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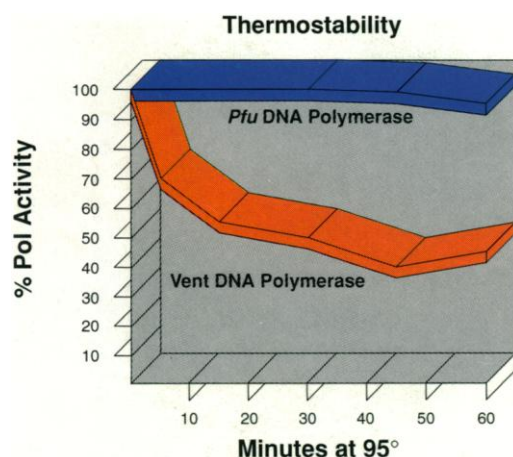


Figure 1: Thermostability of *Pfu* and Vent DNA Polymerases at 95°C.

To determine the thermostability of *Pfu* and Vent DNA polymerases at 95°C, 37.5 units of each enzyme were diluted to a final volume of 150 μ l in the recommended reaction buffer and incubated at 95°C. At 0, 5, 15, 30, 45 and 60 minute time points, duplicated 10 μ l aliquots (2.5 units) were assayed at 75°C for DNA polymerase activity.

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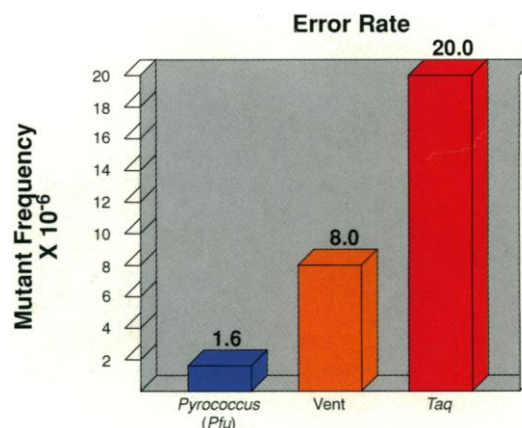


Figure 2: Polymerase fidelity was measured by modification of an assay described by Kohler *et al* (1991) *Pro. Natl. Acad. Sci. USA*, in press. Error rates reflect mutations per nucleotide incurred in the *lacI* gene during DNA synthesis. Vent is derived from *Thermococcus litoralis* and was obtained from New England Biolabs. *Pfu* is derived from *Pyrococcus furiosus* and is sold by Stratagene. *Taq* polymerase is derived from *Thermus aquaticus* and was obtained from Cetus Perkin Elmer.

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COVER Magnetic resonance image of the human brain, showing activation of the visual cortex. Regional changes in cerebral blood volume were measured during photic stimulation and reflect the task-induced changes in neuronal activity. The area of activated visual cortex (color) is mapped onto the three-dimensional anatomical structure (gray). This combined imaging method may be used in routine clinical examinations, permitting noninvasive high-resolution mapping of cortical function. See page 716. Other neuroscience reports pages 719 to 729. [Illustration courtesy of the Massachusetts General Hospital-NMR Center]

