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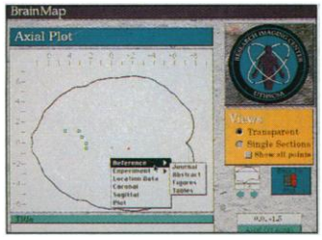
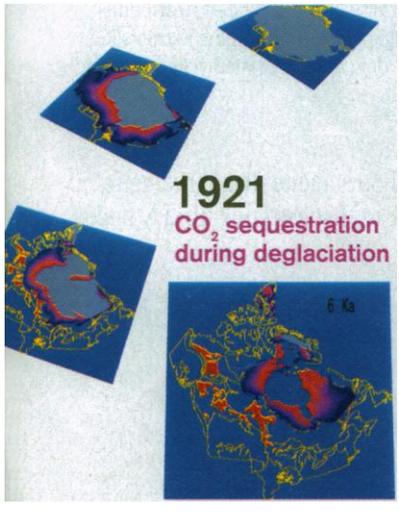


1872
Neuroscientists find common ground



NEWS & COMMENT

RESEARCH NEWS

PERSPECTIVES

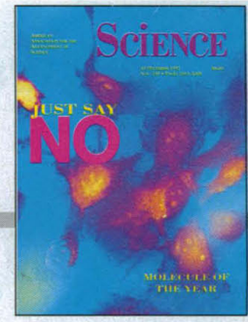
ARTICLE

RESEARCH ARTICLES

DEPARTMENTS

COVER

Cultured human neurons, one of the targets of the potent signaling molecule nitric oxide (the NO of the cover). The diverse and important roles of NO are just beginning to be discovered; see the Editorial on page 1861 and the Molecule of the Year story on page 1862. [Photograph: Visuals Unlimited]



REPORTS

1955
Foiling the hangman's noose ... in worms

Indicates accompanying feature

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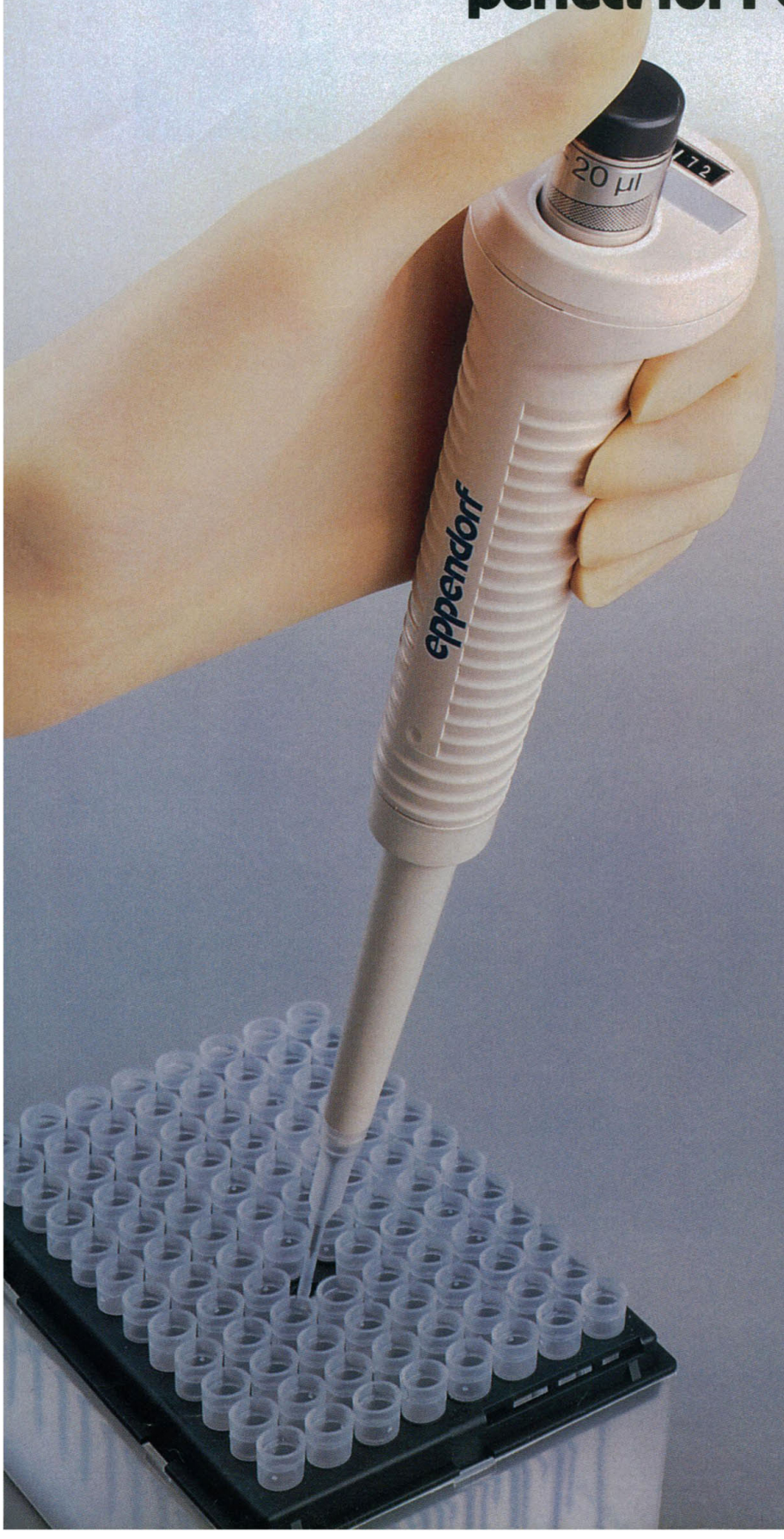

