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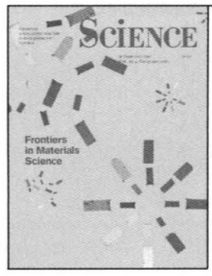

COVER Silicate glasses prepared with the sol-gel process that contain the encapsulated metalloproteins ferricytochrome c and ferrocytochrome c, copper-zinc superoxide dismutase and its cyanide adduct, and metmyoglobin. For the samples arranged in a circular fashion, the outer circle consists of aged gels and the inner circle of the corresponding xerogels. See page 1113. This issue of *Science* focuses on advances in the design, synthesis, and processing of materials. [Photographs by Louis Meluso]

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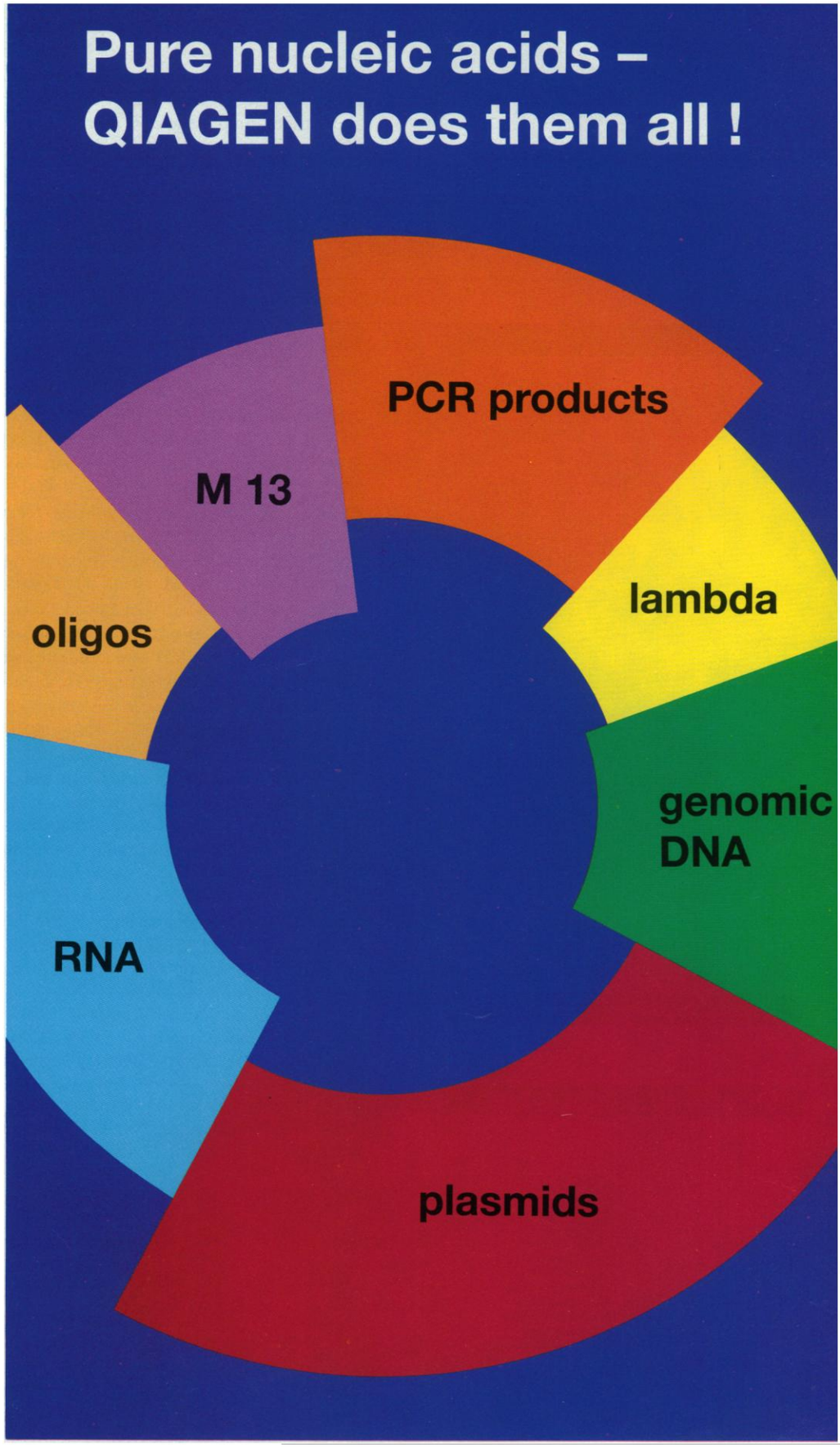