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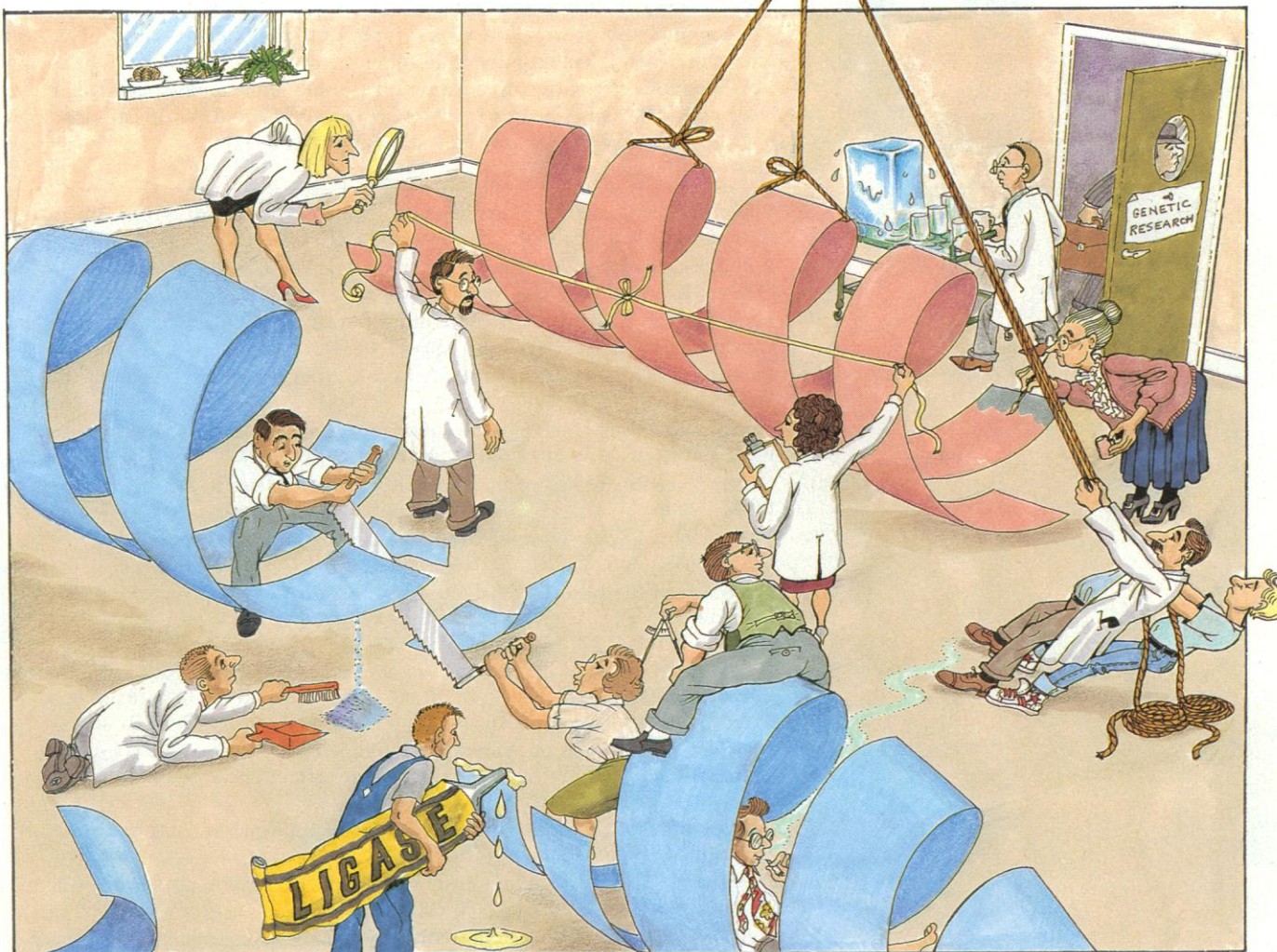
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This Week in SCIENCE

Neuroscience research

Making sense of the senses. That's the task of neuroscientists. This issue of *Science* contains a sampling of their recent research findings. **BRAIN DEVELOPMENT:** Transgene technology has been used to trace the development of the cerebellum's Purkinje cells. Smeyne *et al.* have sorted out how positional effects and factors intrinsic to the cells contribute to proper development (page 719). **BRAIN ACTIVITIES:** Magnetic resonance imaging has been used to map visual centers of the brain at high resolution. Belliveau *et al.* note that this noninvasive technology provides the best resolution attainable so far and is cheaper than other mapping techniques (page 716). **HEARING:** How are sound signals processed in the brain? Spitzer and Semple examine neurons in the inferior colliculus that are fine-tuned to respond to changing auditory cues (page 721). **BREATHING:** The location of neurons that control breathing and ensure stable respiratory rhythms has been identified by Smith *et al.* as the pre-Bötzing complex of the brainstem (page 726). **TASTE:** Ye *et al.* provide an explanation for why various sodium salts taste different even though sodium is responsible for the salty taste (page 724). The solution to the "anion paradox" is also discussed by Barinaga (page 654). **CHANNEL BIOPHYSICS:** Bezanilla *et al.* discuss the molecular basis for gating (the switching on and off) of potassium channels and the interplay of subunits of membrane proteins and charge carriers in the electric field (page 679).

Early foraminifera

Early protists, the foraminifera, were, like primitive metazoans, developing skeletal parts as long ago as the Early Cambrian (page 689). This finding must be considered in models proposed to explain how and for what purposes skeletalization came into being. Foraminifera are marine organisms whose single-celled bodies are usually surrounded by a carbonate shell.

Diverse genera have been traced as far back as the Middle Cambrian. Now Culver reports on the discovery of even older fossil foraminifera. The new specimens, which include both free-living and adherent forms, date from the Early Cambrian, at least 550 million years ago (page 689). The specimens were discovered in West Africa in the Walidiala Valley, which includes portions of Senegal, Mali, and Guinea. The agglutinated fossils were uncovered in siltstone, and their age was established on the basis of associated fauna and supported by radiometric data.

Changing vegetation

Vegetation patterns on the Earth could change enormously in the coming centuries if, as has been proposed, greenhouse gases continue to accumulate in the atmosphere and global warming occurs. Overpeck *et al.* have combined pollen data from the geologic record with projections from three global circulation models; they have assessed the likely impact on vegetation of a doubling of atmospheric CO₂ and a rise in global temperature by as much as 4.5°C (page 692). Since the last glacial age, some 18,000 years ago, global air temperature has risen by about 4°C; thus, the change in vegetation patterns over this long period can serve as a reasonable standard against which future change can be estimated. The future rate of change is expected to be much faster, and it is estimated that within 200 to 500 years changes comparable to those of the past 18,000 years could be realized. Some plant species are expected to shift their ranges as much as 1000 kilometers. Such shifts would have a dramatic impact on individual species and ecosystems.

