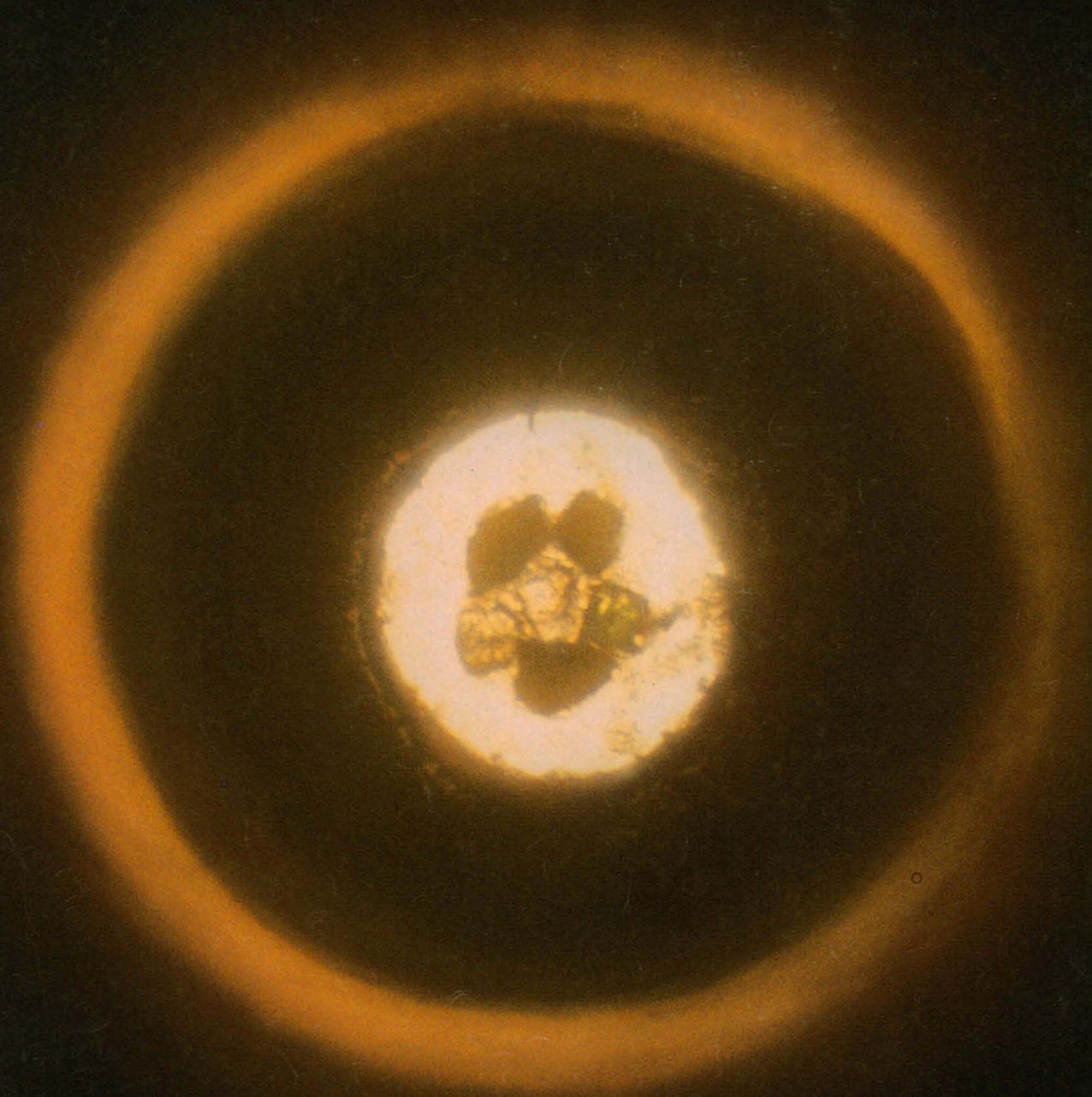


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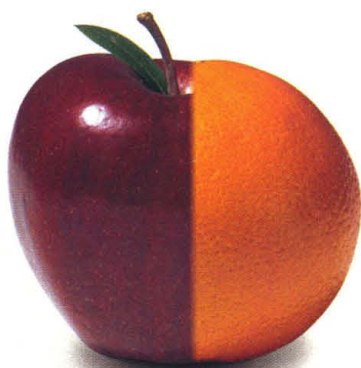
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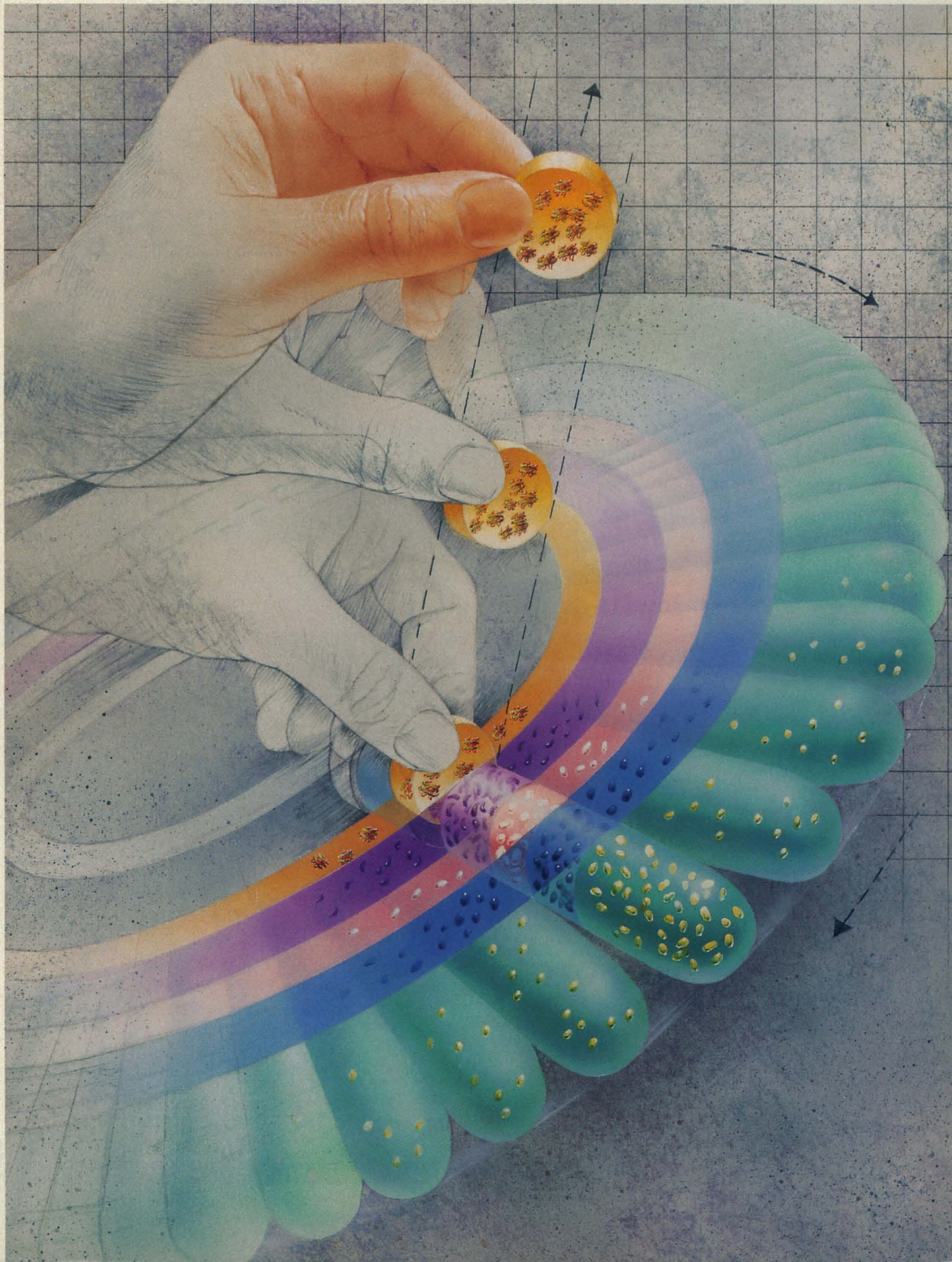
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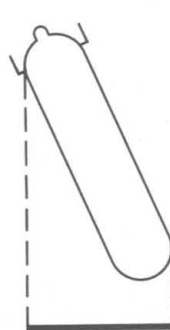
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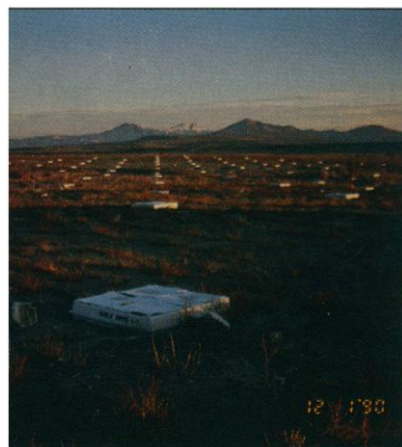
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## COVER

Six crystals of silicate spinel, a high-pressure mineral abundant in the transition zone of Earth's mantle, confined in a diamond-anvil cell (mount diameter, 0.45 millimeter). High-pressure x-ray studies of these crystals reveal that the  $\text{Mg}_2\text{SiO}_4$  end member is 13% more

compressible than the  $\text{Fe}_2\text{SiO}_4$  end member even though its molar volume is 6% less. Such anomalous compressibility suggests that the behavior of  $\text{Mg}^{2+}$  and  $\text{Fe}^{2+}$  at mantle pressures is divergent. See page 206. [Photo: R. M. Hazen]