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This Week in

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Materials world

This special issue focuses on advances in the synthesis and processing of materials, which can open new areas of scientific investigation as well as technological opportunities (pp. 1082 to 1112; see editorial by Brauman, p. 1049). How materials actually get developed in the real world is the focus of a special news section (pp. 1077 to 1081), including the development of superconductors in Japan, entrepreneurial efforts to harness scientific advances in the former Soviet Union, and proposed funding initiatives in the United States.

Proteins under glass

Encapsulation of proteins into porous, transparent glasses could lead to numerous biosensor applications, but proteins normally denature under the harsh conditions used in sol-gel processing. Ellerby *et al.* (p. 1113; cover) found that modifying the normal sol-gel processing conditions, such as omitting excess alcohol and buffering the acid, allowed proteins and enzymes to be incorporated in their native state. The porosity of the glass allows small molecules to diffuse into the glass and bind to or react with the protein. For example, encapsulated ferricytochrome c could be reduced and reoxidized, and the resulting color changes could be observed.

Molecular rectifier

Molecular adsorbates can affect the flow of electrical current through a surface, but most studies have involved small molecules or atoms. Pomerantz *et al.* (p. 1115) have used a scanning tunneling microscope to measure the properties of a surface covered with the larger species, copper phthalocyanine. Attachment of the molecules to graphite changes the current-voltage behavior from symmetric to highly asymmetric, or rectifying. The electronic energy levels of the organic adsorbate are responsible for the change.

Meteorite ages

Most iron meteorites are samples of the iron-rich cores of small planets that were subsequently fragmented by collisions with other bodies. The age of the iron meteorites thus constrains the times of core formation and cooling of these early planets. Recent advances in analyzing isotopes of rhenium and osmium, elements that fractionate into metal cores of planets, now allow recognition of differences in ages among iron meteorite groups. Horan *et al.* (p. 1118) show that group IIAB iron meteorites likely originated from a planet that melted and cooled within 100 million years of formation of the solar system. Other iron groups show younger apparent ages and may have been derived from larger planets that cooled more slowly.

Acceptor overlap

Acceptor stems of transfer RNAs (tRNAs) may confer a substantial part of the recognition of tRNAs by their cognate amino acyl tRNA synthetases. Francklyn *et al.* (p. 1121) found a seven–base pair RNA microhelix to which glycine is added specifically. A small number of sequence elements specified this charging with glycine. Sequence variants were made so that this microhelix could be compared with microhelices specific for histidine or alanine. The nucleotide positions determine charging overlap, but microhelices constructed with mixed signaling sequences would accept no more than one amino acid.

Initiating transcription

Appropriate initiation of basal-level transcription by RNA polymerase II may be regulated by the interaction of other general transcription factors with transcription factor IID (TFIID), which recognizes the TATA element and serves as a base for assembling a competent transcription initiation complex. Ranish *et al.* (p. 1127) have isolated the genes that encode subunits of yeast TFIIA and show that they are essential for growth of yeast. Buratowski and Zhou (p. 1130) studied a region of TFIID that is rich in basic amino acids. Mutations in this region caused TFIID to be defective in its interaction with TFIIA, suggesting that this region is important for protein-protein interactions.

Selective transmission

Viral sequences of human immunodeficiency virus–1 (HIV-1) appeared to be less diverse in children than in their mothers when the virus was transmitted during pregnancy. Wolinsky *et al.* (p. 1134; see news story by Palca, p. 1069) analyzed sequences from the V3 and V4-V5 regions of the envelope genes of HIV-1 for three mother-infant pairs. The prevalent genotype in the infants appears to be derived from a single form in their mother; in two pairs a proviral form that occurred infrequently in the mother was the most common form in the infant. The conserved N-linked glycosylation site was absent in all of the infant sequences.