IL-4 knock-out mice

What happens to an animal's immune system when there is no interleukin-4 (IL-4)? This cytokine is one of the soluble secreted molecules whose pleiotropic actions affect differentiation and proliferation of

many types of cells. Kühn *et al.* used a gene-targeting strategy for mutating the mouse genes that encode IL-4; the functional losses to the immune systems were then assessed in a variety of ways (page 707). The so-called IL-4 knock-out mice had no detectable IgE in their blood streams. Furthermore, they were unable to produce IL-4 or IgE in response to nematode infections. Another antigen, derivatized chicken γ -globulin, elicited only one-third to one-half the normal amount of IgG1, but compensatory amounts of other IgG immunoglobulins—IgG2a, IgG2b, and IgG3—were produced. In the absence of IL-4 no obvious changes were observed in the development of T and B cell populations. The results of these in vivo experiments do not completely mirror those of in vitro experiments, showing that IL-4 effects in the test tube and in the body may differ.

IL-4 immunotherapy

Tumor cells can be genetically altered to produce a substance that assists in their own destruction (page 713). The strategy, which has been worked out in experimental mice, may be directly applicable to therapy for human tumors. Golumbek *et al.* used a viral vector to introduce genes for interleukin-4 (IL-4), a helper cytokine, into spontaneously arising mouse kidney tumor cells. The transgenic tumor cells were injected back into mice where they secreted large amounts of IL-4. One of the known effects of IL-4 is enhancement of the lytic activity of cytotoxic cells. Local immune reactions against the tumor, which eventually led to the destruction of the tumors, were associated with the arrival of activated macrophages and smaller numbers of granulocytes (mostly eosinophils) at the tumor injection site. Few T cells were involved in the immediate response. Some 2 weeks after the injection of the altered cells, CD8⁺ T cells appeared at the site and later circulated through the body, effectively rejecting similar (but unaltered) tumors at metastatic locations. ■ RUTH LEVY GUYER

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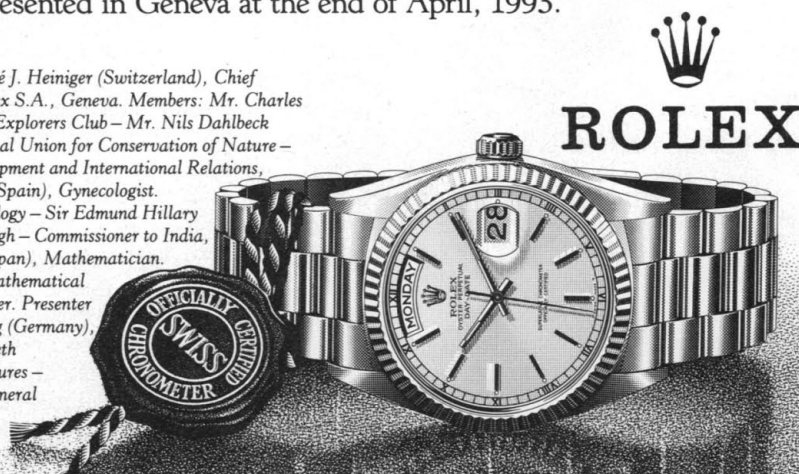
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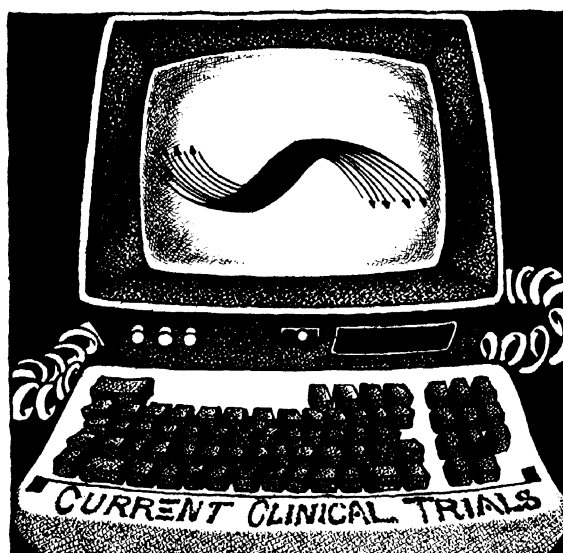
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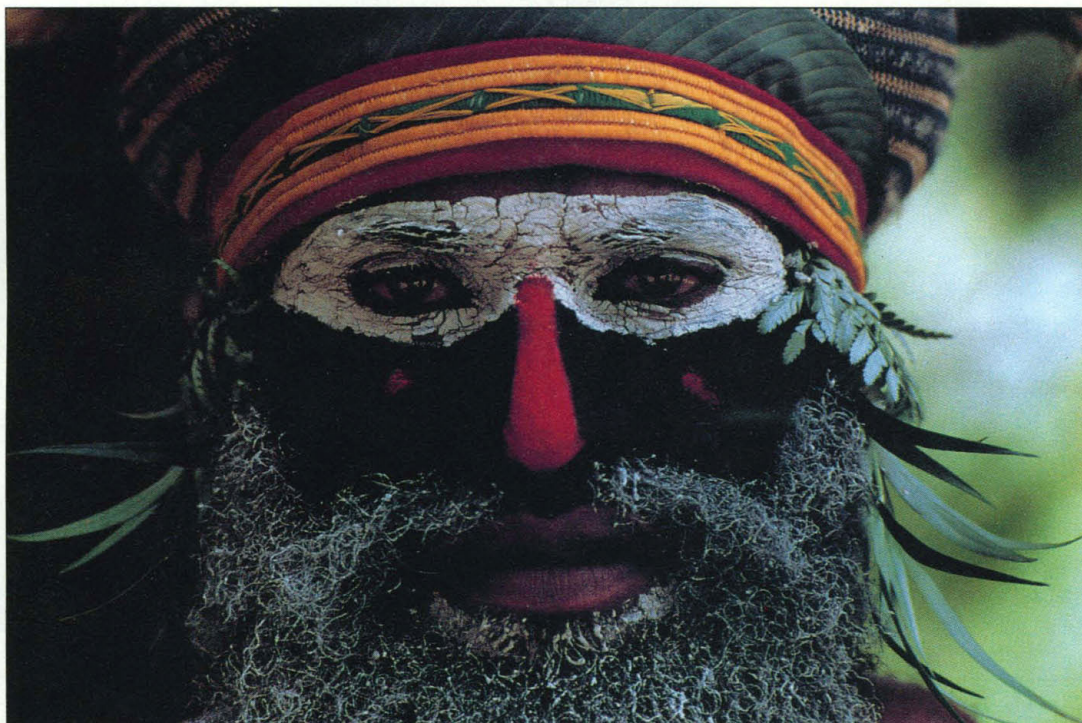
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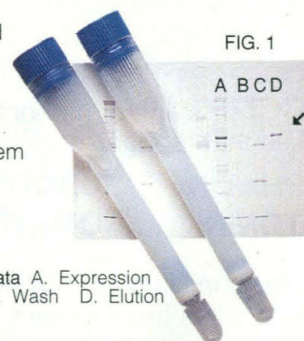