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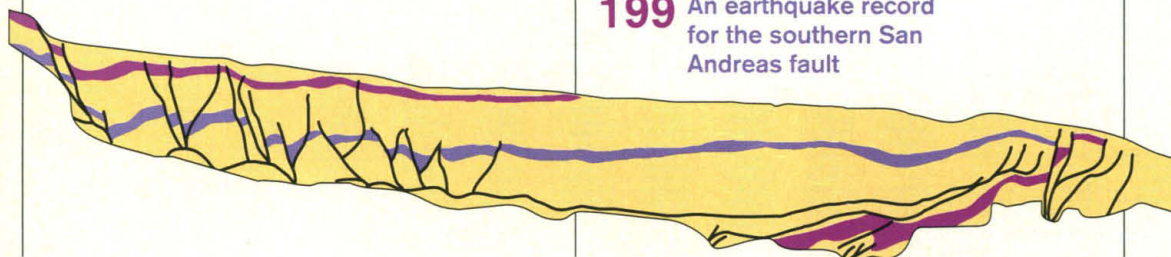
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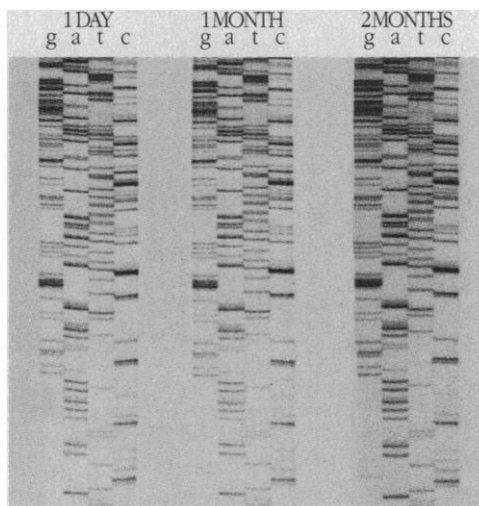
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## Hanging around

Some of the compounds that are released into the atmosphere remain there for long times because they do not react easily with the major oxidants or are not readily photolyzed. Some of these, notably the fully fluorinated carbon compounds such as  $CF_4$ , are greenhouse gases; thus, their continual accumulation in the atmosphere has a long-term impact on global warming. Ravishankara *et al.* (p. 194) evaluate the lifetimes of several of these compounds by using laboratory data and an atmospheric model. The analysis indicates that  $CF_4$  and  $C_2F_6$  likely have lifetimes of greater than 10,000 years and that most of the other compounds studied have lifetimes of thousands of years. Even if emissions of these compounds ceased, it would still take a long time for the atmosphere to recover.

## Flexible response

Langmuir-Blodgett films may provide a medium in which to create new materials with engineered electronic and mechanical properties. Chi *et al.* (p. 213) have used the atomic force microscope (AFM) to study domain structures in Langmuir-Blodgett films of stearic acid deposited on mica. With the normal imaging mode, the authors were able to observe the domains at different rates of monolayer compression. Images of the elastic properties of the surface layer over two dimensions were obtained by vibrating the AFM tip and mapping out the response of the film. Although the results of the AFM study agreed with those of fluorescence microscopy for large structures (30 to 200 micrometers), the added dyes can alter the structure of smaller domains.

## Growing with the flow

As neurons grow and project neurites out from the cell body, growth appears to occur at the tip of the neurite, the growth cone. It has been generally accepted that lipid molecules that make up the plasma membrane of the neurite are added at the tip. Popov *et al.* (p. 244) tested this theory in *Xenopus* spinal neurons by locally perfusing a fluorescent analog of membrane lipid into growing neurites. Instead of accumulating at the growth cone, the fluorescent lipid rapidly spread along the membrane. The lipids flowed forward with time, and the rate of flow increased with increasing distance from the cell body. The results show that incorporation of lipid molecules in *Xenopus* neurites occurs near the cell body and along the neurite rather than at the tip.

## Rupture record

The recurrence intervals of major earthquakes along the San Andreas fault have been best determined from geologic and radiocarbon studies of the sequence of ruptures preserved along the fault zone. For the southern San Andreas fault, the classic study has been at Pallet Creek; this site recorded three large earthquakes in the past 500 years. Fumal *et al.* (p. 199) describe the paleoseismic record for this time interval at Wrightwood, about 30 kilometers southeast. This site has recorded five large events in the past 500 years. The two new events most likely reflect rupture on a segment of the fault that did not extend to Pallet Creek.

## Molecular repair

Carcinogens of the nitrosourea family can damage cellular DNA by methylating guanine residues, which are then read as adenosine during subsequent DNA synthesis. Dumenco *et al.* (p. 219) show that this type of mutation, which is frequently observed in the activated *ras* oncogenes of certain nitrosourea-induced murine tumors, can be reversed in transgenic mice that express a human DNA repair protein. The expression

of the enzyme  $O^6$ -alkylguanine-DNA alkyltransferase decreased the incidence of thymic lymphomas from 58 to 4 percent in the carcinogen-treated mice and increased the latency of the lymphomas that did occur. These results suggest that the rate-limiting step for cancer initiation by a number of carcinogens may be the formation of  $O^6$ -alkylated guanine adducts.

## Trimerization and transcription

Under heat stress, heat shock factor (HSF) trimerizes and activates the transcription of heat shock genes by binding to conserved DNA regions (heat shock elements) upstream of heat shock genes. Although HSF is constitutively expressed, it only trimerizes and binds to DNA with high affinity in response to heat shock. Rabindran *et al.* (p. 230) have found that two regions at the COOH-terminus of HSF are required to suppress HSF trimerization in the absence of heat shock. One of these regions contains a leucine zipper, which when mutated results in HSF trimerization and high-affinity binding of DNA. Thus, in the absence of heat shock, HSF may be stabilized as a monomer by

coiled-coil interactions involving the COOH-terminal zipper.