Hematopoietic model

In normal development mature hematopoietic cells originate from rare progenitor cells such as stem cells, but coaxing immature human cells into producing the diverse array of cells in the blood system has been difficult. Lapidot *et al.* (p. 1137; see news story by Thompson, p. 1072) report that in irradiated severe combined immunodeficient (SCID) mice, stimulated immature human cells in transplanted bone marrow could form mature myeloid, lymphoid, and erythroid cells when certain growth factors were coadministered. These factors included human mast cell growth factor and a fusion of interleukin-3 and human granulocyte-macrophage colony-stimulating factor. This approach can be used to detect immature human cells and to identify key growth factors.

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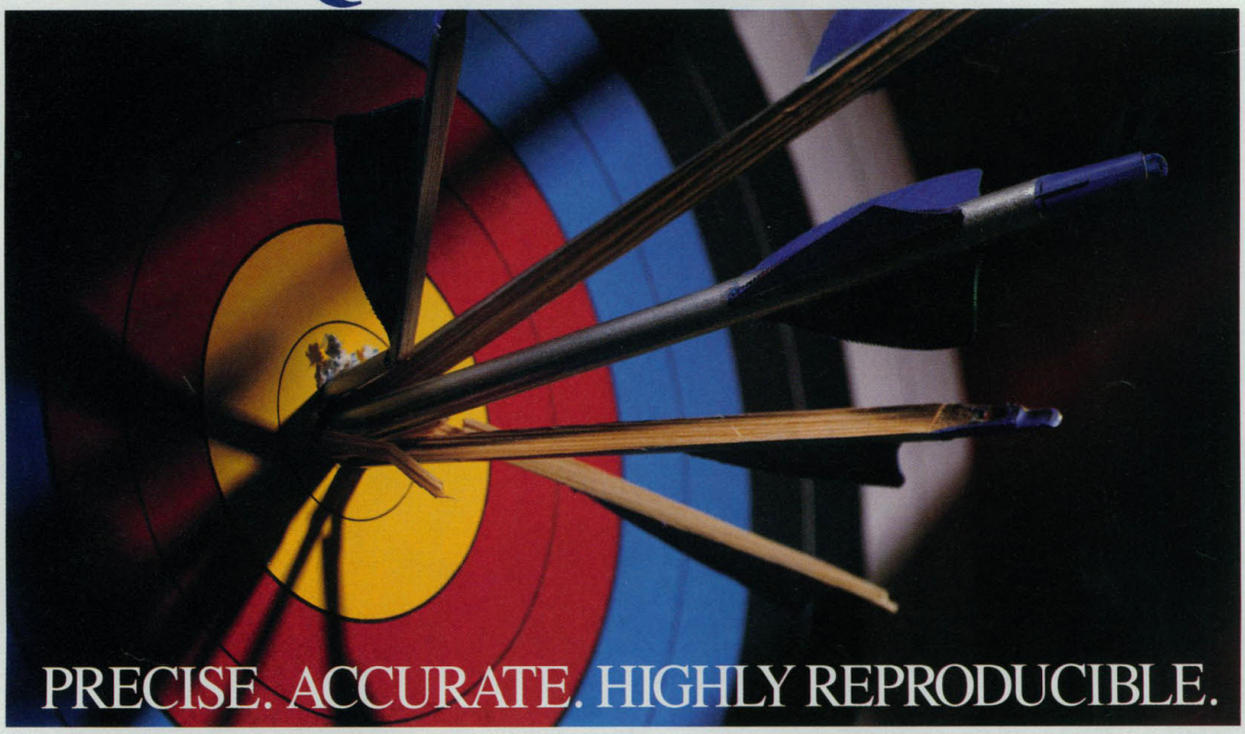

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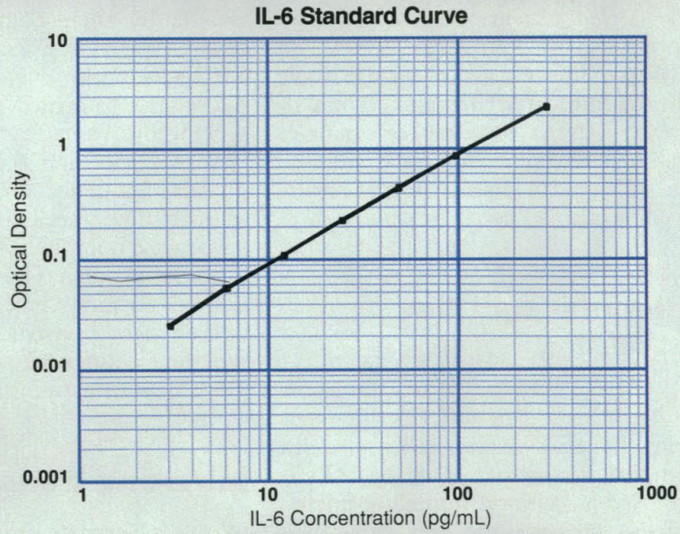

