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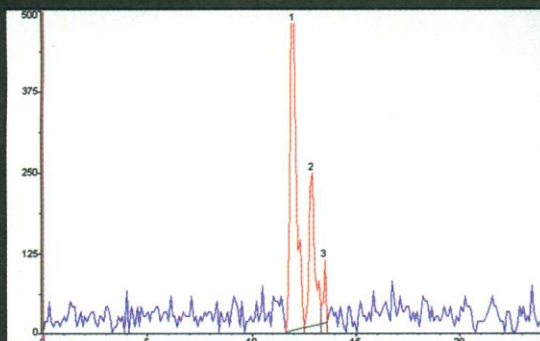
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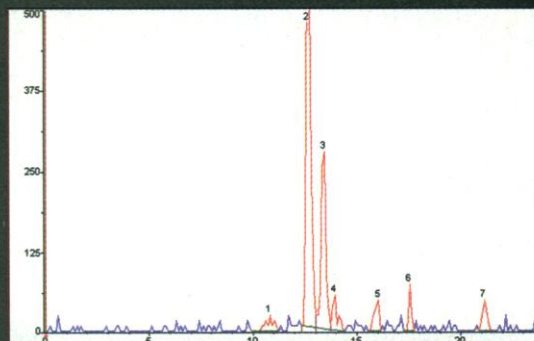
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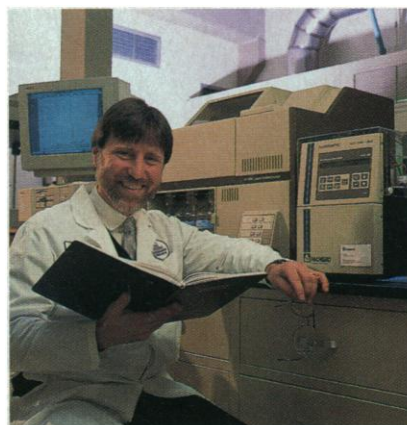
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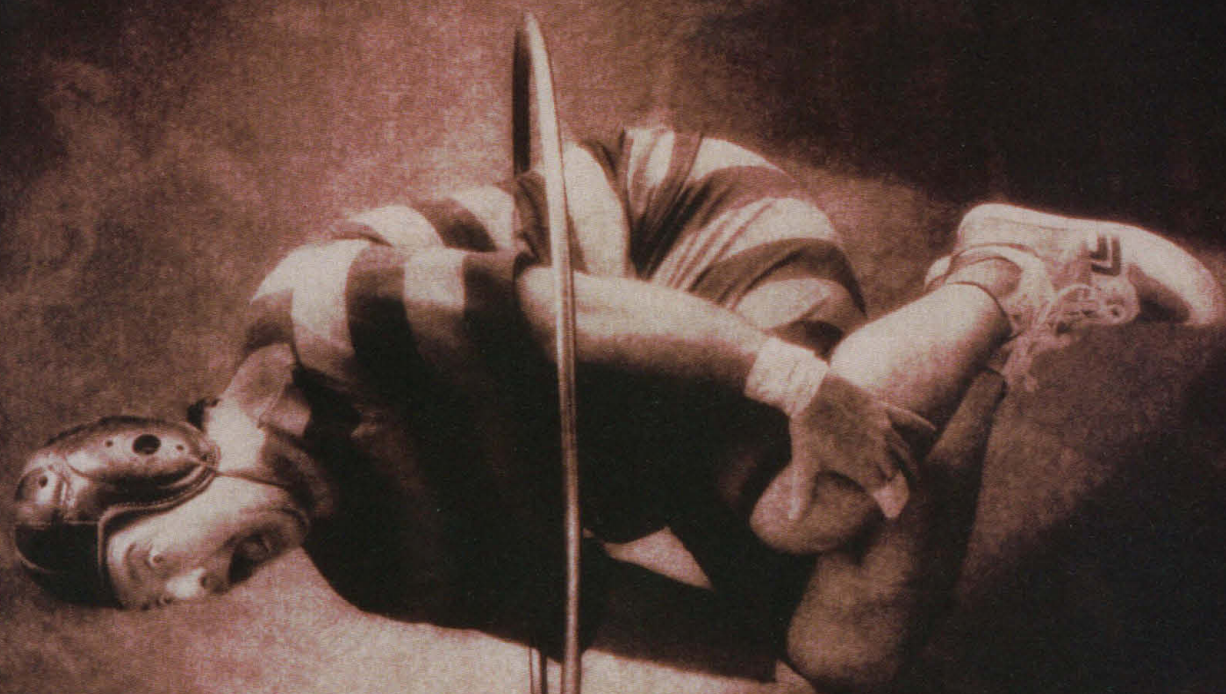
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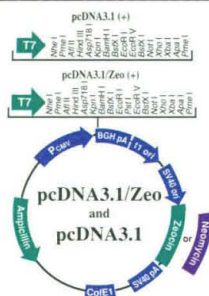
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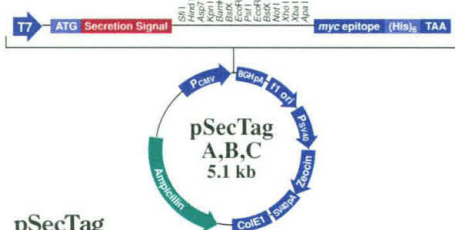
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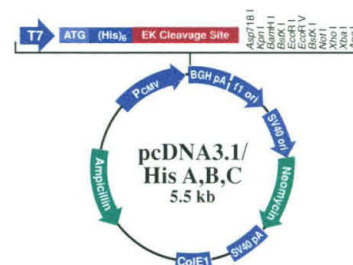
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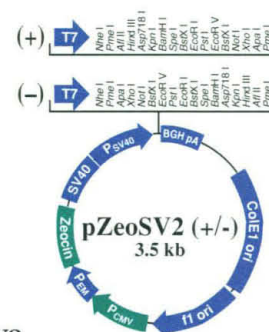
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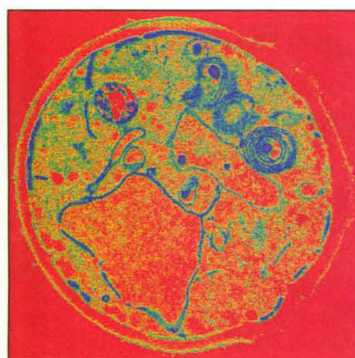
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COVER