Figure 1: Expression Data A. Expression B. Flow Through C. Wash D. Elution

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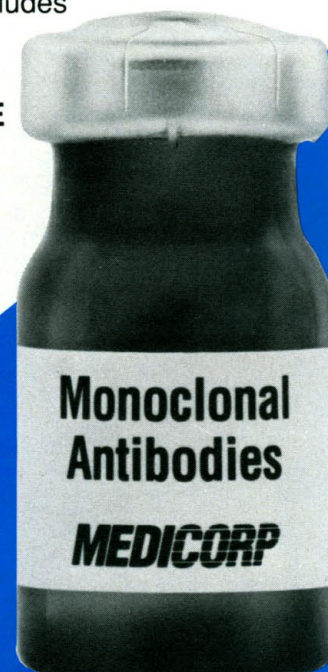
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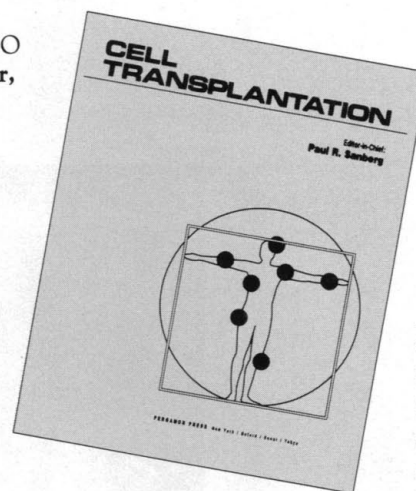
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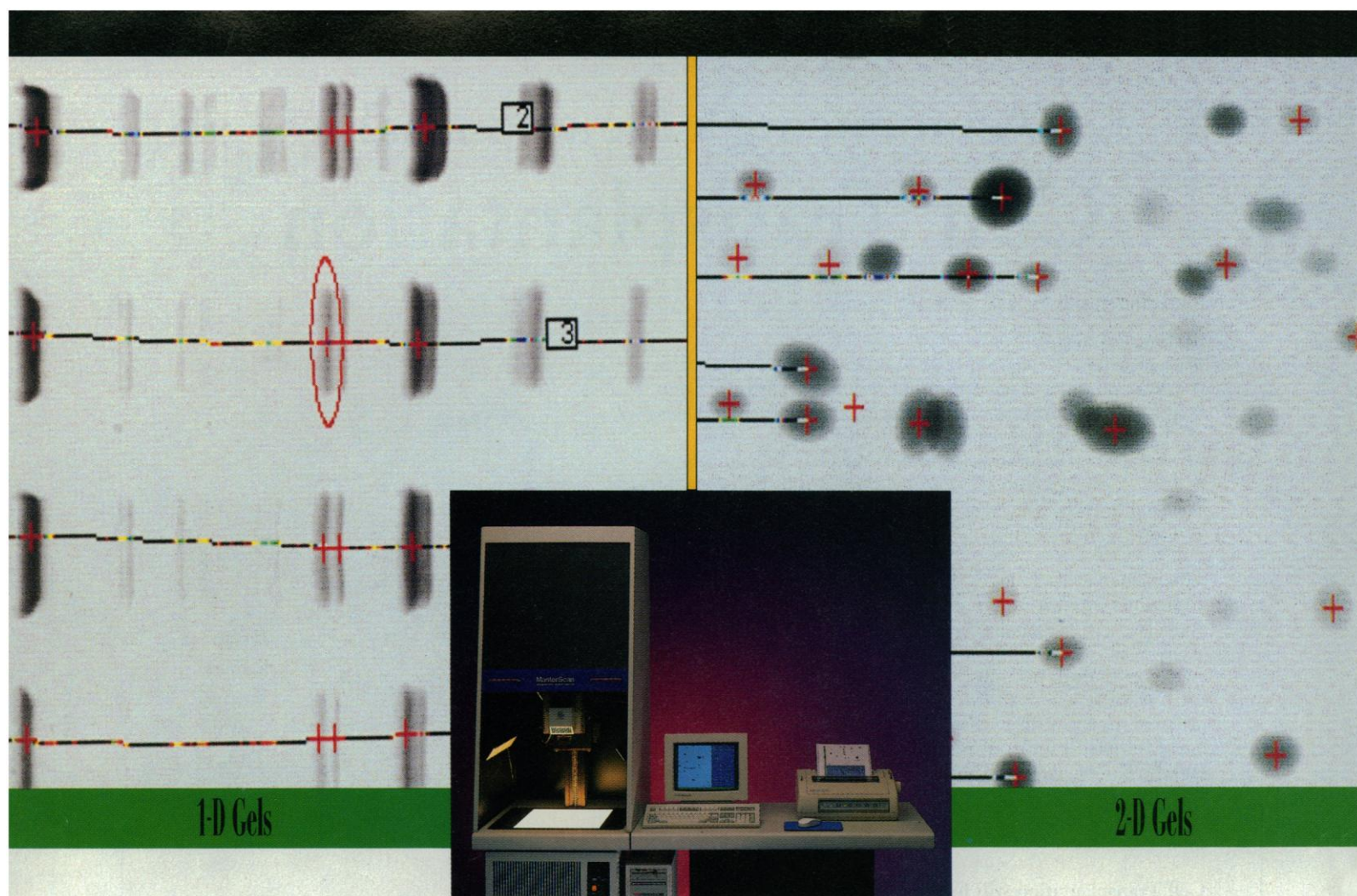
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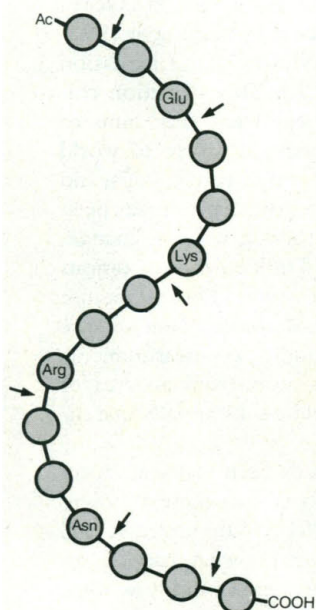