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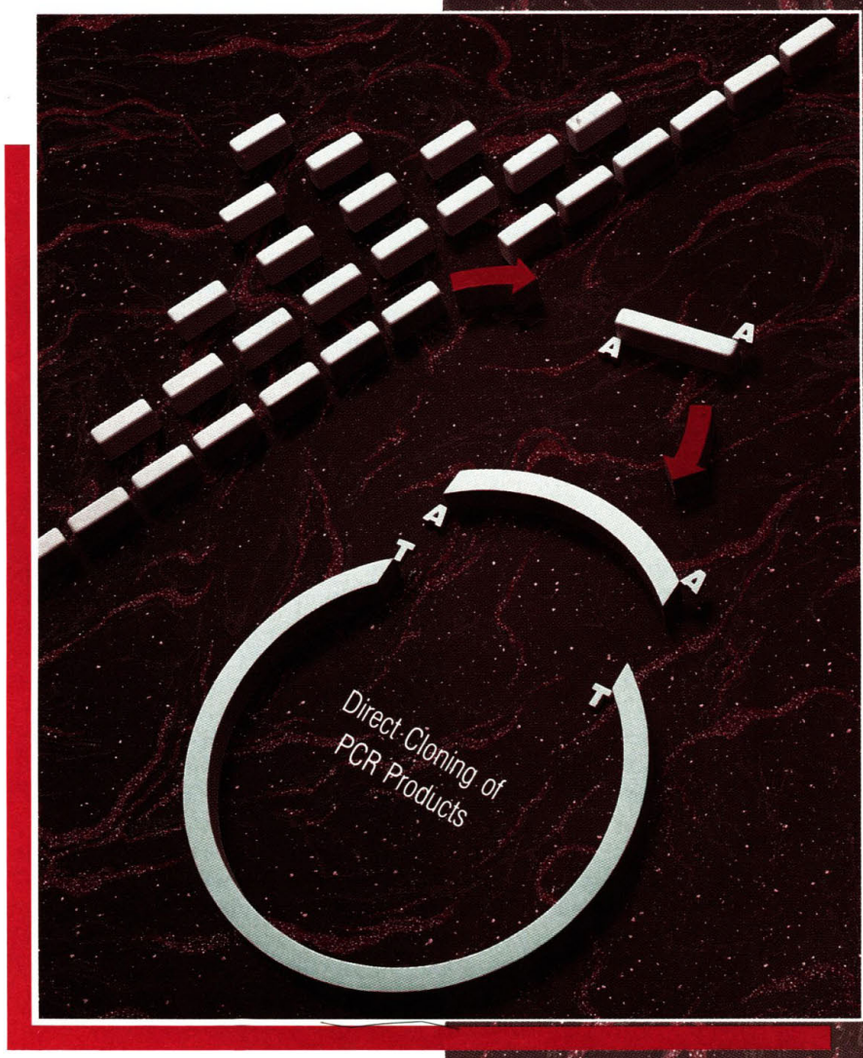

