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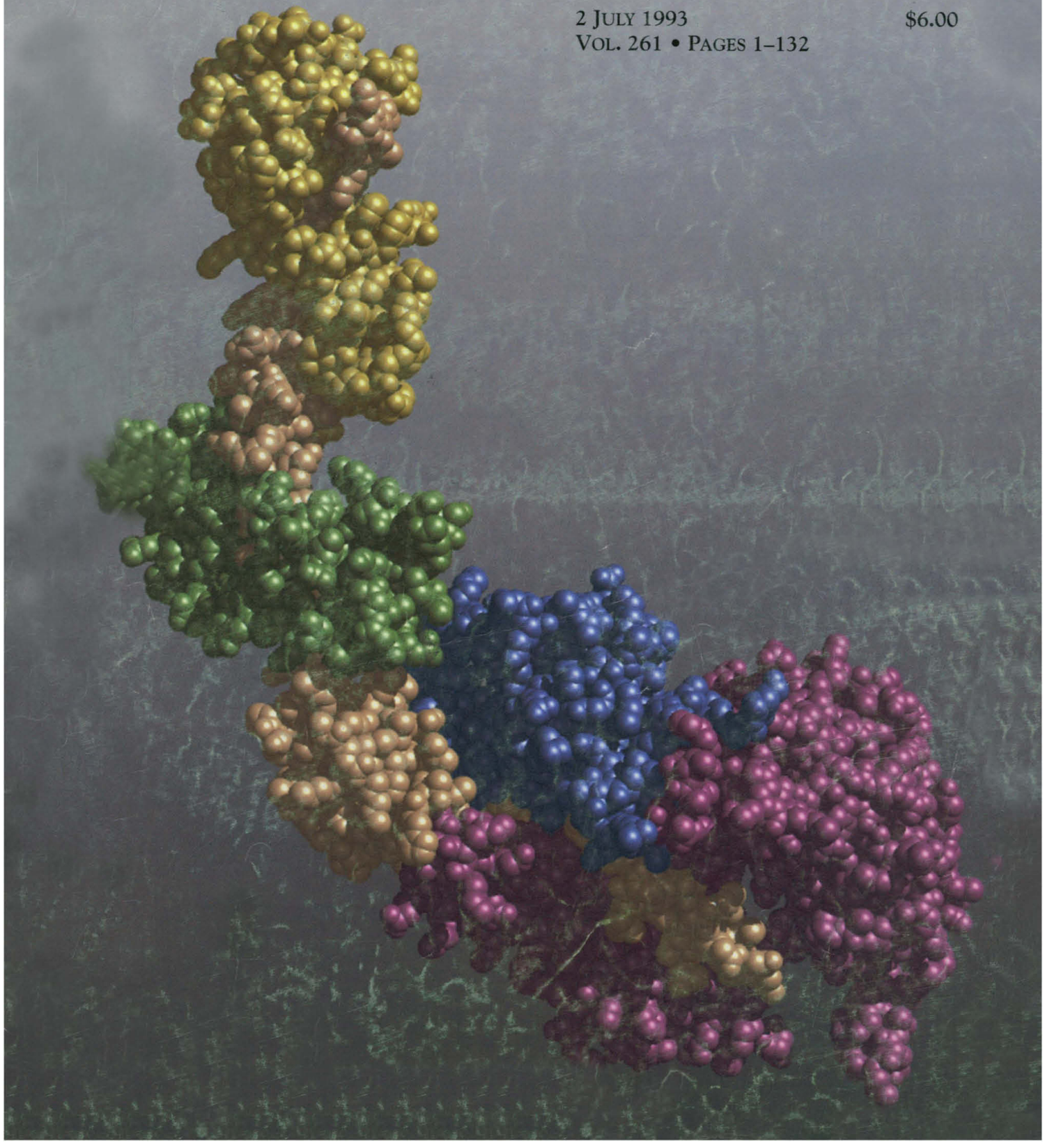

