials and analyzed their atomic structures and properties by x-ray diffraction and transmission electron microscopy. Like the two other classes of superconducting compounds (lanthanum and yttrium-barium copper oxides), the new materials have sheets of copper and oxygen; in the new superconducting phases, double copper-oxygen sheets alternate with double bismuth-oxygen sheets. In all of the copper oxide–based superconductors, the copper component is present in mixed oxidation states. The new materials and the lanthanum compounds differ from the yttrium-barium high-temperature superconductors in not having prominent copper-oxygen chains; such chains have previously been considered important for the mechanism of high-temperature superconductivity. The new material begins to undergo a transition to superconductivity (electric resistance drops) at about 116 K and is fully superconducting at 91 K.

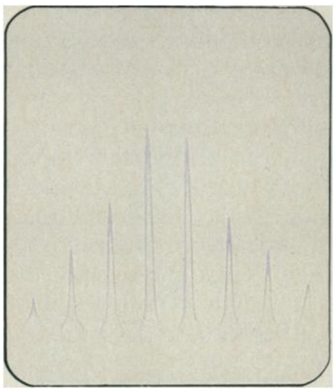
Transplants for twitcher mice

TWITCHER mice have a genetically determined enzyme deficiency that has severe neurologic consequences; within a few weeks of birth, these mice develop tremors and hind-leg paralysis, have extensive nerve demyelination, and accumulate psychosine (a toxic lipid) in the central and peripheral nervous systems (page 1035). The mice usually die by 5 weeks of age. Transplantation of bone marrow cells can partially reverse some of the consequences of the disease, and foamy macrophages, which originate from the donor, appear to be responsible for the transplant's ameliorative effects. The foamy macrophages typically infiltrate regions of tissue damage and can remove the toxic lipids that accumulate as a result of the enzyme deficiency and that may be responsible for the degeneration of oligodendrocytes and demyelination. Some remyelination was apparent in the central nervous systems of transplant recipients, galactosylceramidase (the deficient enzyme) activity increased, less psychosine accumulated, and fewer globoid cells were present. Hoogerbrugge *et al.* propose that human patients with lysosomal storage diseases such as Krabbe's disease (an analog of the twitcher mouse disease) may experience similar clinical benefits from bone marrow transplants.



BANDS

A sample of gels from quality control for function-testing of SDS-PAGE with PhastGel™ Gradient 10–15 gels. Each gel batch is thoroughly tested for reproducibility and reliability. From sample to result: 60 min (for 1 or 2 gels).

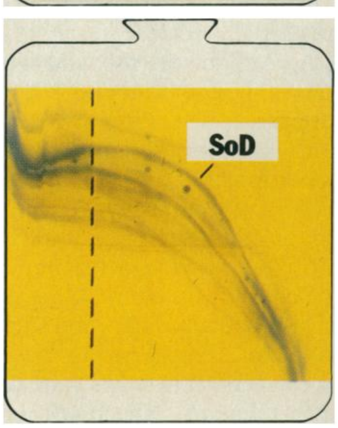


ROCKETS

Immunoelectrophoresis on PhastSystem saves antiserum and time. In this example, human serum proteins are precipitated with anti-albumin. From sample to result: 65 min.

SPOTS

Two-dimensional electrophoresis is fast and easy with PhastSystem. PhastGel IEF media are used in the first dimension, and PhastGel gradient or homogeneous media are used in the second dimension. Here, a cell extract from *E. coli* is analyzed. From sample to result: 2.5 h.



CURVES

Electrophoretic titration curve separations take only 25 minutes to perform with PhastGel IEF media. Information about protein charge characteristics is easily obtained, and can be used to plan protein purification schemes. Here, a clarified cell homogenate in the production of superoxide dismutase is analyzed. From sample to result: 55 min.