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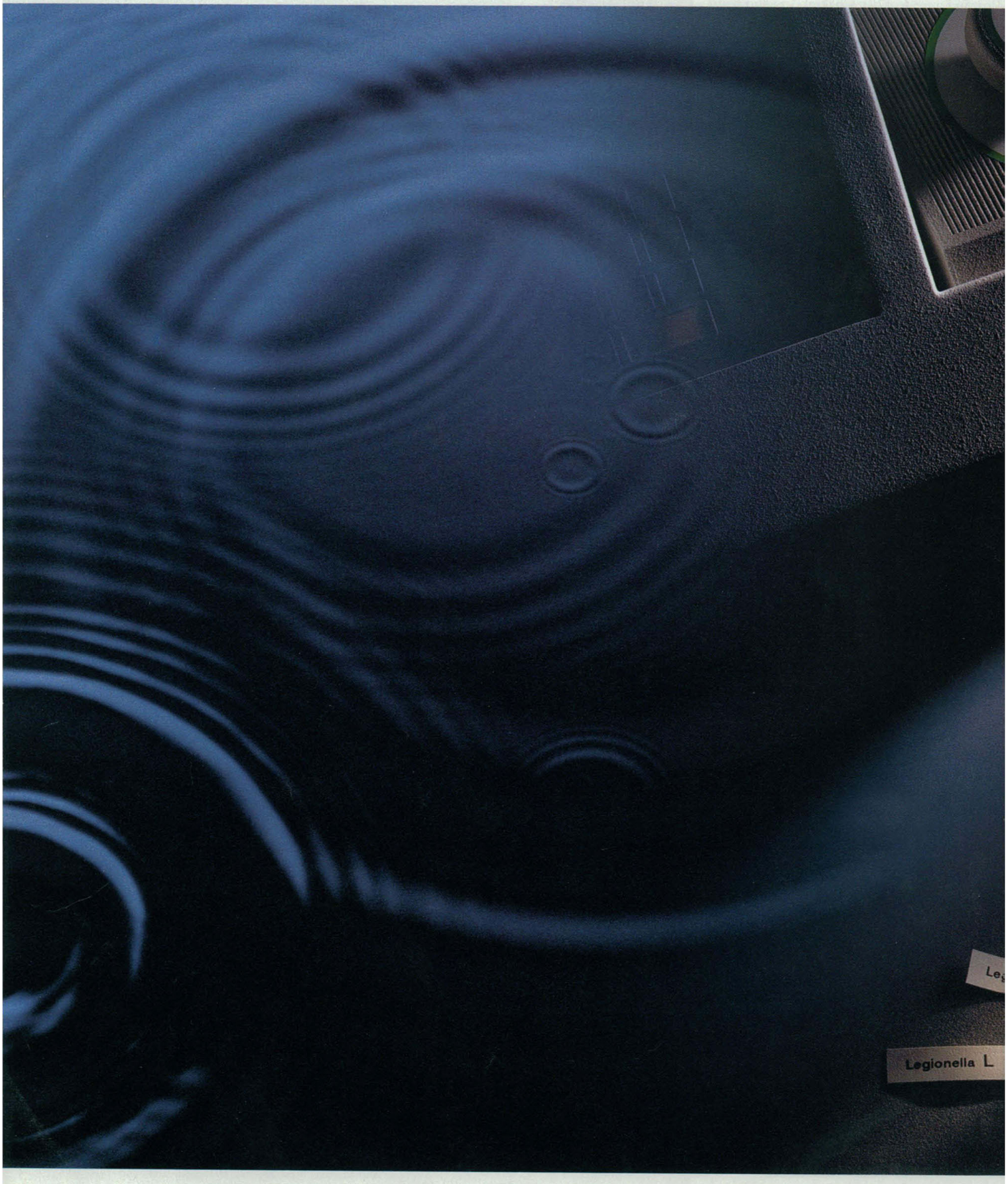
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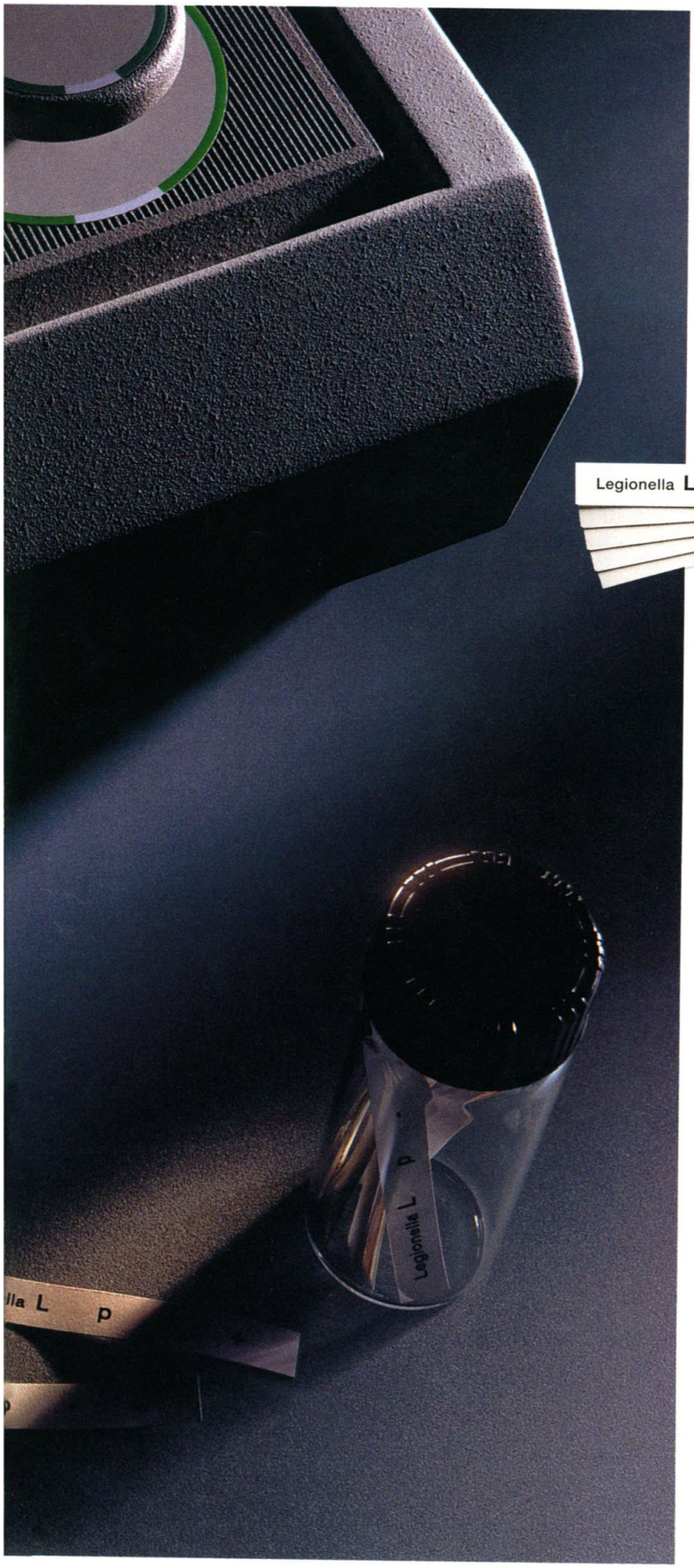