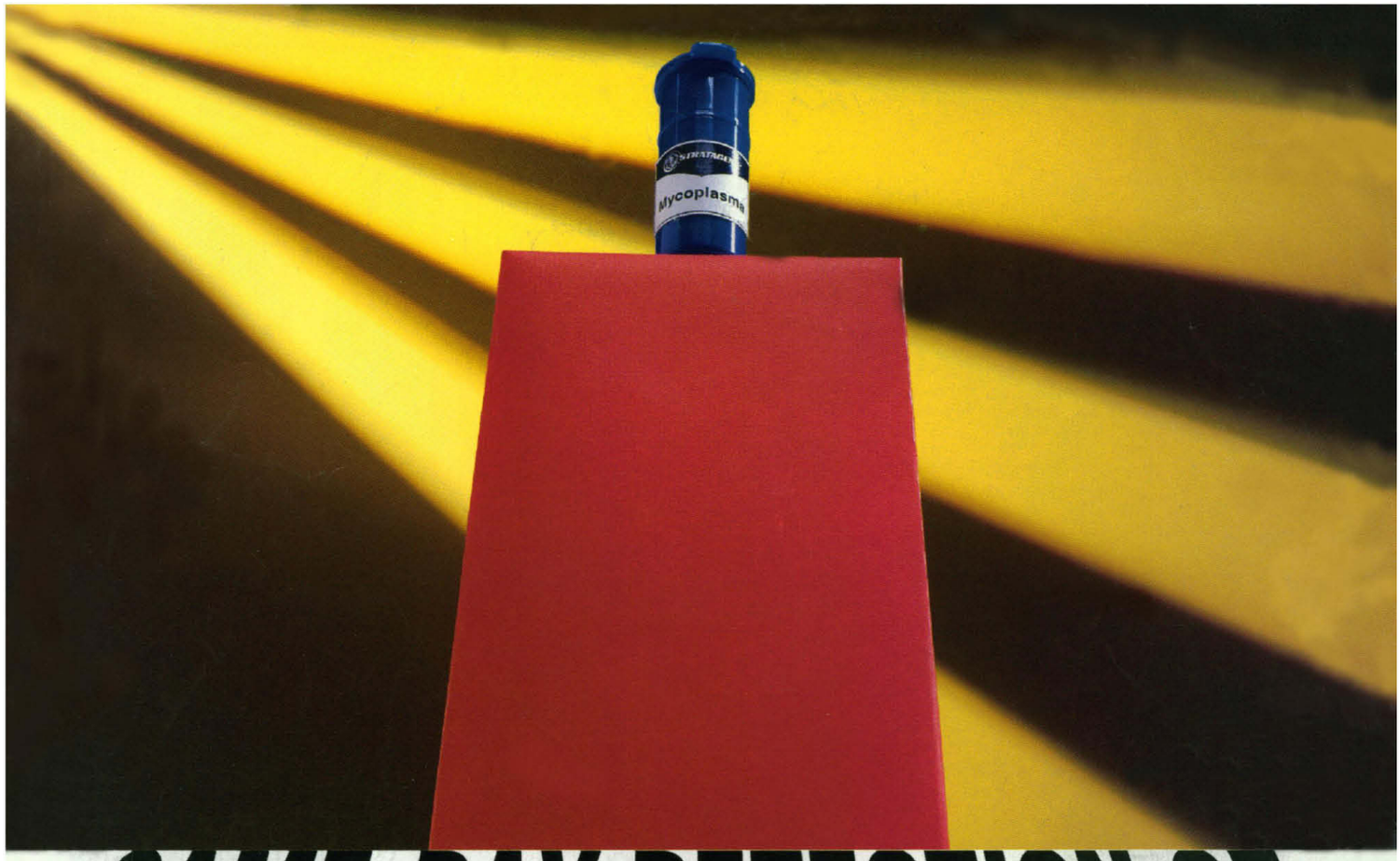