Talented undergraduates in Japan are being pulled in different directions. The government and the universities are urging them to pursue advanced scientific degrees as part of a larger effort to stimulate economic growth, while companies traditionally prefer to train them on the

job. The cover is drawn in a style known as *manga*, a form of illustration popularized in serial cartoons and comic books in Japan. A more traditional depiction of the same idea appears on page 43 to open our special report on Science in Japan. [Illustration: Tomoko Saito]



"Further, deeper study—Investment for future"

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"Government"

"Corporation"

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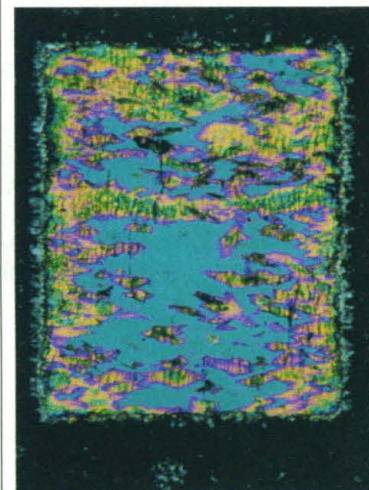
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Olivine to spinel

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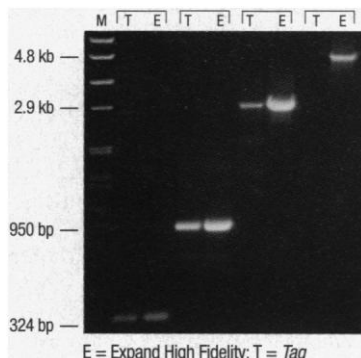
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THIS WEEK IN SCIENCE

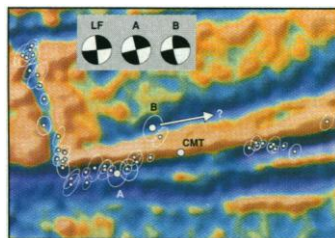
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Pacific climate

The climate in the tropical Pacific basin is characterized by strong sea surface temperature differences along the equator between an eastern cold region (the "cold tongue") and a western warm region (the "warm pool"), and by interannual sea surface temperature fluctuations associated with the El Niño–Southern Oscillation (ENSO). Jin (p. 76) presents a simple coupled model that reproduces essential aspects of the tropical Pacific climate. Positive feedbacks between trade winds, equatorial sea surface temperature contrast, and upper ocean heat content lead to ENSO-like oscillations in the model Pacific basin.

Quake precursors

Some large earthquakes, particularly on oceanic transform faults, seem to have been preceded by an extended low-frequency signal of up to hundreds of seconds in which considerable energy is released, but these have been difficult to discern and are controversial in part because the events could



not be seen directly in the typical seismic record. McGuire *et al.* (p. 82) now report that they have detected a slow precursor on the Romanche transform fault on the mid-Atlantic ridge in the time domain. The precursor released about half of the energy of the earthquake that followed it.

What's the matter in the universe?

The distant observable universe takes the form of stars, galaxies, and clusters, but where has all the matter gone that was not used to form these large structures? Dodelson *et al.* (p. 69) review cold dark matter theory, which argues that the nucleosynthesis that formed ordinary baryonic matter after the initial rapid expansion of the universe still left the bulk of the universe as cold dark matter, which consists of small, slow-moving elementary particles that have not been detected yet but that may provide the gravity that holds the universe together. They discuss several cold dark matter models that are based on recent observations from the Cosmic Background Explorer, the Hubble Space Telescope, and several large sky surveys.

Amazon climate record

The climate and fauna of the Amazon during the last glacial maximum has been uncertain, in part because of the lack of continuous climate records from the region. Colinvaux *et al.* (p. 85; see the news story by Kerr, p. 35) now present a pollen record that extends back to about 40,000 years ago from a lake in the lowland Amazon rain forest. The data imply that rain forest was still extant in the region during glacial times and was not highly fragmented. They are also consistent with an average climate cooling of about 5°C that has been inferred from other proxy records.