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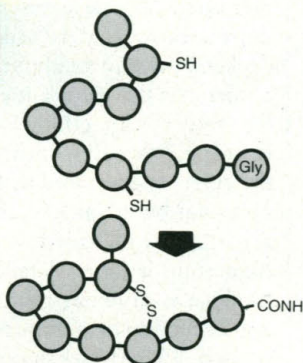
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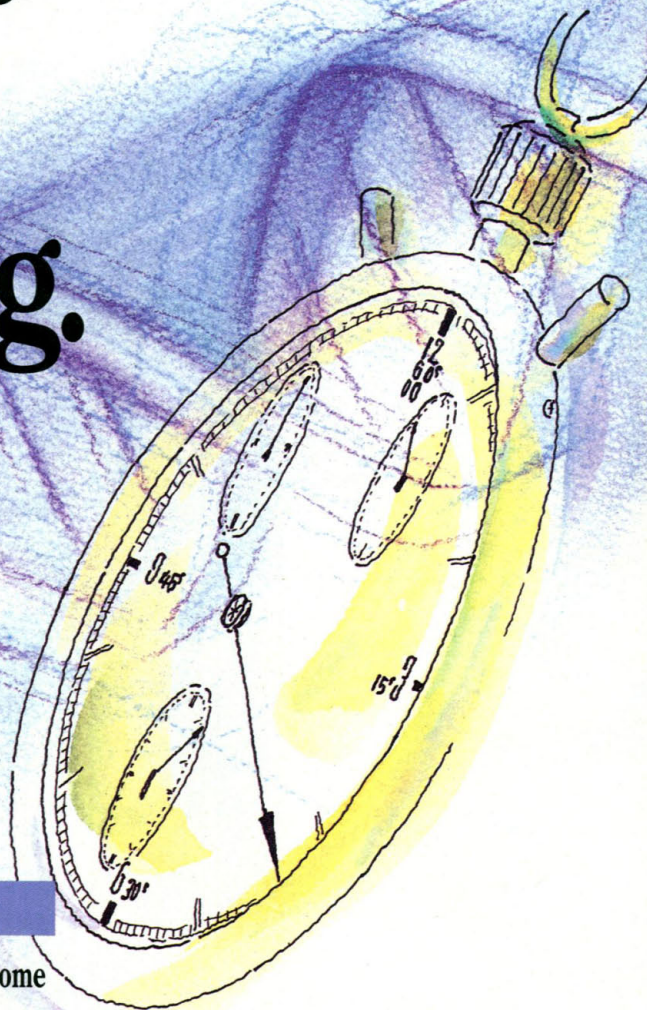
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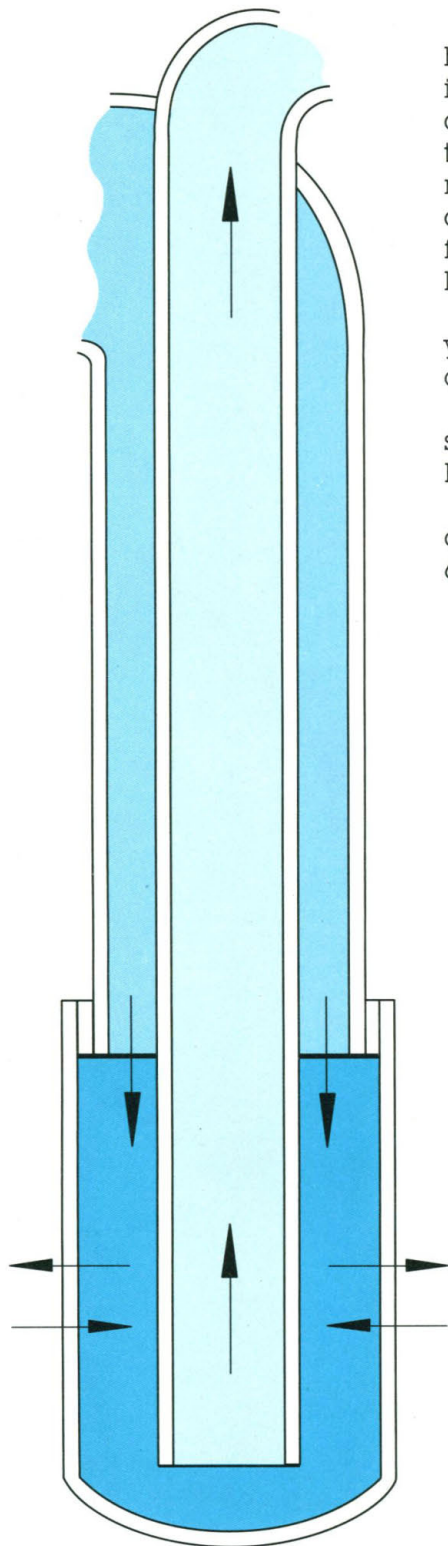
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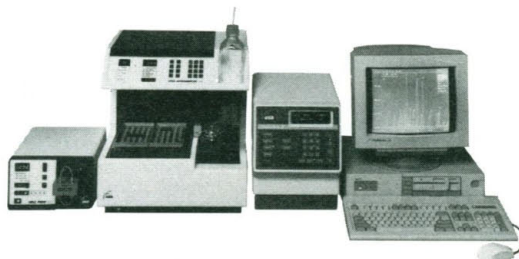


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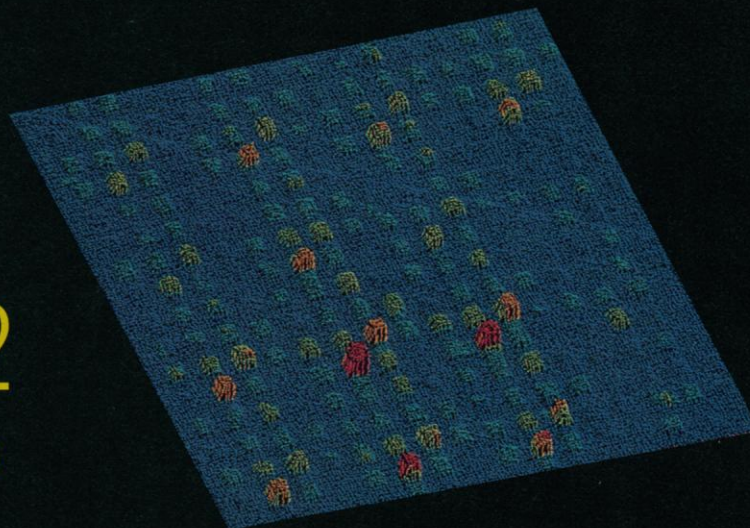


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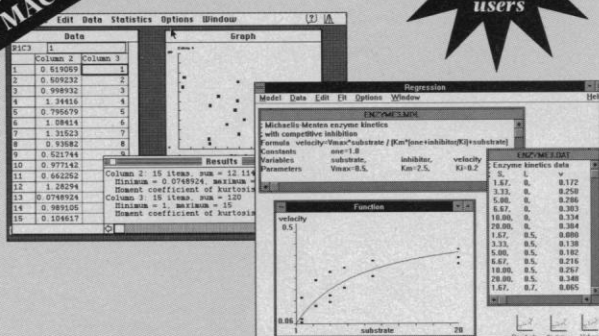
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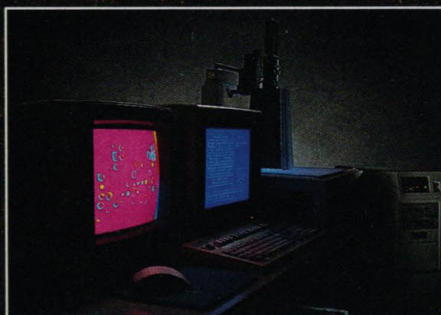
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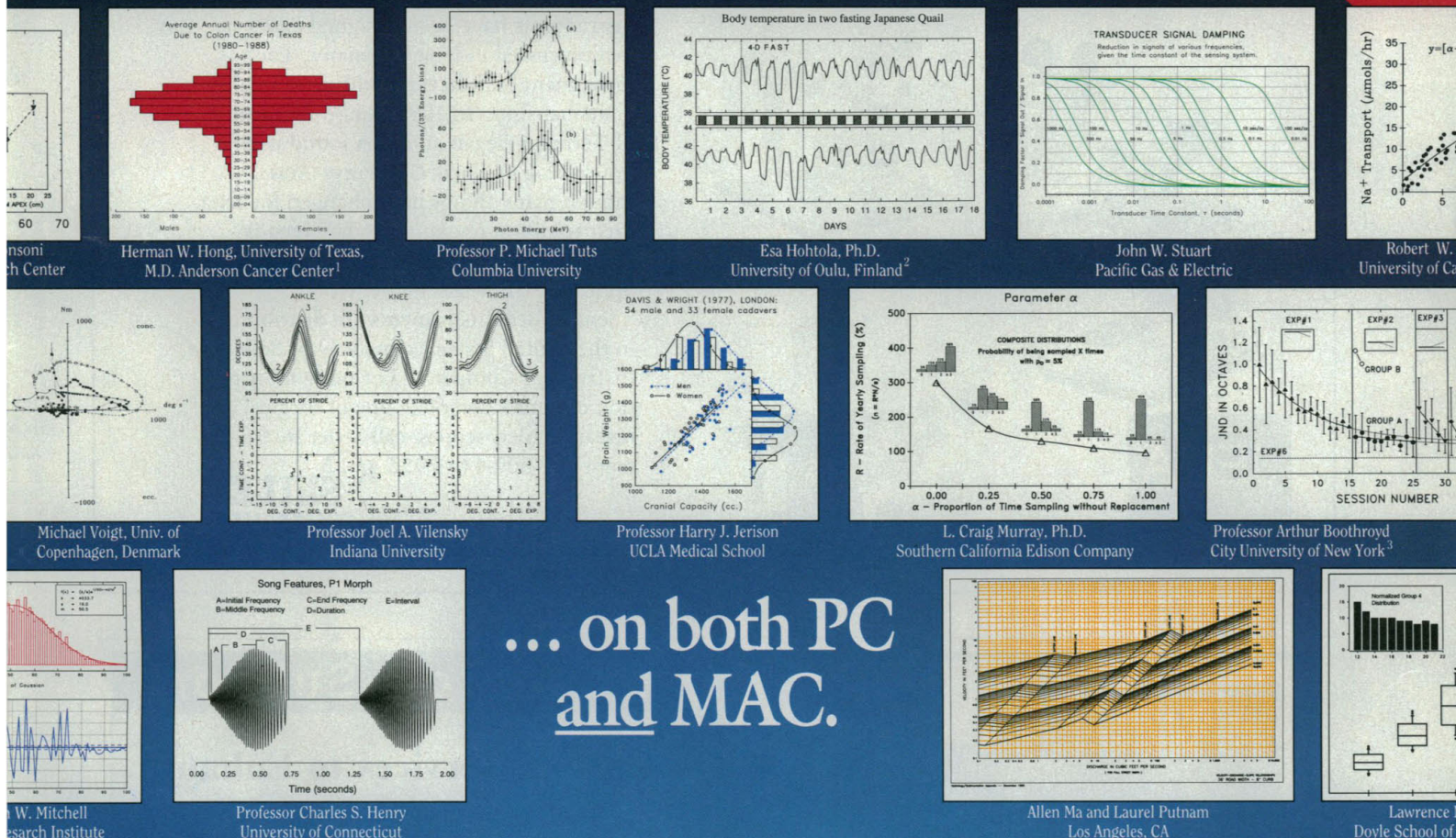
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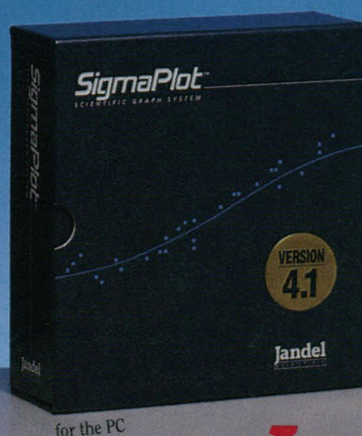
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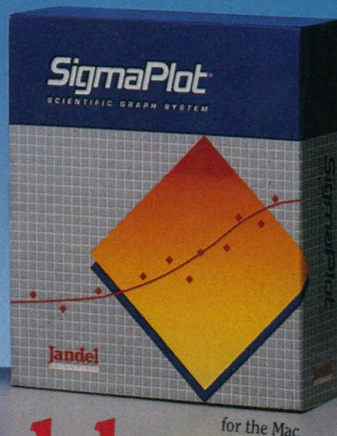