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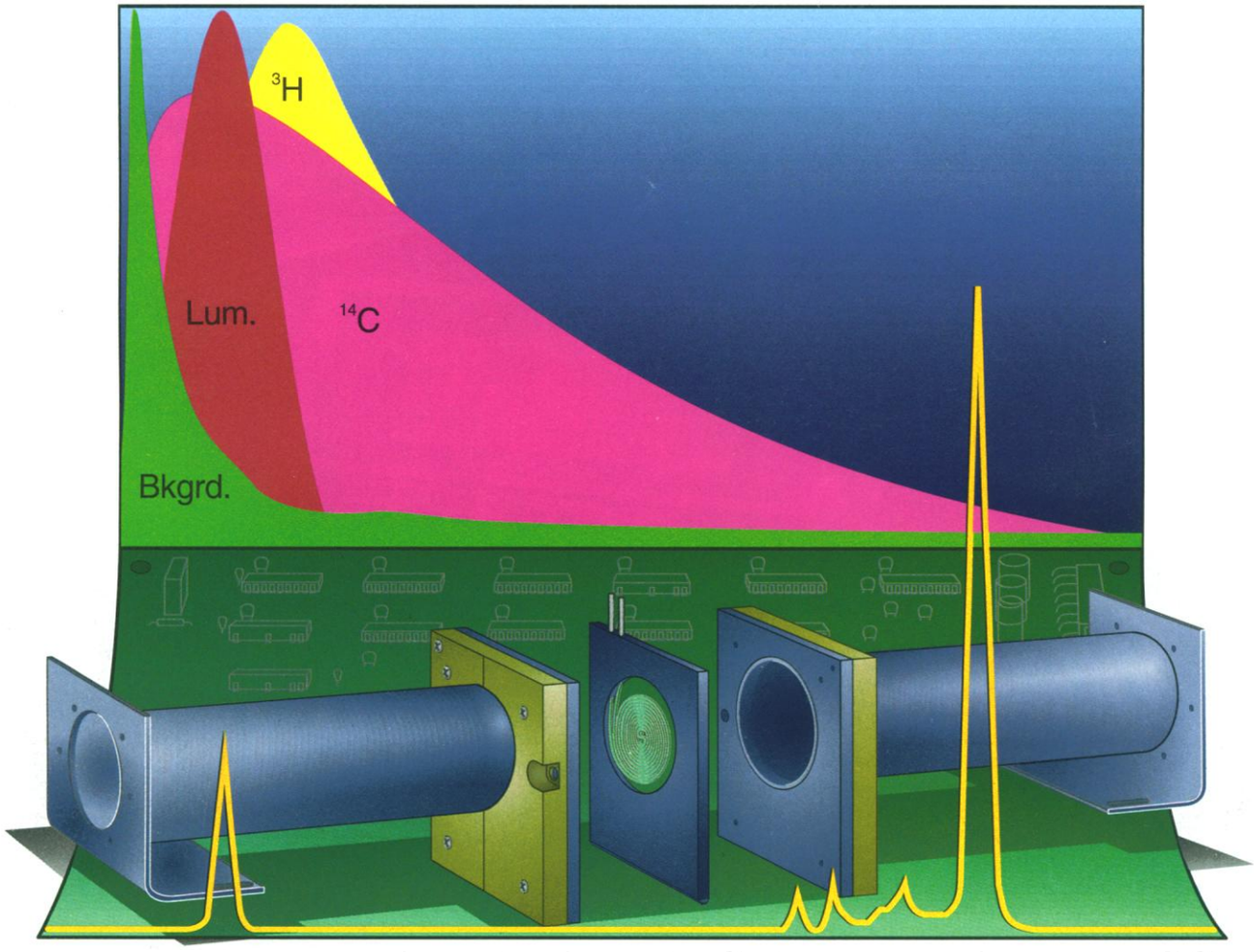