T cell tool

Immune responses mediated by B lymphocytes can be easily quantified by using monoclonal antibodies that recognize the immunoglobulin bound to the B cell surface. Similar tracking of T lymphocyte responses has been frustrated by the lack of an analogous tool to identify the antigen-specific receptors on the surface of the T cells. Altman *et al.* (p. 94) suggest one solution: they use tetramers of soluble complexes of major histocompatibility complex (MHC) mol-

ecules and peptides to label antigen-specific T cells directly. Staining with peptide-specific tetramers to identify cytolytic T lymphocytes (CTLs) against influenza virus correlated well with functional cytotoxicity assays, and the tetramers can also be used to sort an antigen-specific CTL population.

Mitochondrial helpers

Membrane proteins in the mitochondria, the cell's energy-generating organelles, frequently form specific interactions in order to build a multifunctional protein complex. The correct and efficient assembly of these membrane complexes is essential for mitochondrial function. Rep *et al.* (p. 103) now demonstrate that a mitochondrial protease can also act as a molecular chaperone to promote membrane complex assembly independently of its proteolytic functions.

Chain of command

Class II MHC molecules associate with invariant (Ii) chains, which act as chaperones for their folding and transport. Shachar and Flavell (p. 106)

show that Ii is also essential for B cell maturation. In mice lacking Ii, peripheral B cells were immature and did not proliferate when stimulated by type II thymic-independent antigens. This block in development did not depend on expression of MHC class II molecules.

Firing together

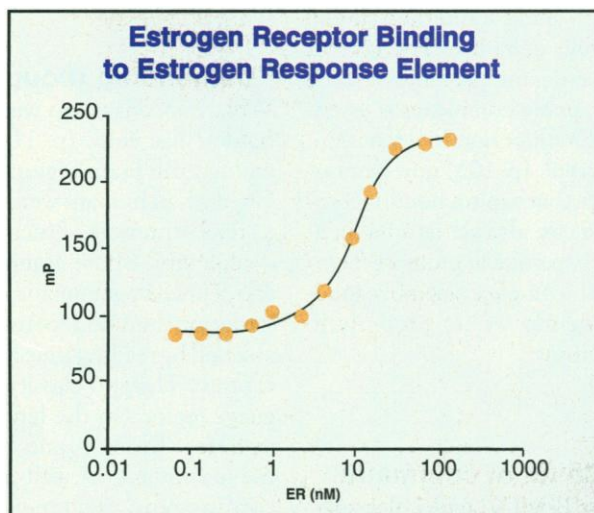
A recurring question in visual processing studies is how the segregated features in a stimulus (such as orientation or color) are recombined to create an image. The synchronized activity of neurons (at 20 to 70 hertz) in the visual cortices of cats and monkeys has been proposed as a mechanism for binding together these features appropriately. Gray and McCormick (p. 109) describe a new class of pyramidal cell (the most common excitatory type) whose properties suggest that it may underlie the generation of the rhythmic firing and recruitment of other neurons into these synchronized assemblies.

Demanding thoughts

What happens when we think harder? Just *et al.* (p. 114) examined the brain regions activated when humans were asked to read sentences of increasing complexity, where complexity was defined by grammatical construction and independently assessed by reading time and error rate. The two classical language regions in the left hemisphere—Broca's and Wernicke's areas—as well as the corresponding regions of the right hemisphere displayed an increasing volume of activated neural tissue as the "thinking" demands escalated.

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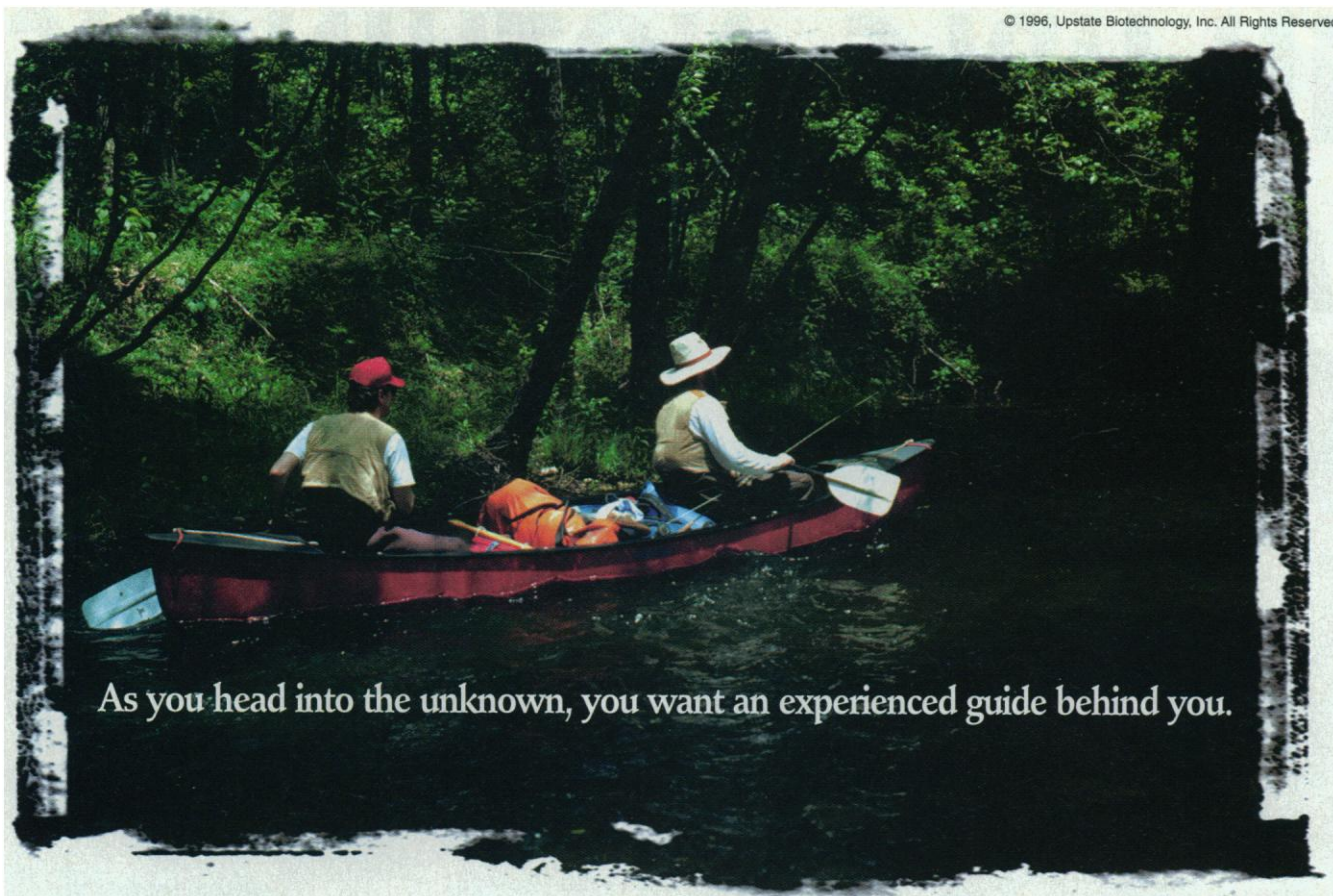