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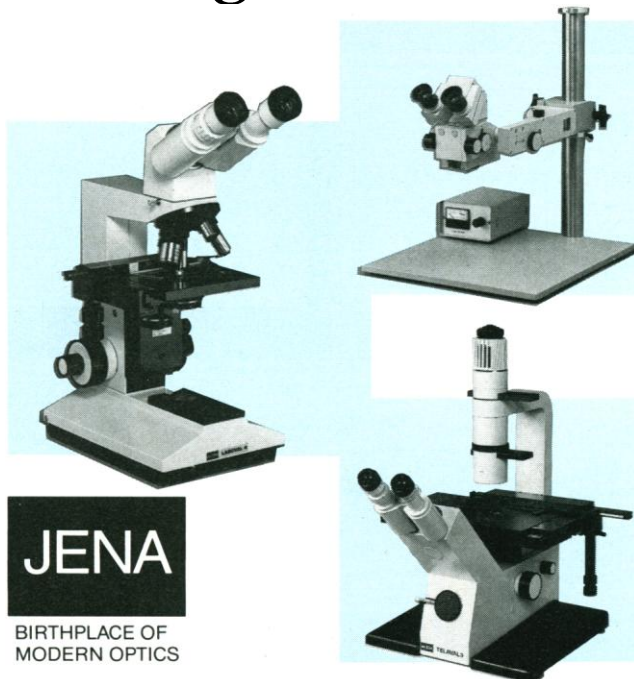
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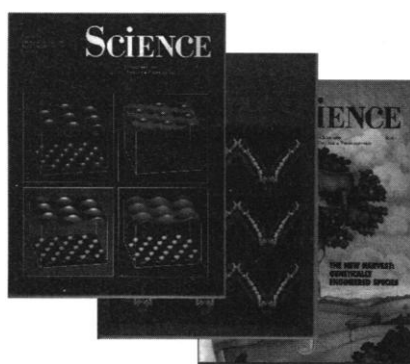
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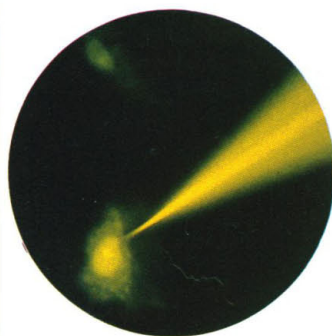
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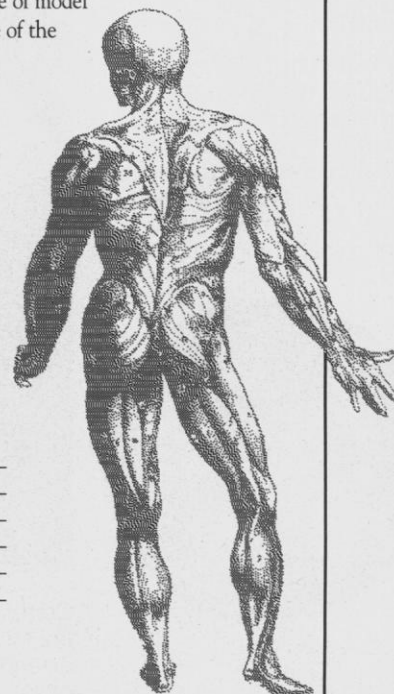
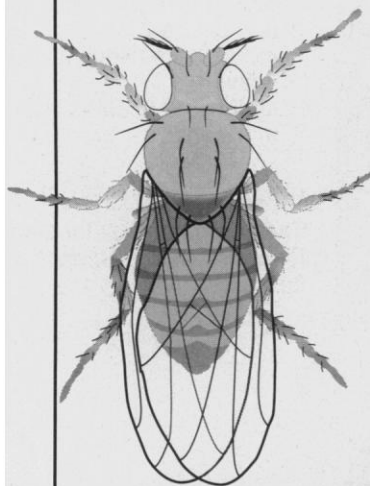
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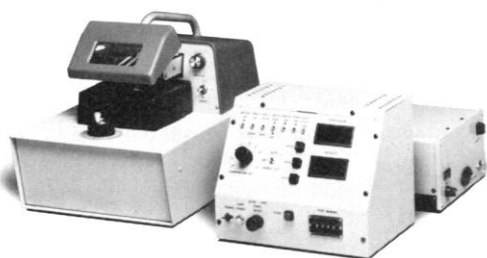
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