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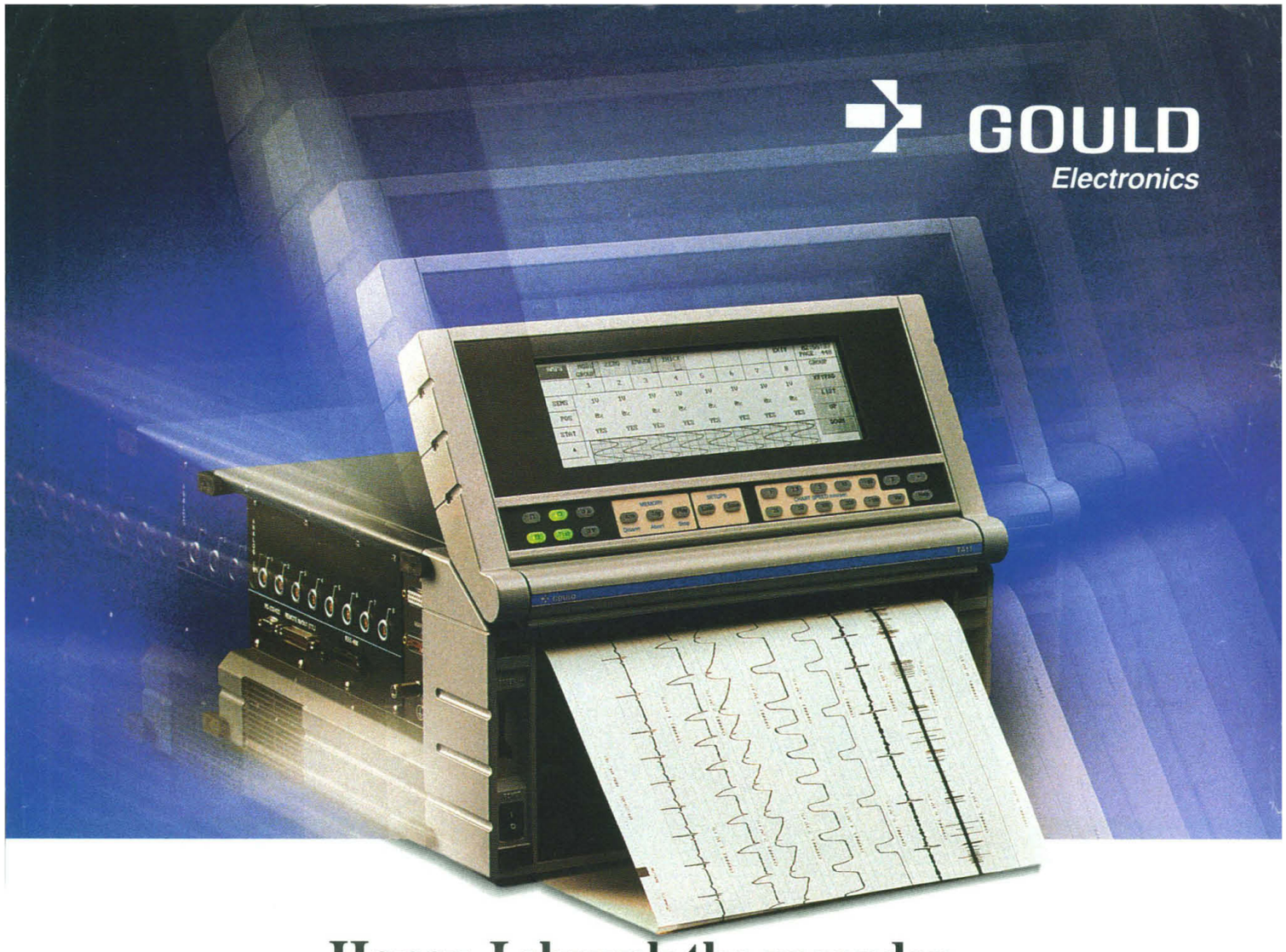

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His 'last' theorem has now been solved

POLICY FORUMS

NEWS & COMMENT

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PERSPECTIVES

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COVER

Space-filling representation of myosin subfragment-1, a molecular motor. The colors define the global organization of the polypeptide chains that constitute this molecule. This structure provides the basis for hypotheses for the molecular mechanism of muscle contraction. See pages 50 and 58 and the Perspective on page 35. [Graphics: Adam Steinberg and Ivan Rayment]

RESEARCH ARTICLES

REPORTS

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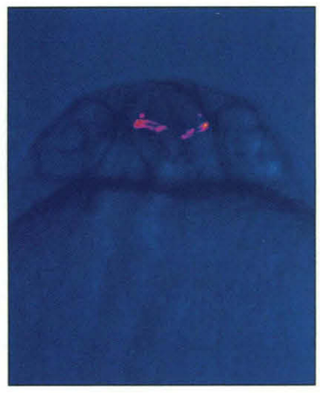
Cellular fate during zebrafish development



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THIS WEEK IN SCIENCE

edited by PHIL SZUROMI

Cleaner air?

More stringent automobile emission standards that will be implemented in the next decade in the United States may in some cases have negligible impact on air quality. Calvert *et al.* (p. 37) point out that maintaining existing emission standards for cars currently on the road may be far more effective. They also note that some of the changes in fuel formulation, such as increasing oxygenate content and reducing aromatics, may have limited benefit.

Beginnings of a rift

Rifting of continents to form ocean basins commonly leads to subsidence of continental margins as hot crust cools, but some rifts, such as the West Antarctic rift system, have large flanking mountains—in this case the Transantarctic Mountains, which rise to elevations of 4500 meters. Ten Brink *et al.* (p. 45) describe results of a geophysical survey across the Ross Ice Shelf to assess the origin of the Transantarctic Mountains. Seismic evidence for the continuation of rifted mantle lithosphere under the mountains and the lack of a prominent trough suggest that thermal buoyancy rather than isostatic rebound produced the uplift.

Diamonds and oxygen

Diamond is found in only some rocks exhumed from appropriate mantle depths. In an experimental and theoretical investigation on the stability of carbon-bearing phases (such as diamond and calcium and magnesium carbonates) in mantle rocks, Luth (p. 66) shows that the occurrence of diamond is particularly sensitive to the oxygen fugacity. At the same oxygen fugacity, diamond may form in mantle of one composition but be absent in a slightly different one.

Muscle contraction at the molecular level

When muscles contract, thin actin filaments slide past thick myosin filaments. Globular head regions on the myosin molecule form crossbridges that power the movement. As the products of adenosine triphosphate (ATP) hydrolysis are released, the filaments contract and convert the released energy into mechanical motion. Two Research Articles present a detailed structural basis for this process. Rayment *et al.* (p. 50) present the structure of the myosin head, which formed high-quality crystals after the lysine residues were methylated. Both the actin and ATP binding sites were identified. This structure was used in interpreting cryoelectron microscopy images of myosin-actin complexes in Rayment *et al.* (p. 58), who present a working model for the crossbridge cycle. In a Perspective, Taylor (p. 35) discusses the biophysical implications of these results.

The hydrogen edge

Neutral interstellar atoms can approach within a few astronomical units of the sun before they are ionized and pushed back out by the solar wind and radiation pressure. Interstellar helium has been detected at the Earth's orbit, but hydrogen, which is more easily ionized, cannot penetrate so far into the solar system. Gloeckler *et al.* (p. 70) report the detection by the Ulysses spacecraft of interstellar hydrogen, ionized by solar photons, at a distance of almost 5 astronomical units from the sun. This "pick-up" hydrogen is distinguished from protons of solar origin by its velocity: The mechanics of ionization allow pick-up ions to move at up to twice the speed of the solar wind.

Class I antigens and autoimmune disease

The mechanisms that lead to autoimmune diseases are still not well understood. The possible role of helper T cells, which can stimulate antibody production by B cells, has implicated the major histocompatibility complex (MHC) class II antigens, which are needed to present antigens to the helper cells. However, Mozes *et al.* (p. 91) show that class I MHC molecules are essential for development of a mouse model for systematic lupus erythematosus (SLE), which is characterized by antibodies to DNA, nuclear antigen, and RNA nuclear protein. Mice that lacked MHC class I molecules did not develop the clinical manifestations of SLE.

Thymic signal

Rearrangement of the variable, diversity, and joining [V(D)J] regions of the antigen receptor occurs in immature T cells in the thymus. The thymic environment secretes factors that are critical for this process; rearrangement is not seen in cultured immature thymocytes. Muegge *et al.* (p. 93) tested numerous agents and found that interleukin-7 restored V(D)J rearrangement in fetal thymocytes in cell culture.

Addressing the envelope

Many simple cells in the early visual cortex respond to changes in luminescence that occur at a particular frequency; the output of these cells can be used to compute movement, depth, and contours at higher processing levels. However, envelope patterns, in which a high-frequency luminescence pattern is modulated by a low-frequency envelope can be recognized, even though there is no Fourier component corresponding to the larger area low-frequency signal. Zhou and Baker (p. 98) identified neurons from areas 17 and 18 of the cat cortex that responded to such envelope signals. They conclude that two processing pathways exist in such cells, a linear one for luminescence and a three-stage nonlinear scheme for envelope processing.

Early commitment

Cells in the early animal embryo that are initially undecided about their eventual fate become progressively more committed to specific fates. Ho and Kimmel (p. 109) analyzed the commitment of cells of the zebrafish embryo during gastrulation. Individual fluorescently labeled cells were transplanted from one embryo to another (unlabeled) embryo, and their progress was followed. Cells taken before mid-gastrulation were still uncommitted and could take on new developmental fates according to the transplant site. By late gastrulation, cells of the hypoblast were committed to forming mesoderm, and when transplanted into a non-mesoderm site, actually migrated into the new embryo's mesoderm.

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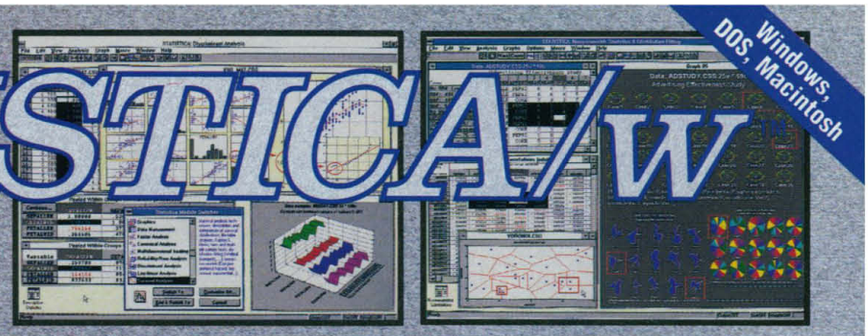