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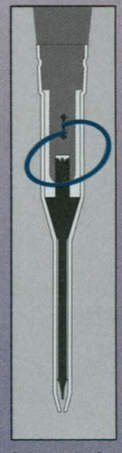

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For information Circle #17

For a demonstration Circle #18

edited by PHIL SZUROMI

RNA as template and catalyst

A self-copying RNA molecule, or RNA replicase, would need to act both as a catalyst and as a template. Green and Szostak (p. 1910) used a group I self-splicing intron (the *sunY* ribozyme) as a starting point for creating an RNA molecule that can perform both of these functions. Self-replication would likely be faster for a small molecule, and so a deletion mutant was created that included only conserved domains. This 141-nucleotide mutant, which was almost inactive, was used to generate potential compensatory mutants for an in vitro selection assay. The most active mutant had five substitutions and was more active than the original ribozyme. This greater activity, along with its smaller size, improves the rate at which it can copy itself from three smaller fragments.

■

Better superlattices

Scanning tunneling microscope (STM) studies have been used to improve an electrochemical method for growing oxide semiconductors. Switzer *et al.* (p. 1918) have shown that lead thallium oxide materials can be grown with alternating layers of differing compositions on a nanometer scale. The STM studies show that sharper interfaces result when potential is used to control the process; ordering is seen out to fourth-order Bragg reflections.

■

Soil carbon and CO_2

Although CO_2 levels in the atmosphere are known to have increased markedly during the 18,000 years since deglaciation, some of the carbon must have been sequestered in soils that were newly exposed as the ice sheets receded. Harden *et al.* (p. 1921) estimate this soil carbon budget by considering the changing distribution of soil types, vegetation, and climate as deglaciation progressed across North America. Most of the sequestration occurred during the early stages of soil development (4000 to 8000 years ago), but the analysis suggests that sequestration is continuing today in deglaciated peat bogs.

■

Help from hemoglobin

The nematode *Ascaris*, a human parasite, has an unusual hemoglobin molecule that is found in the perienteric fluid and that binds oxygen remarkably tightly. When Sherman *et al.* (p. 1930) purified the hemoglobin, an unexpected molecule copurified: squalene, one of the precursors in sterol biosynthesis. These parasitic worms appear to have a large requirement for sterol, which is rather inconvenient because this metabolic pathway requires molecular oxygen, and the worms live in a low-oxygen environment in the intestine. The oxygen-avid hemoglobin sequesters molecular oxygen and assembles other components required for epoxidation in the synthesis of sterol from squalene.