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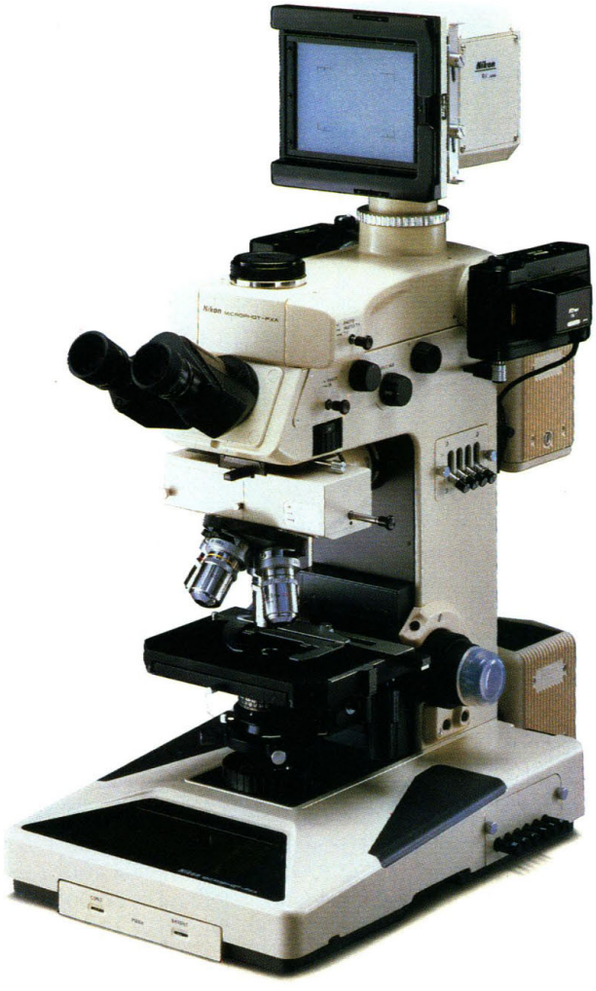

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