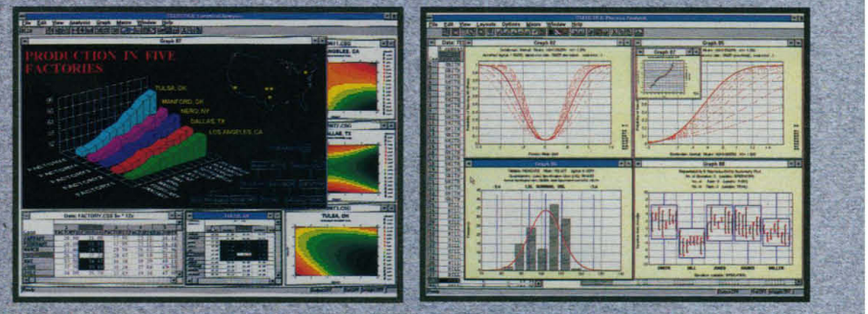

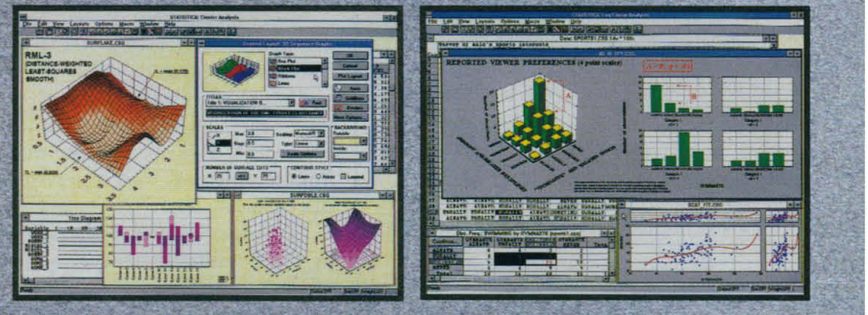

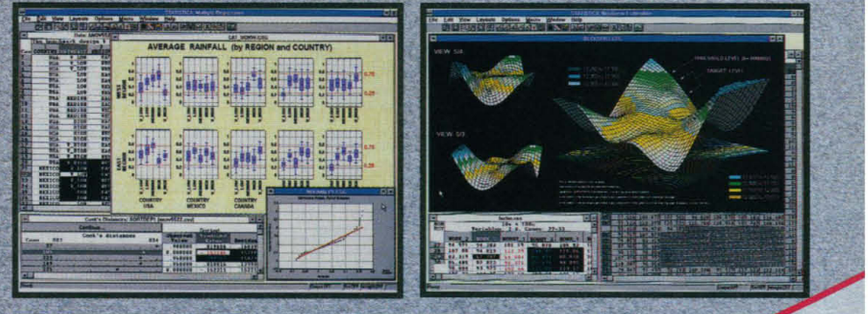

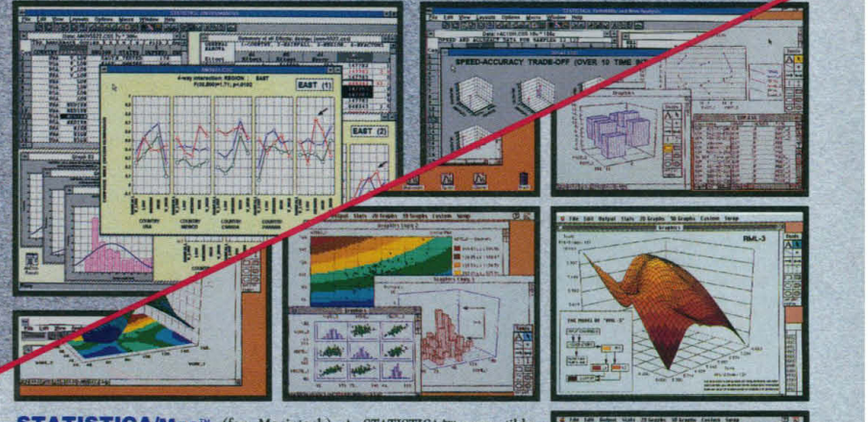

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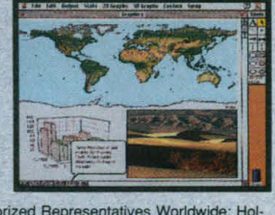

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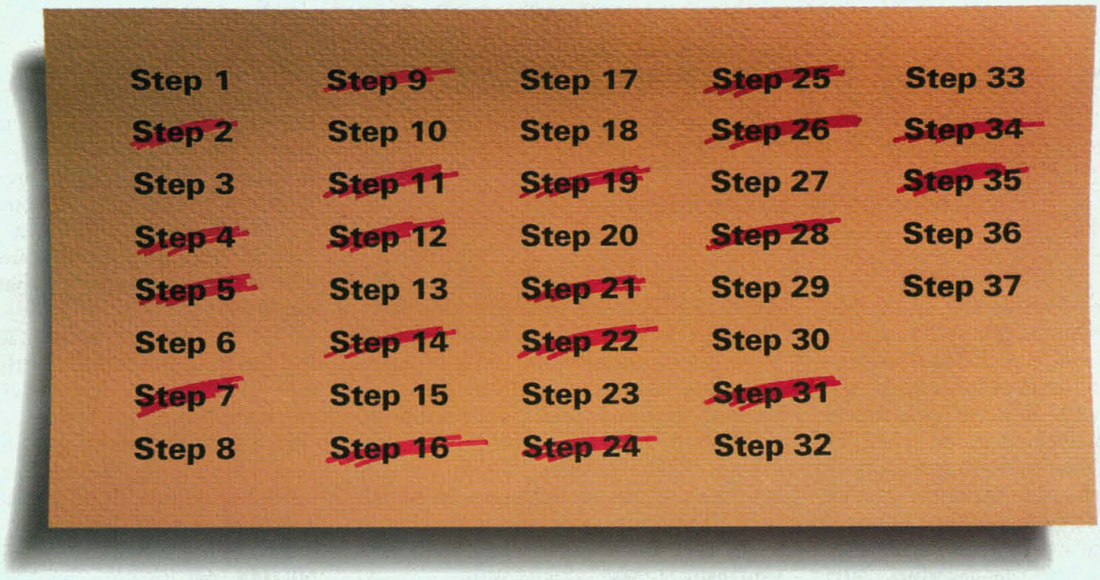

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