■

Degradation signals

Many agents that stimulate cell growth activate the transcription factor AP-1, which is a heterodimer composed of the proteins c-Fos and c-Jun. The activity of AP-1 is regulated by control of the synthesis of c-Fos and c-Jun. Papavassiliou *et al.* (p. 1941) found that the rate of degradation of c-Fos also appears to be regulated. c-Fos was degraded more rapidly in vitro (in a rabbit reticulocyte lysate) when it formed a dimer with phosphorylated c-Jun. c-Jun isolated from cells stimulated to divide with a tumor-promoting agent caused less degradation of c-Fos than did c-Jun from unstimulated cells. The retroviral protein v-Fos was not degraded even when complexed with phosphorylated c-Jun, which might be one reason why v-Fos causes unregulated growth or transformation.

Selective activation

Retinoids, the natural and synthetic analogs of retinoic acid (RA), perform a variety of important natural functions and can be used as drugs. The RA receptors (RARs) and the retinoid X receptors (RXRs) mediate retinoid activity; the RARs are activated by heterodimerization with RXRs. Homodimers of RXRs can be activated by 9-*cis*-RA, a compound that also activates RAR-RXR heterodimers. Lehmann *et al.* (p. 1944) designed and synthesized a series of retinoids that activate the RXR homodimers but that do not activate the RAR-RXR heterodimers. Such compounds should not only be useful in separating response pathways of chemically distinct retinoids, but their more restricted activity may result in fewer side effects in therapeutic applications.

■

Direction detection

How the directionally selective (DS) ganglion cells of the retina receive input from the starburst-shaped cells and deduce the direction of movement of a visual image across the retina is unknown. Yang and Masland (p. 1949) find that the area over which the DS ganglion cells are responsive to stimuli (its receptive field) and the area covered by the dendrites of a DS cell are coincident. This result was unexpected because the size of the dendritic network of amacrine cells that have input to any one DS cell greatly exceeds the size of the dendritic field of the DS cell itself. Thus, the size of the receptive field of the DS cells was expected to reflect the dendrites from the amacrine cells. This finding challenges previous models of retinal directional selectivity.

Tyrosine kinases and the hippocampus

In the hippocampus, the process of long-term potentiation (LTP), in which short bursts of high-frequency synaptic activity may enhance the strength of the connections between excitatory synapses, can activate the *N*-methyl-D-aspartate receptor in the postsynaptic cell. The resulting influx of calcium can activate protein kinases. Grant *et al.* (p. 1903) generated mice that were deficient in the hippocampal expression of four nonreceptor tyrosine kinases. Mutations in the *src*, *fyn*, *yes*, and *abl* genes were introduced by homologous recombination in embryonic stem cells. In the *fyn*-mutant mice, unlike the other mutants, induction of LTP was more difficult, while synaptic transmission and other measures of short-term synaptic plasticity were normal. In a spatial learning task, these mice showed impairments. More granule cells in the dentate gyrus and more pyramidal cells were found in the CA3 region in the *fyn* mutants than in wild-type mice. These studies suggest further experiments for exploring the relation of tyrosine kinase signaling pathways to hippocampal development, LTP, and learning tasks.

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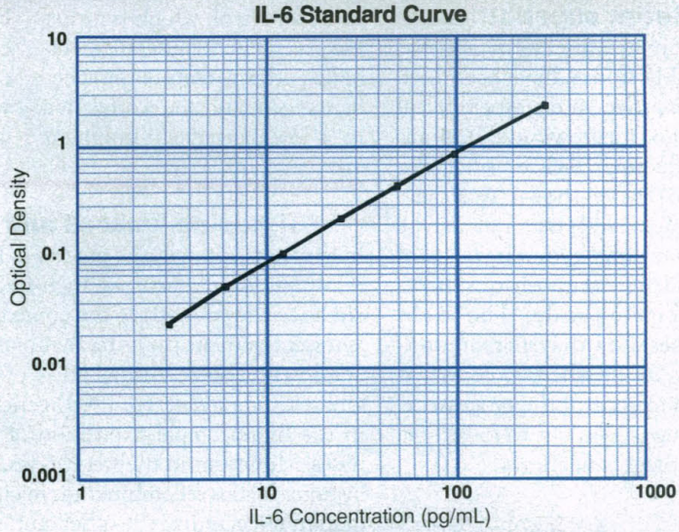