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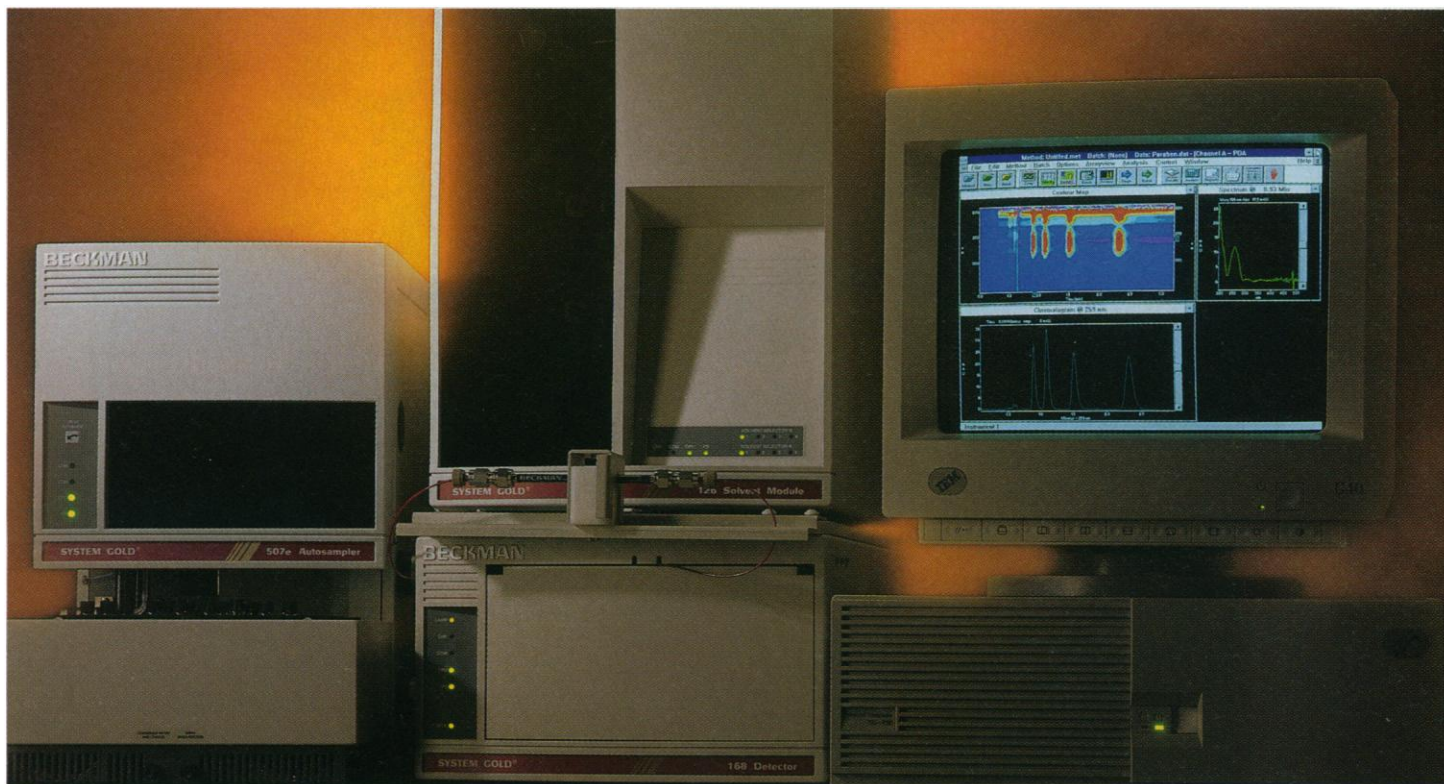

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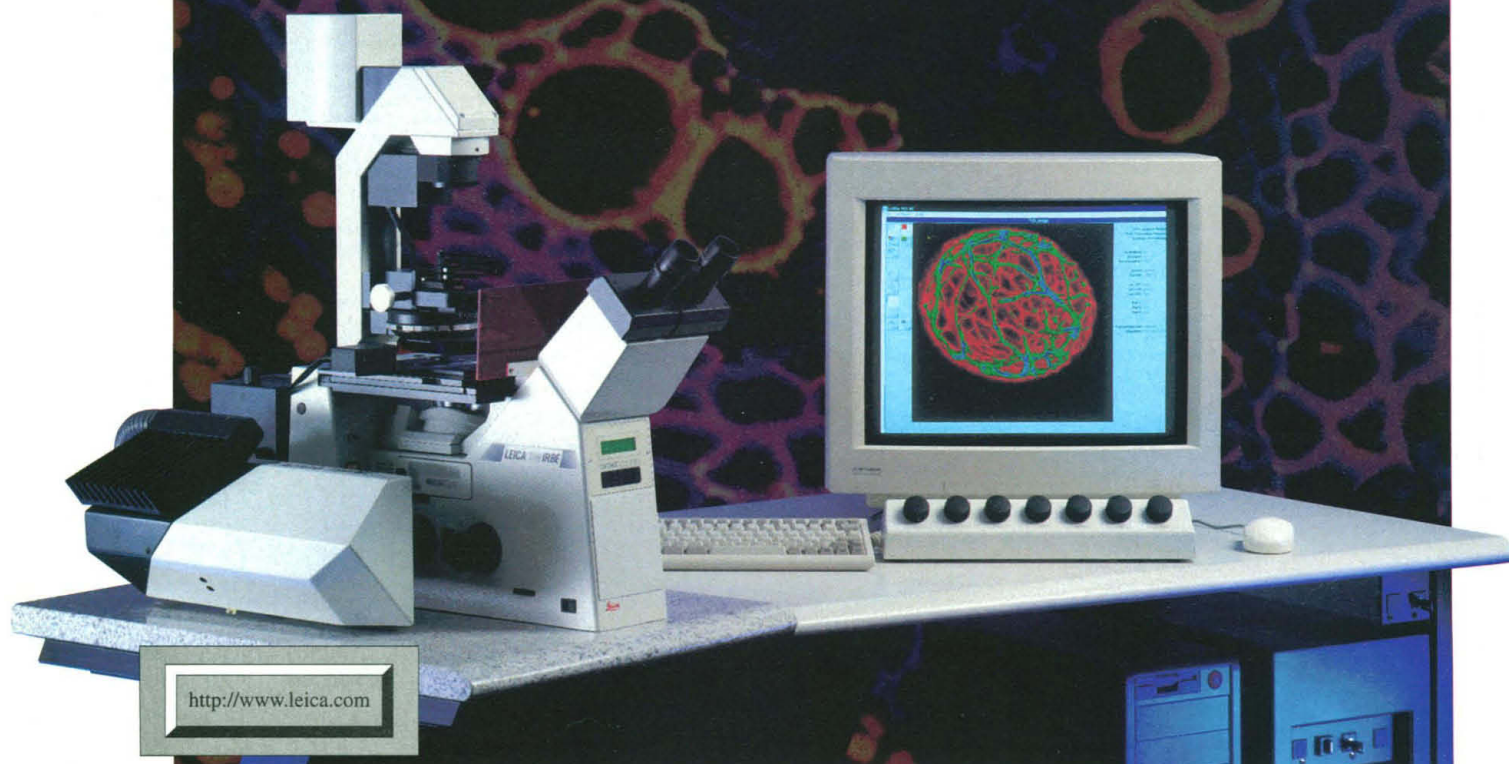
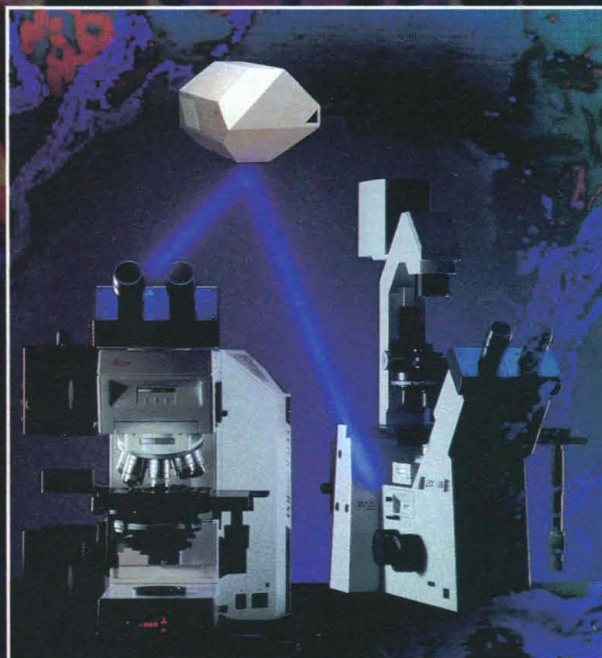