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Soviet Science

A broad sample of the status of Soviet science was presented on 14 February at the AAAS annual meeting in Boston. Twelve presentations by Russians dealt with fields ranging from ecology and microbiology to space science and engineering research. The symposium, arranged by Yevgeni Velikhov, Vice President of the Soviet Academy of Sciences, at the invitation of Alvin Trivelpiece, Executive Officer of the AAAS, was further evidence of a thawing in U.S.S.R.–U.S. relations.

One must have reservations about judgments formed on the basis of 20-minute talks, but some impressions follow. Soviet scientists range in quality, but there are creative, dynamic, world-class individuals among them. They have been handicapped by a lack of computer capabilities and by a paucity of good instrumentation. In the past, opportunities for individual initiatives have been few. As a result, in general, Soviet science lags behind that in the United States. The lag is not great, and in space science the Russians excel at this time.

An example of where the United States leads, although not distantly, is in biotechnology. A number of U.S. companies have produced interferons alpha, beta, and gamma, interleukin-2, and tumor necrosis factor. The Russians have also made substantial quantities of these substances and have completed clinical tests on some of them. They have made human growth hormone and growth hormones that can be used in cattle, pigs, and chickens. They have changed some of the amino acids in these hormones to enhance stability. They have engaged in animal gene engineering to obtain transgenic animals, including fish. They have introduced genes into plant cells. Through gene engineering they have created superior organisms for the synthesis of amino acids and riboflavin.

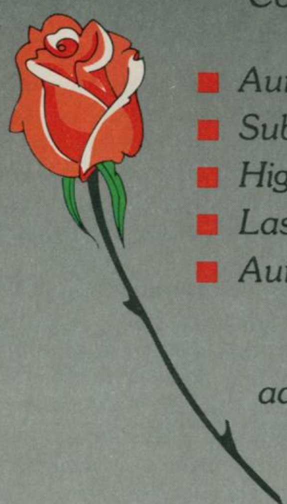
For a short time with Sputnik the Russians held leadership in space, but this was followed by nearly three decades of U.S. leadership. The world center for excitement about results of planetary exploration was the Jet Propulsion Laboratory in Pasadena. But as a result of bad judgment and bad luck in the United States, excitement is shifting to the Institute for Cosmic Research (IKI), near Moscow. While the United States enjoyed the spotlight, the Russians were not idle. They compiled 14 man-years of space flight versus 5 man-years for the United States. They also developed a reliable launch vehicle for planetary exploration and used it in extensive studies of Venus. The Vega mission to Venus and Halley's comet, launched in December 1984, involved investigators from more than a dozen countries, including some from the West. American and European journalists were present at IKI when the Vega machine encountered Halley in March 1986.

The next big scheduled solar system event is the Soviet mission to Phobos, a satellite of Mars. Two Vega missions will be launched during July 1988 to conduct extensive exploration of the planetoid. Each of the Vegas will carry about 25 different experimental packages, many of them provided by Western European countries. American scientists were invited to participate and were eager to do so, but U.S. authorities did not permit U.S. hardware to be placed aboard.

One of the Vegas will fly slowly 30 to 80 meters above the surface of Phobos. It will direct an intense laser beam at the surface to vaporize some of it. The products will be analyzed by time-of-flight mass spectrometry. In another experiment an energetic ion beam from the spacecraft will strike the surface, and mass spectra of the resultant ions will be observed. By these methods, the elemental and isotopic composition of Phobos's surface will be determined. These are but two of the experimental packages.

The Russians have developed a powerful launch vehicle capable of lifting 100-ton payloads into space. They are currently planning many space missions, including extensive exploration of Mars. In their planning, they are involving a large number of countries. They have expressed eagerness to have U.S. participation, even a partnership, in a mission to obtain a sample return. The United States is preparing to launch a number of solar system missions during the next 4 years, if the shuttle is functional, but the United States should not persist in a policy of going it alone while the Soviet Union successfully promotes international cooperation in space research and compiles an impressive record of scientific achievement.—PHILIP H. ABELSON

Your formal invitation



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more intense than the peaks predicted as being primary in multiple twinning models. While, in principle, dynamical interference effects can produce enhancements of secondary peaks in large single crystals of some materials, it is very difficult to explain why such an effect is observed in powder samples from a wide variety of icosahedral alloys prepared by many different methods. It is much more natural to conclude that all of the peaks are primary as the icosahedral quasicrystal model predicts.

I should emphasize that, while Pauling's model requires some of the observed peaks to be secondary, other multiple twinning models utilizing larger unit cells may not have this requirement. I refer the reader to the original article for a description of other experimental evidence against generic twinning models. Also, I disagree with Pauling's statement concerning further evidence in favor of twinning. The evidence that he cites does not distinguish between the models, since it is equally consistent with a larger crystal unit cell or a larger quasicrystal unit cell.

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NOTES

1. Multiple scattering may contribute to the observed intensity of primary peaks, but the peaks would have nonzero intensity even in the absence of multiple scattering.
2. The scattering length is the distance over which half of the x-rays are coherently, elastically scattered out of the primary beam.

Technology Transfer

While I would agree with James Johnson (Letters, 29 Jan., p. 450) that "technology transfer" has been the subject of much faddism both inside and outside universities and it often is misidentified, particularly by politicians, as the magic bullet to solve all our industrial competitiveness problems, I must disagree with his assessment that major research universities should not play a role.

First, universities have always been the source of the most fundamental form of technology transfer—the education of students, both full and part time, who move their knowledge directly into business and industry. After all, technology is not a thing to be packaged and sent as an industrial CARE package. To quote Robert H. Waterman, Jr., "Technology is housed in the skills of people" (*1*).

Second, while perhaps there was a time when universities did basic research and industry did the applied research and development, we now find that in most areas of research this distinction just does not work. Industry now knows that the economic half-life of a new technology in the marketplace is so short it cannot just wait for the thorough but slowly revealed university research. This is one reason why university-industry collaborative research continues to grow in popularity. Of course this is also "technology transfer."

Finally, it is recognized that attempts to provide active technology transfer from university to industry can be somewhat of a failure if incorrectly organized. In our industry-driven program, as is true in a number of others around the country established by major research universities, we have a team of "impedance matchers" to work directly with industry to provide the needed one-on-one approach. These regionally located technology consultants are all "degreed" engineers with substantial industrial experience. It is their job to understand each company's needs and apply the proper resources, be it their own knowledge, that of university faculty, that of a university facility, or even that of an outside resource. We have found the vast majority of our faculty very willing to participate in this stimulating effort, even without salary incentives; and they are directly involved in close to 50% of our assistance efforts.

I certainly do not suggest that university research should just dance to industry's tune, but in today's environment a research university that ignores industrial interfaces will sooner or later find itself inconsequential to its community.