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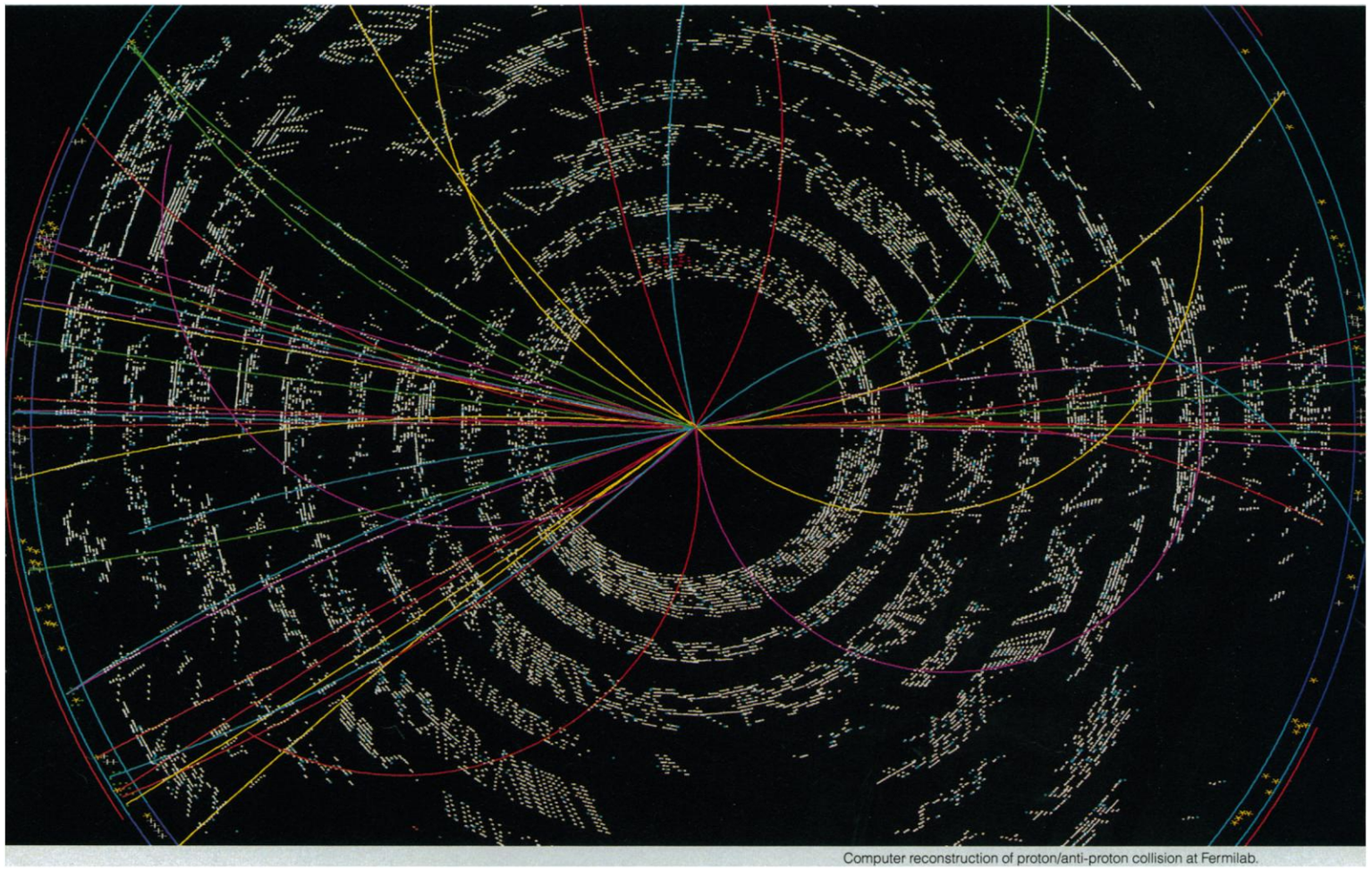