## Maintaining a daily rhythm

Isolated neurons can produce rhythmic activity, but it has not been known whether circadian rhythms (with periods near 24 hours) require an assemblage of neurons. Examples of circadian pacemakers include pinealocytes in birds, which express a rhythm in melatonin release, and the basal retinal neurons in the eye of the mollusk *Bulla gouldiana*, which exhibit changes in membrane potential. Michel *et al.* (p. 239) maintained basal retinal neurons in culture and recorded spontaneous changes in membrane conductance from these physically isolated single cells. Such cells continued to exhibit a circadian rhythm in their conductance changes even though they lacked synaptic connections with other neurons.

## Cell shape and actin phosphorylation

Cells of the slime mold *Dictyostelium* undergo a shape change when transferred to a nutrient medium that promotes growth. Howard *et al.* (p. 241) report that at the same time as the morphological changes occur, the cytoskeletal protein actin becomes phosphorylated on tyrosine. In mutant cells lacking activity of a phosphotyrosine phosphatase, actin was phosphorylated more rapidly and the cells became rounded more quickly. These results indicate that shape changes in response to extracellular signals may occur through changes in the phosphorylation state of structural proteins of the cytoskeleton.

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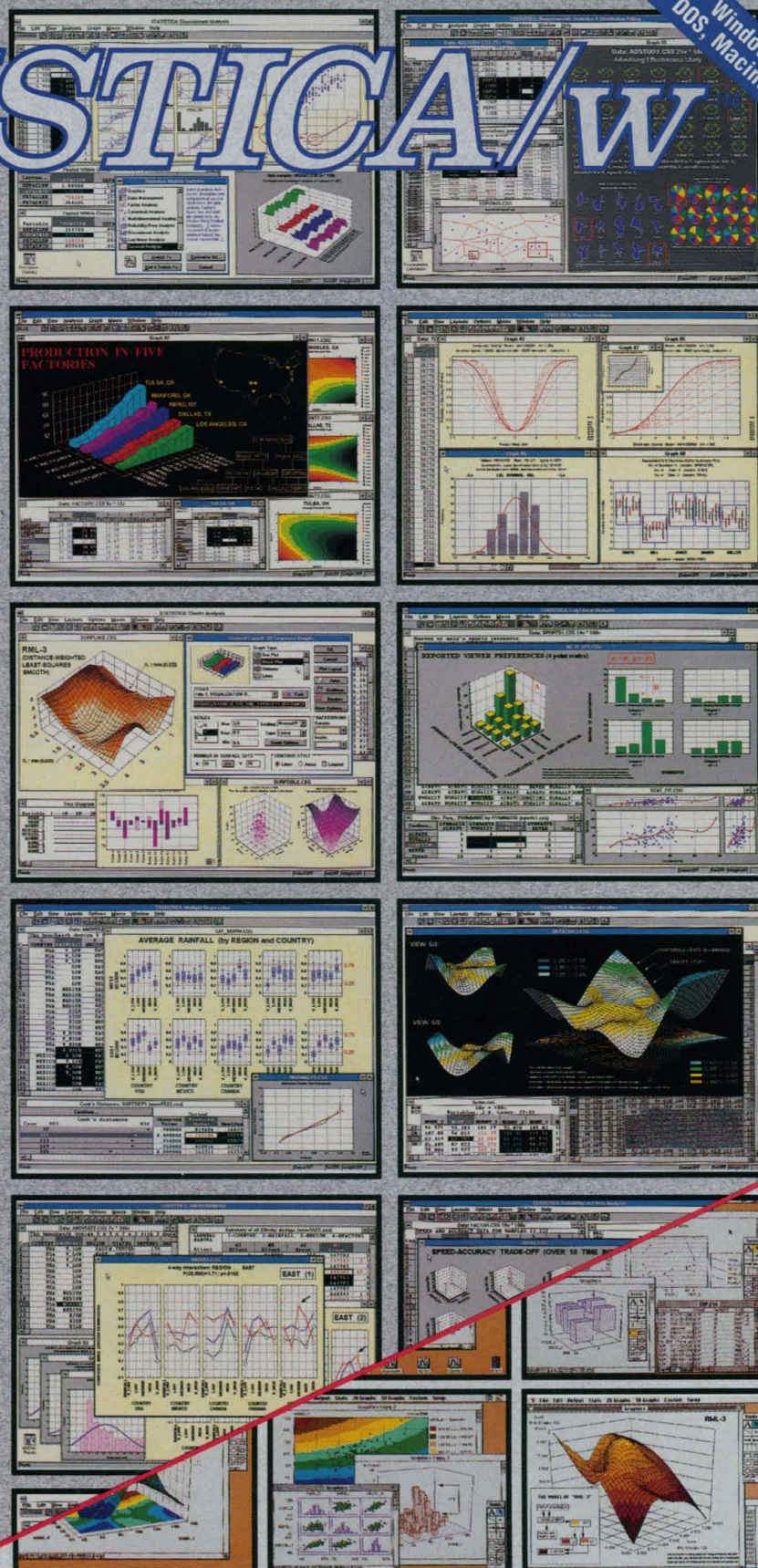