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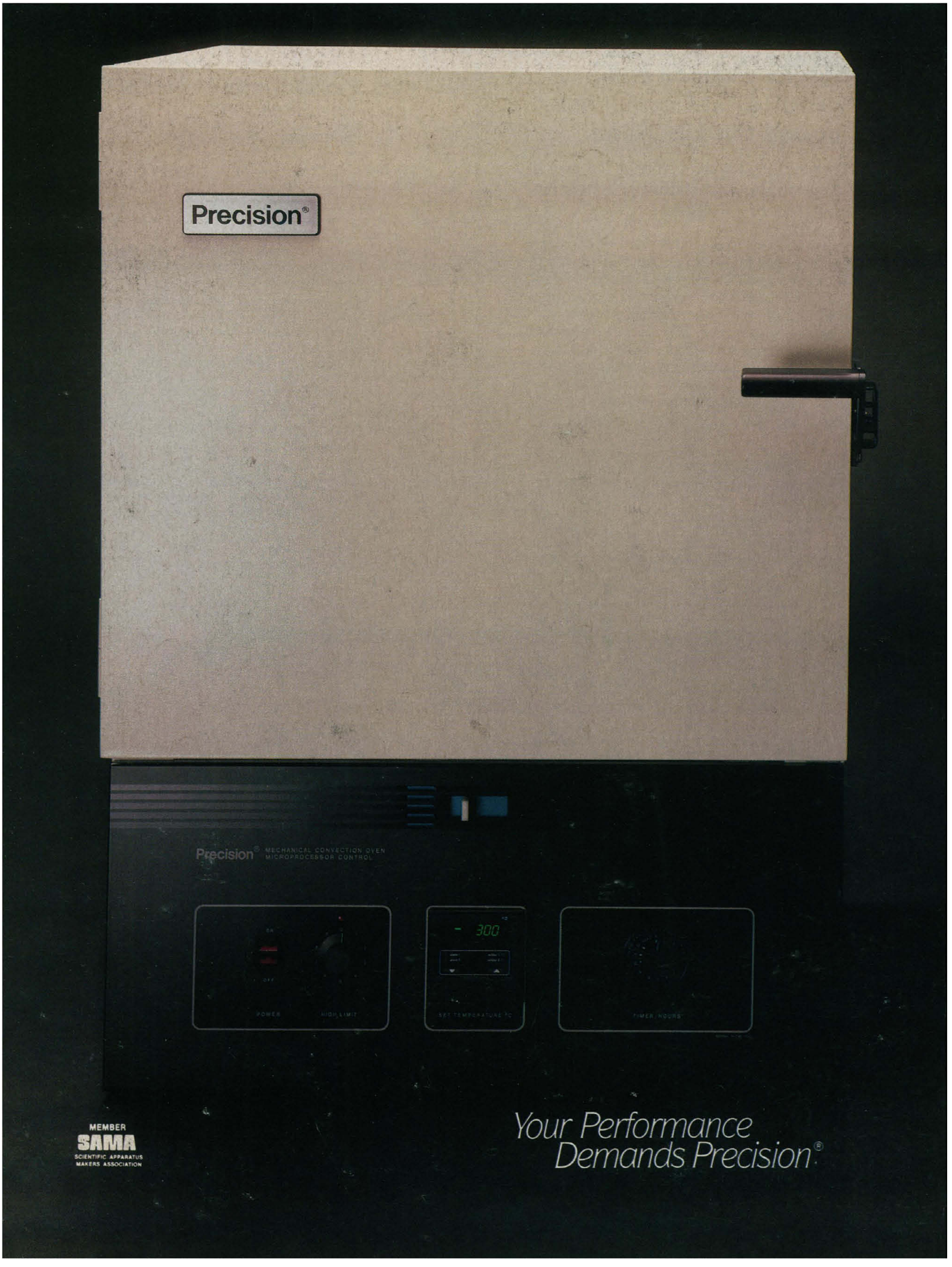
College Park, MD 20874*

REFERENCES

1. R. H. Waterman, Jr., in R. N. Foster, *Innovation: The Attacker's Advantage* (Summit, New York, 1986), p. 17.

Erratum: The last sentence of the fourth paragraph of Devra Lee Davis' letter "Paleolithic diet, evolution, and carcinogens" (18 Dec., p. 1663) contained errors. It should have read, "Moreover, the range of early diets was extensive, from protein-rich diets of far northern peoples to the plant-dependent diets of the Kalahari hunters and gatherers."

Erratum: In the report "Stimulation of heterotrophic microplankton production by resuspended marine sediments" by Sam C. Wainright (18 Dec., p. 1710), two articles should not have been included in reference 2. These are G. T. Rowe, C. H. Clifford, K. L. Smith, Jr., P. L. Hamilton, *Nature (London)* **255**, 215 (1975) and S. W. Nixon, C. A. Oviatt, S. S. Hale, in *The Role of Terrestrial and Aquatic Organisms in Decomposition Processes*, J. M. Anderson and A. MacFadyen, Eds. (Blackwell, Oxford, England, 1976), pp. 269–283.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