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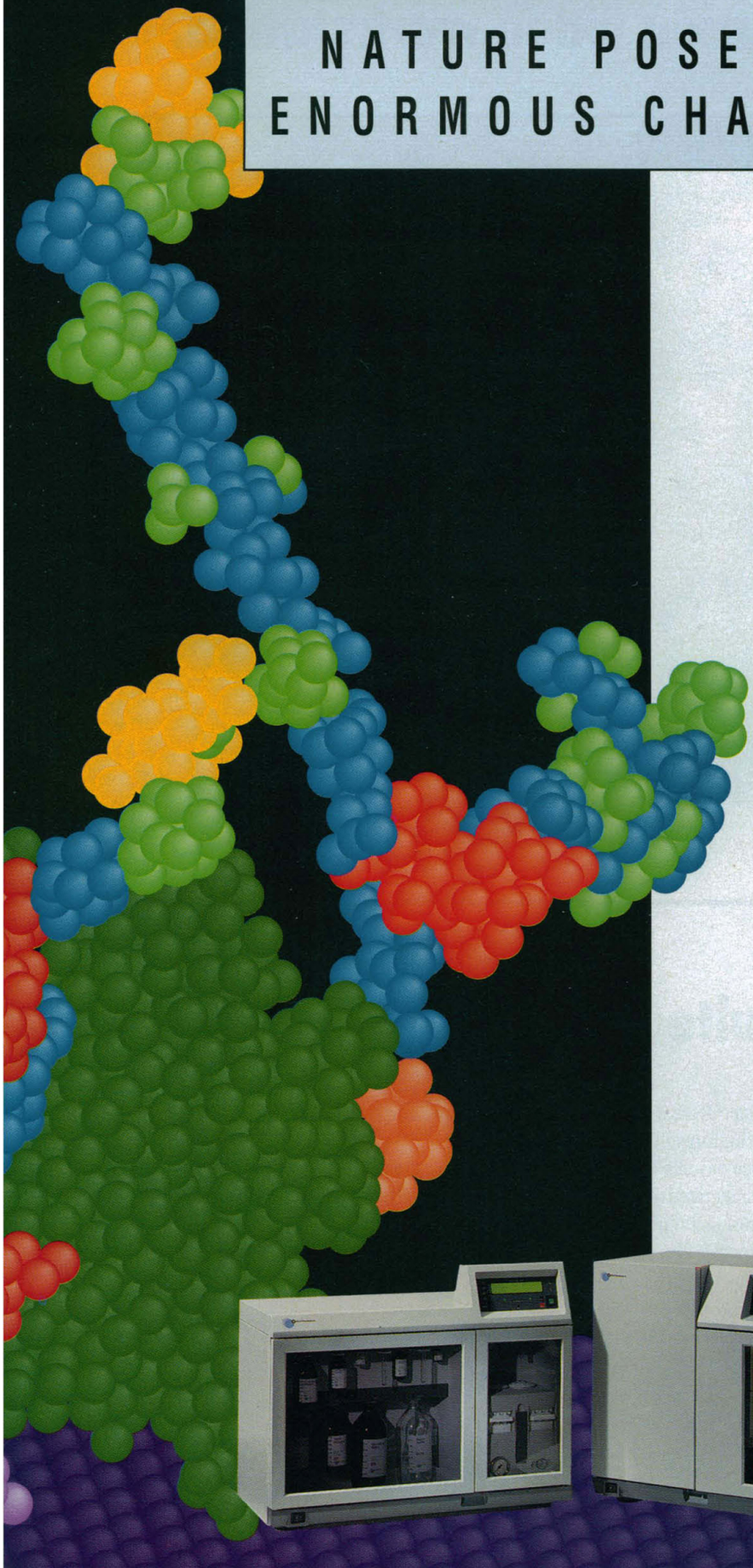