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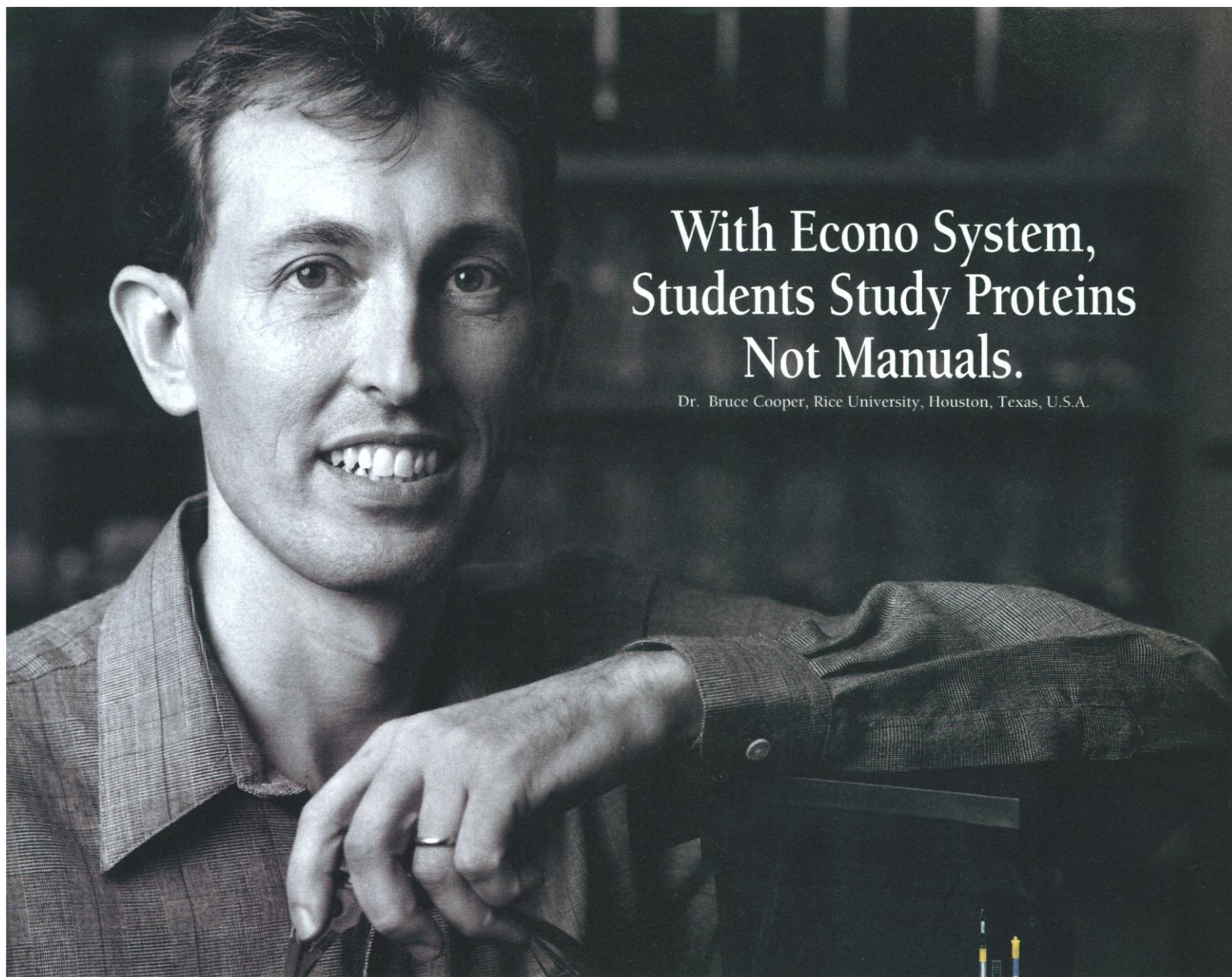


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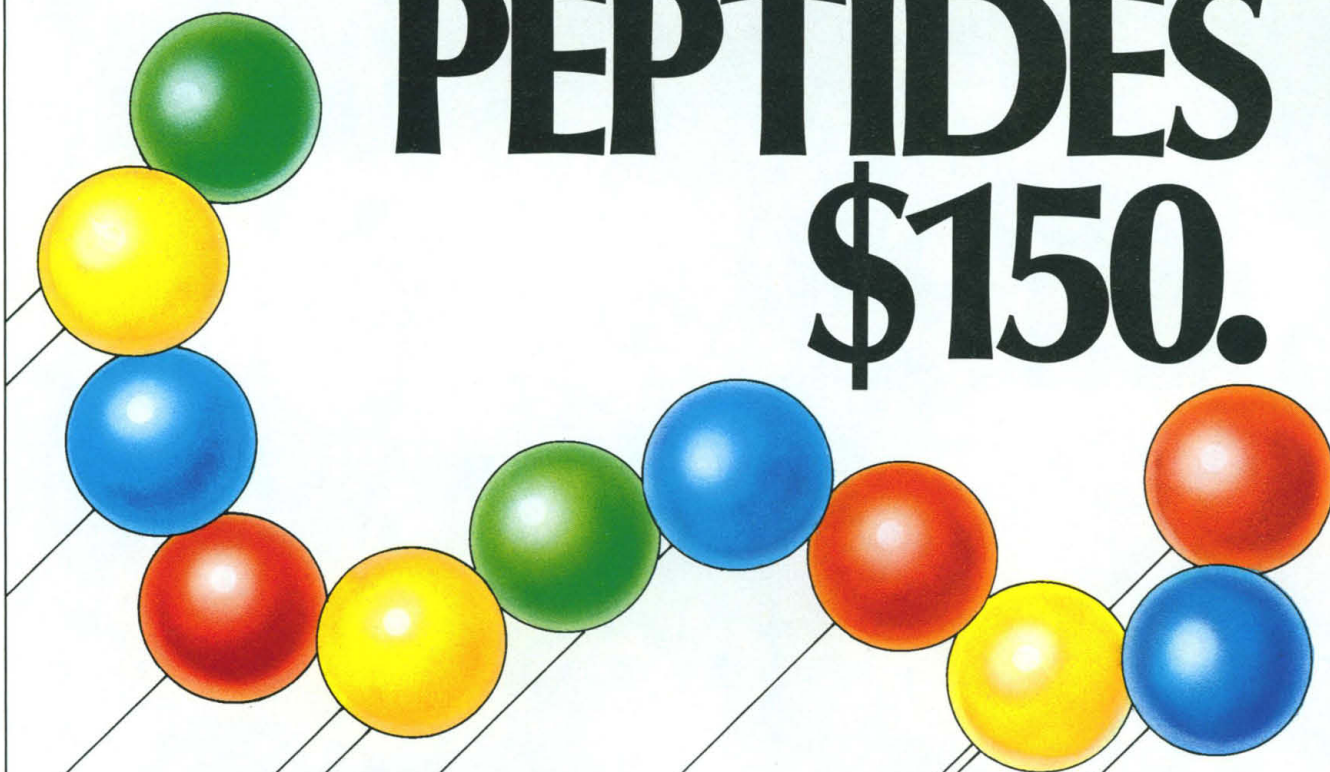
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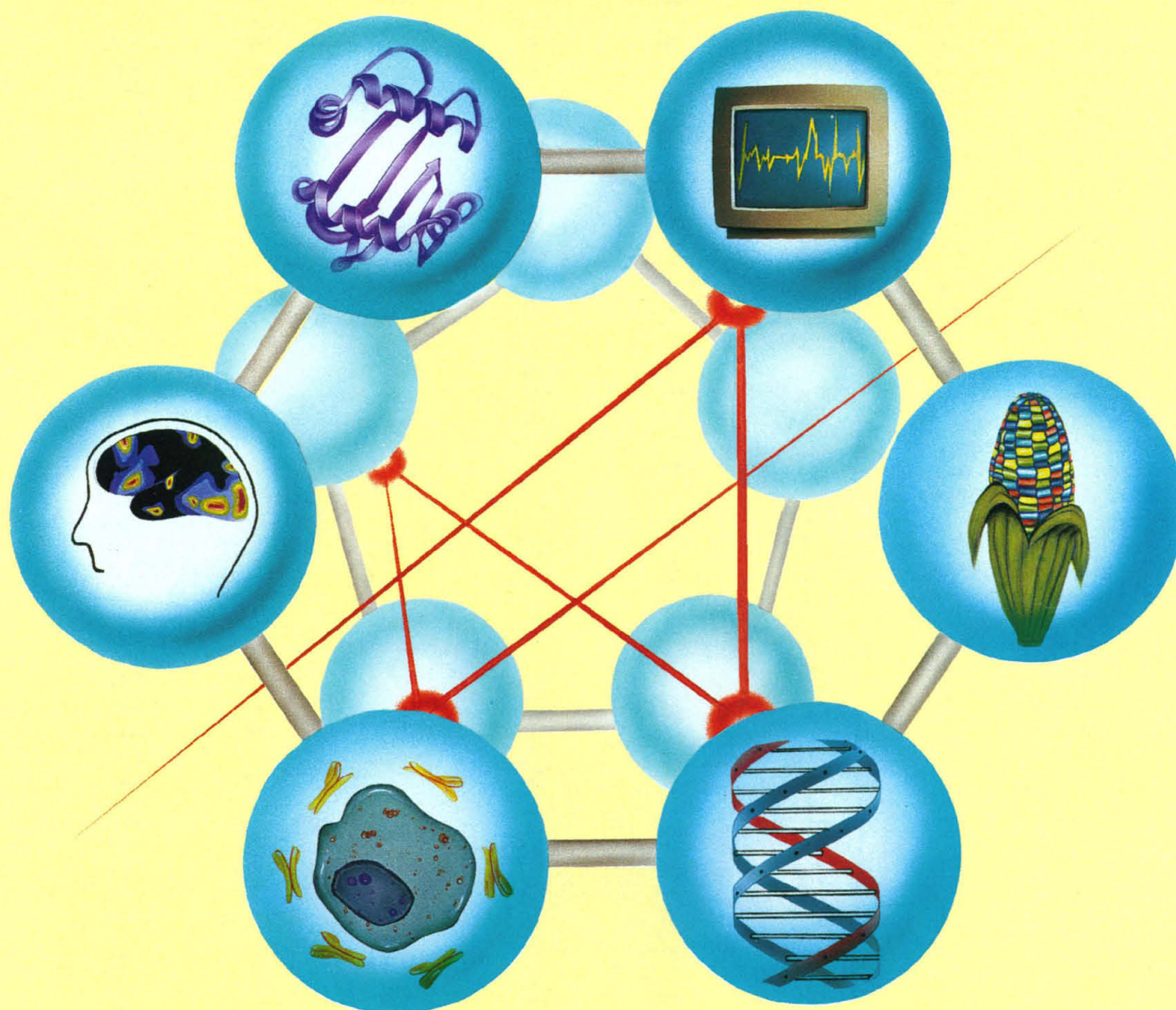
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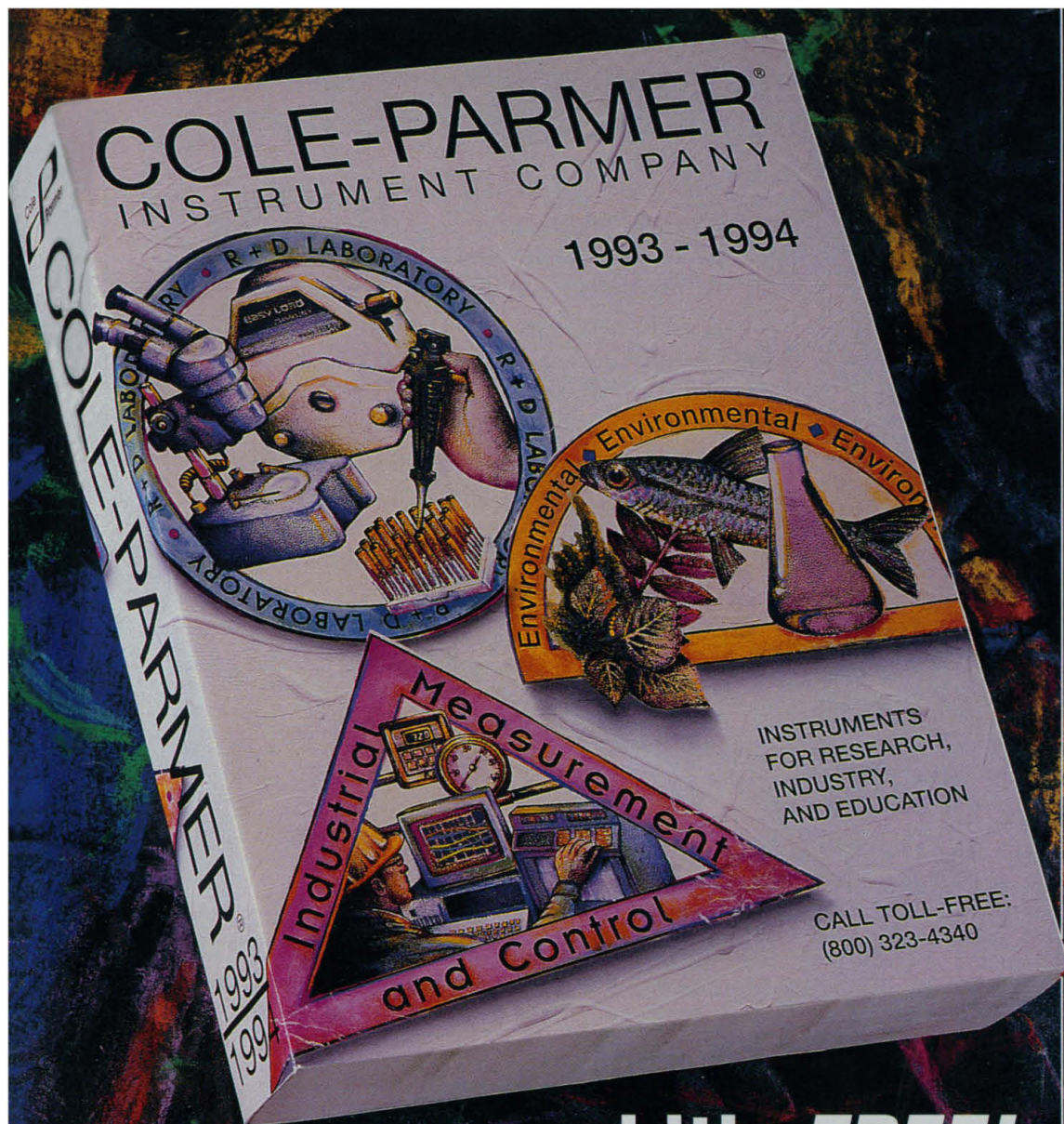
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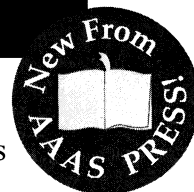
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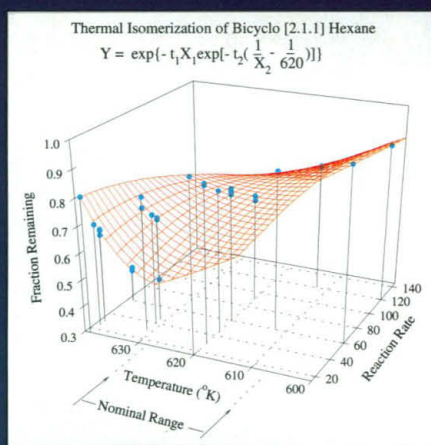
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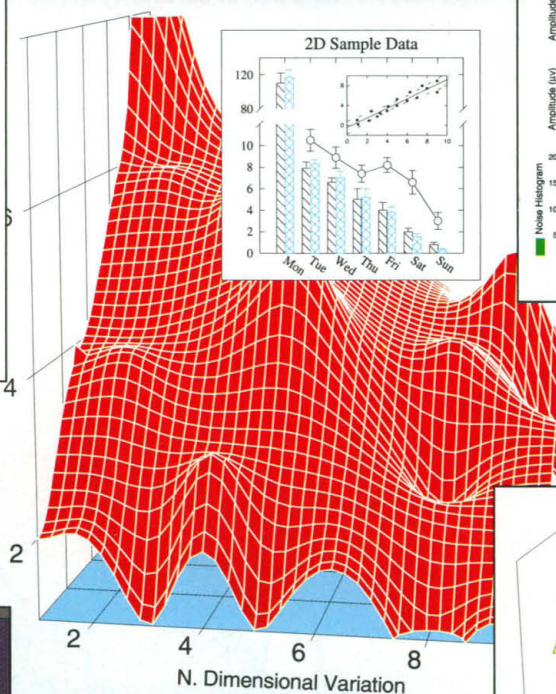
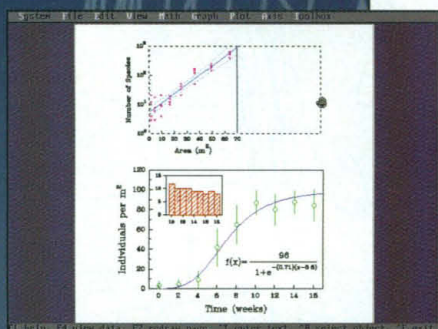
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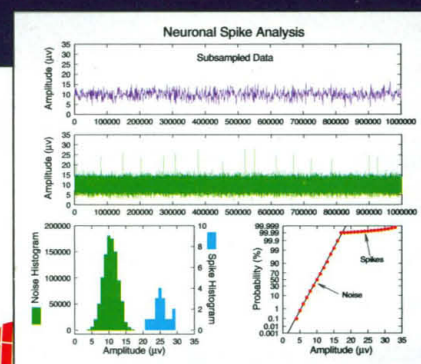


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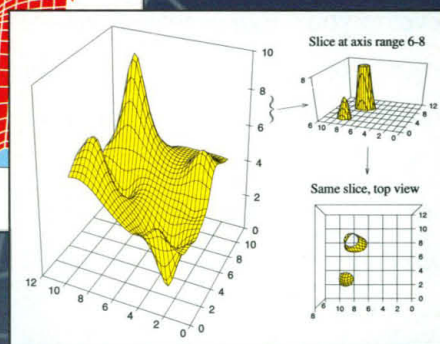
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[1] **22 January deadline:** Registrations received after this date will not be processed, but you may register on site beginning 11 February. On-site rates are \$30 higher than advance rates for Regular members/nonmembers, \$10 higher for students, and \$20 higher for all others. **One-day registration** (for all sessions *except* seminars) will be available to AAAS members (\$90) and nonmembers (\$120) on site only.

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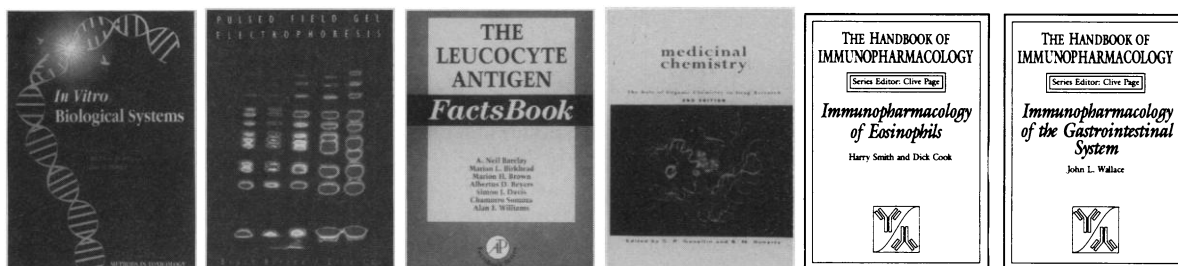
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