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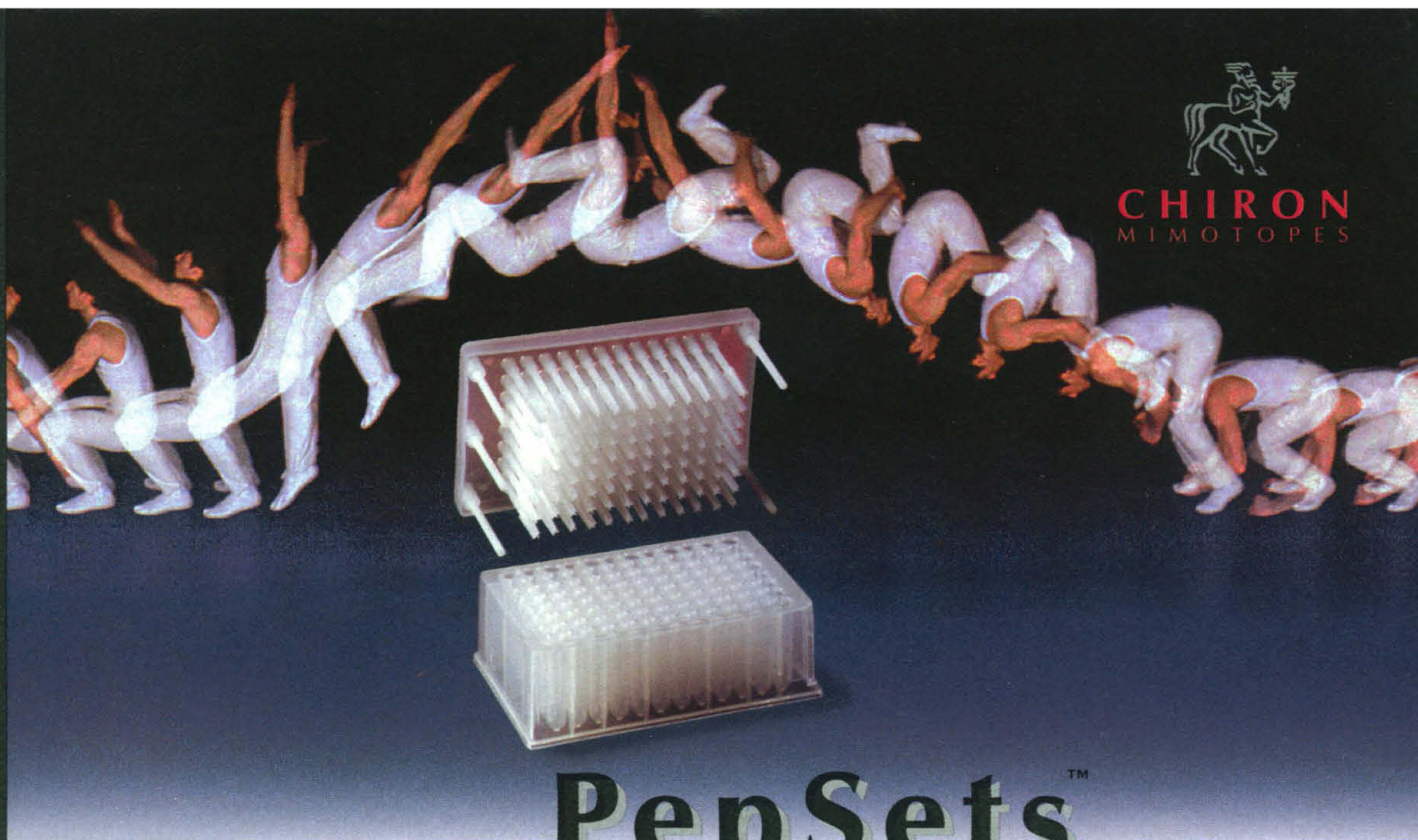


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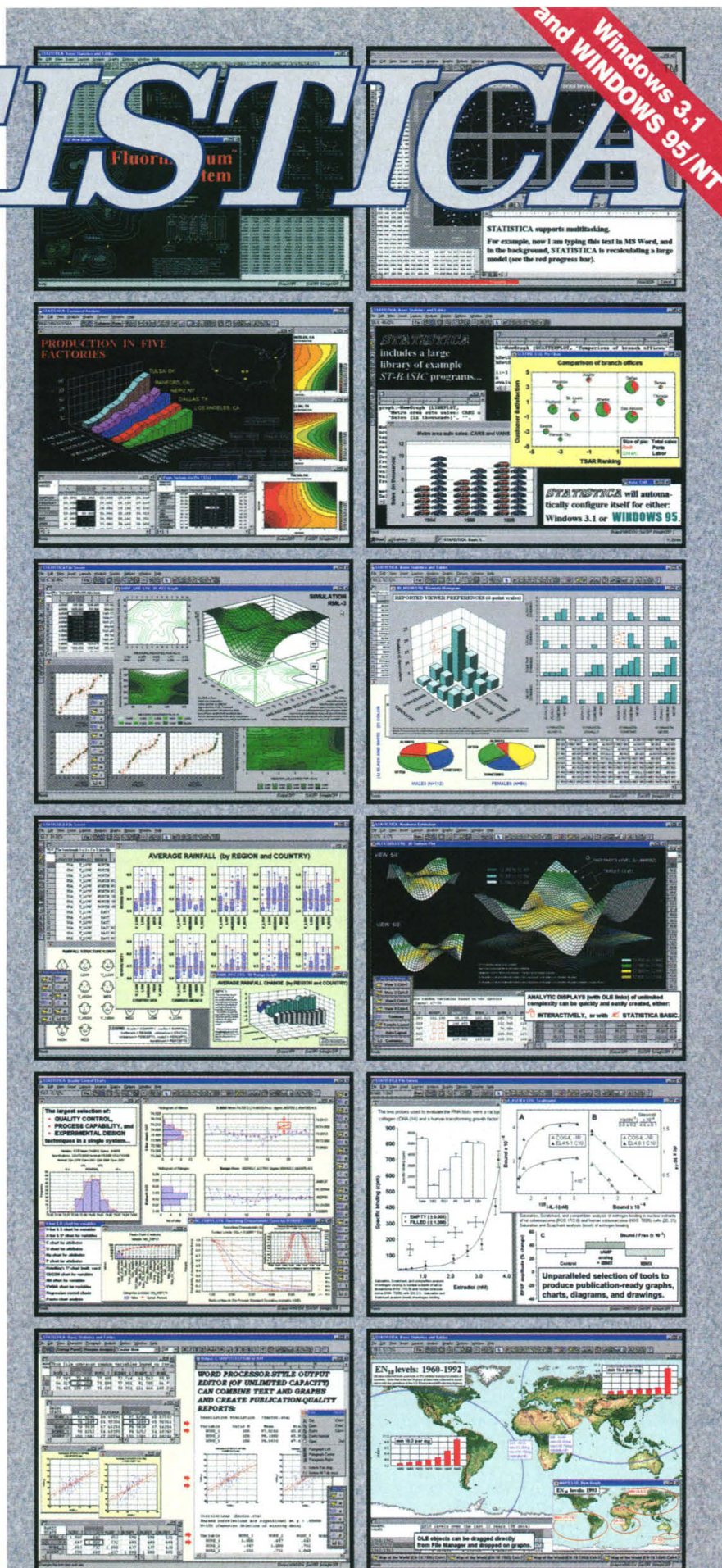
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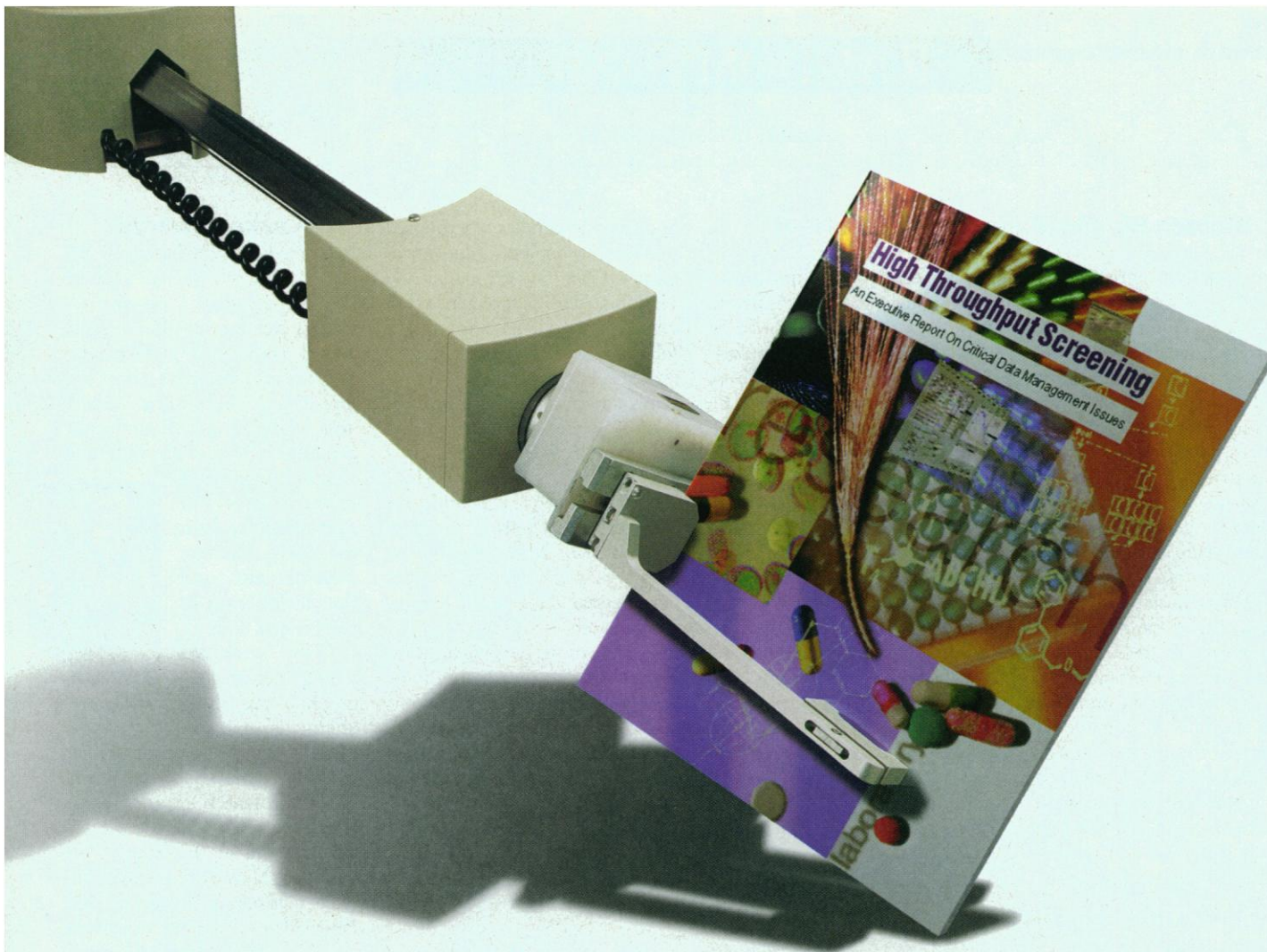
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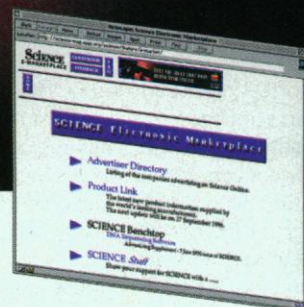
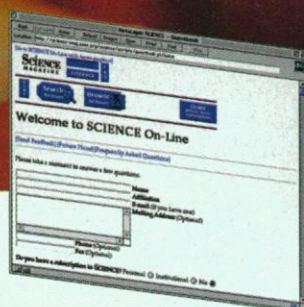
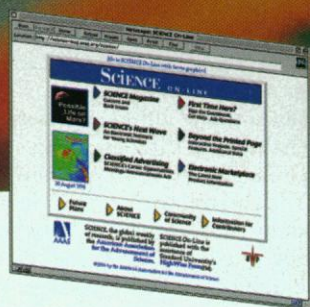
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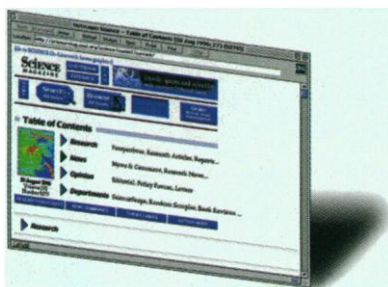
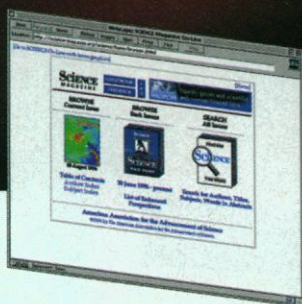
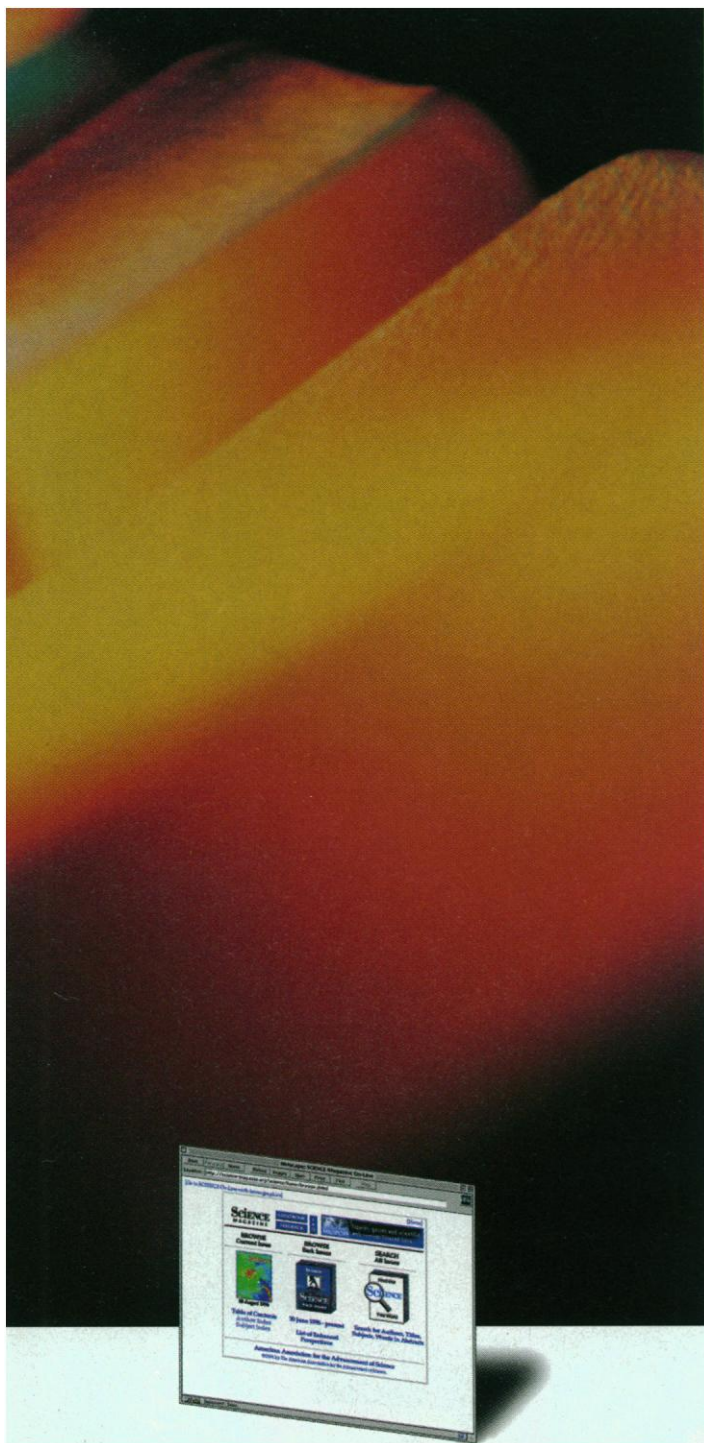
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