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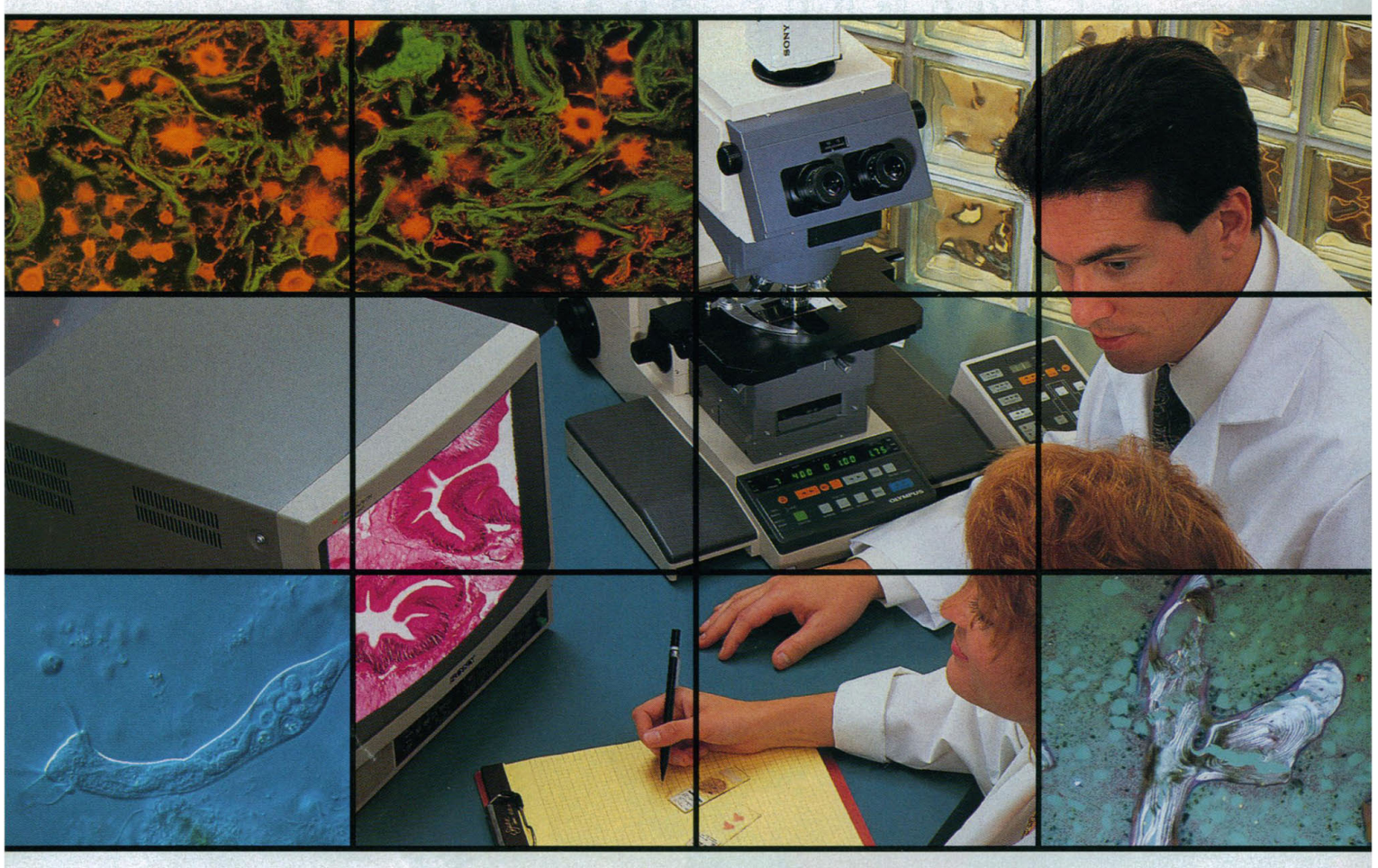

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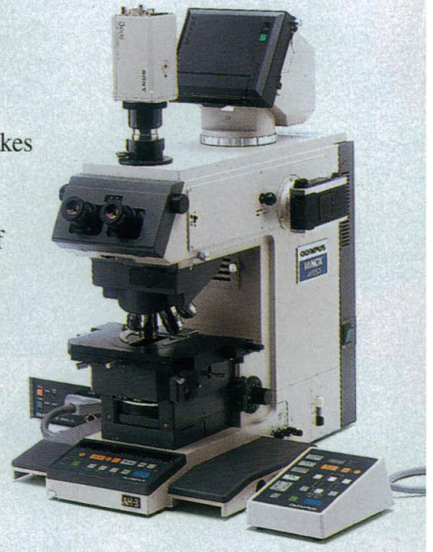

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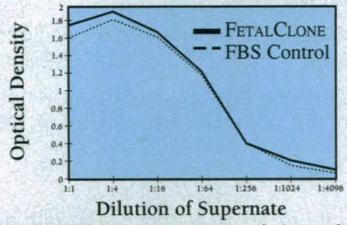

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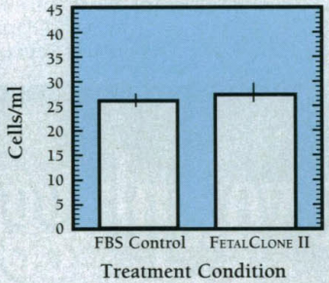

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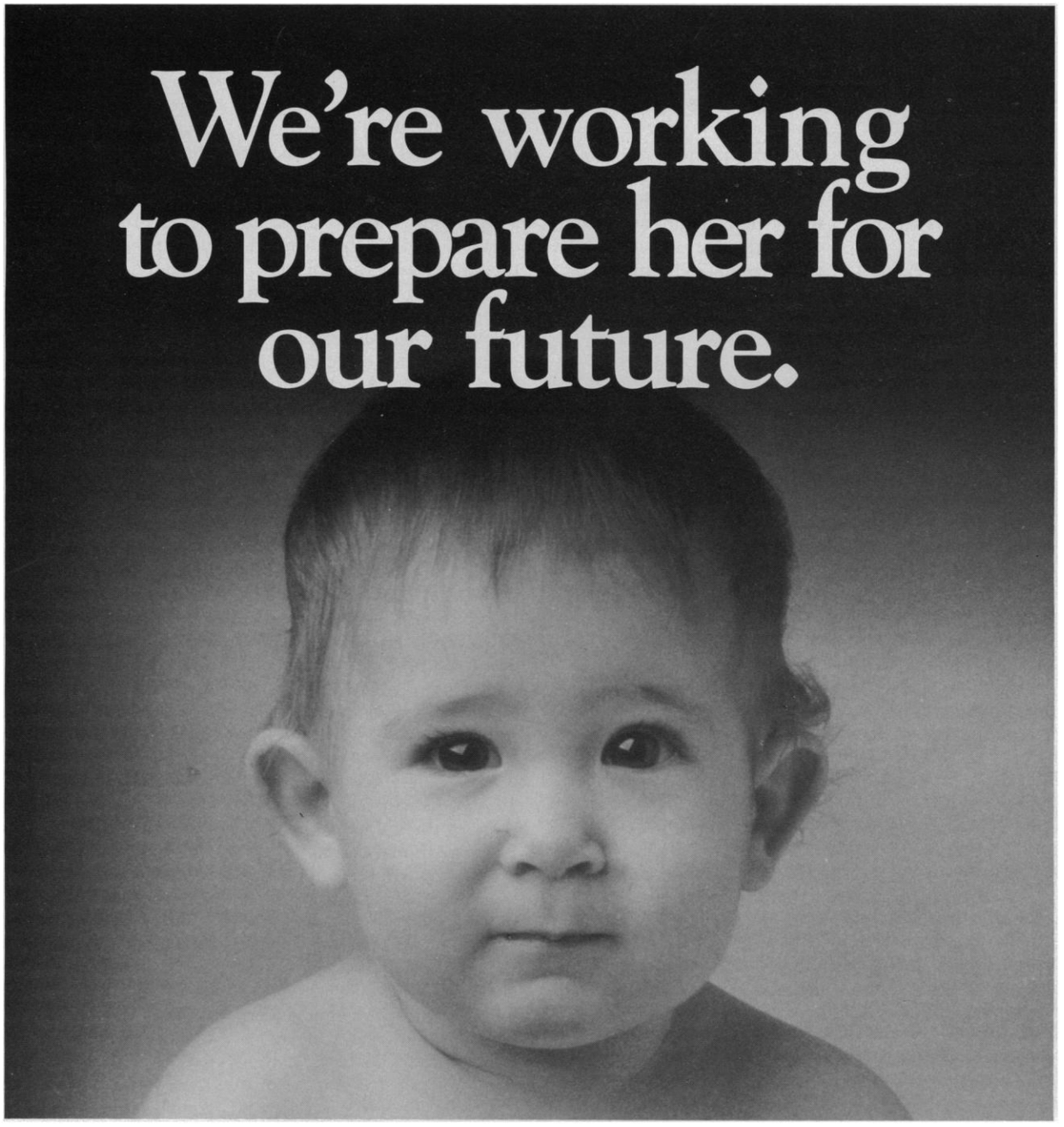

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Although just a beginning, AAAS and its members are not only dedicated to the advancement of science today, but through Project 2061 and other educational programs, to the continual advancement of science in years to come.

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE