



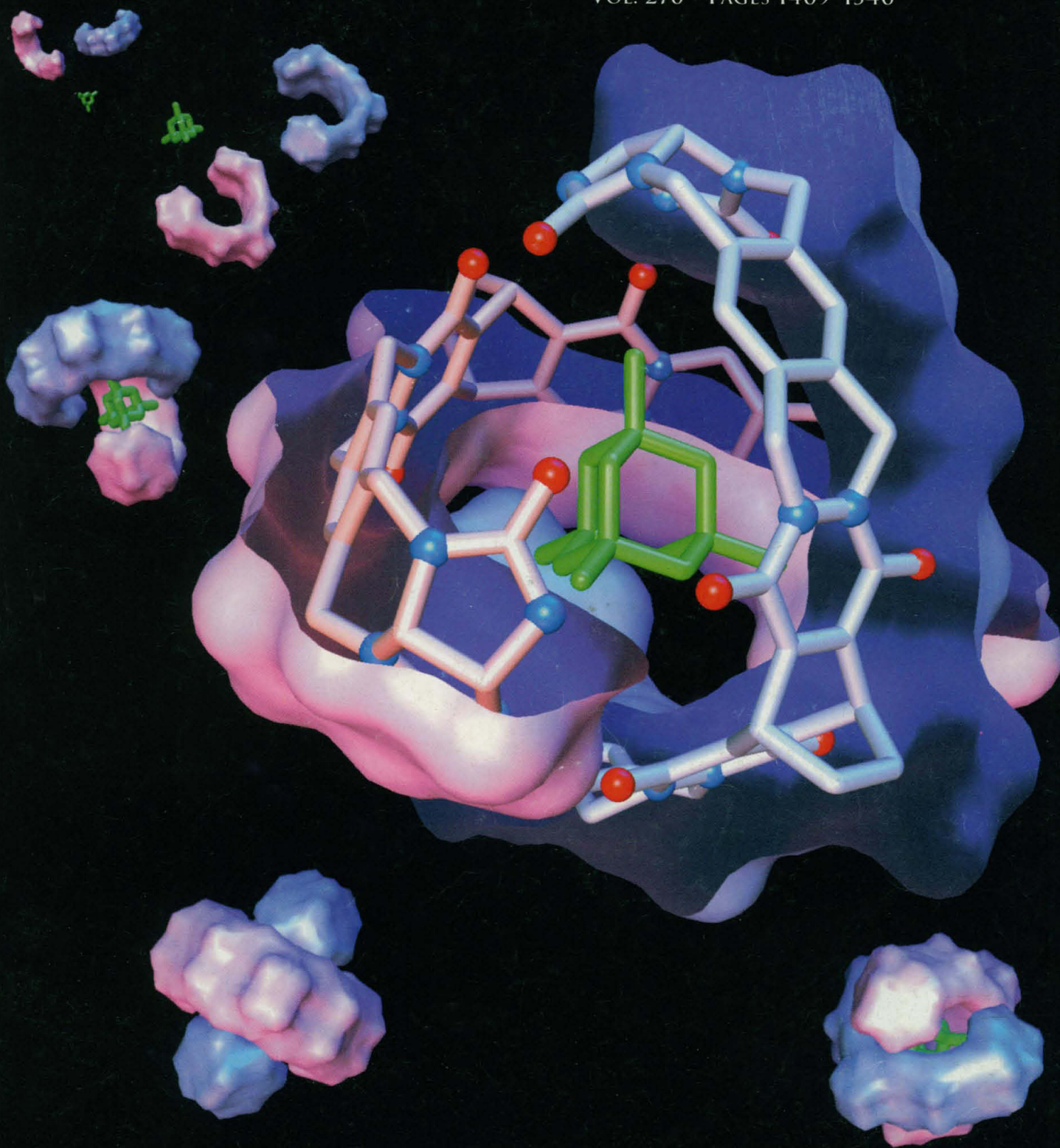
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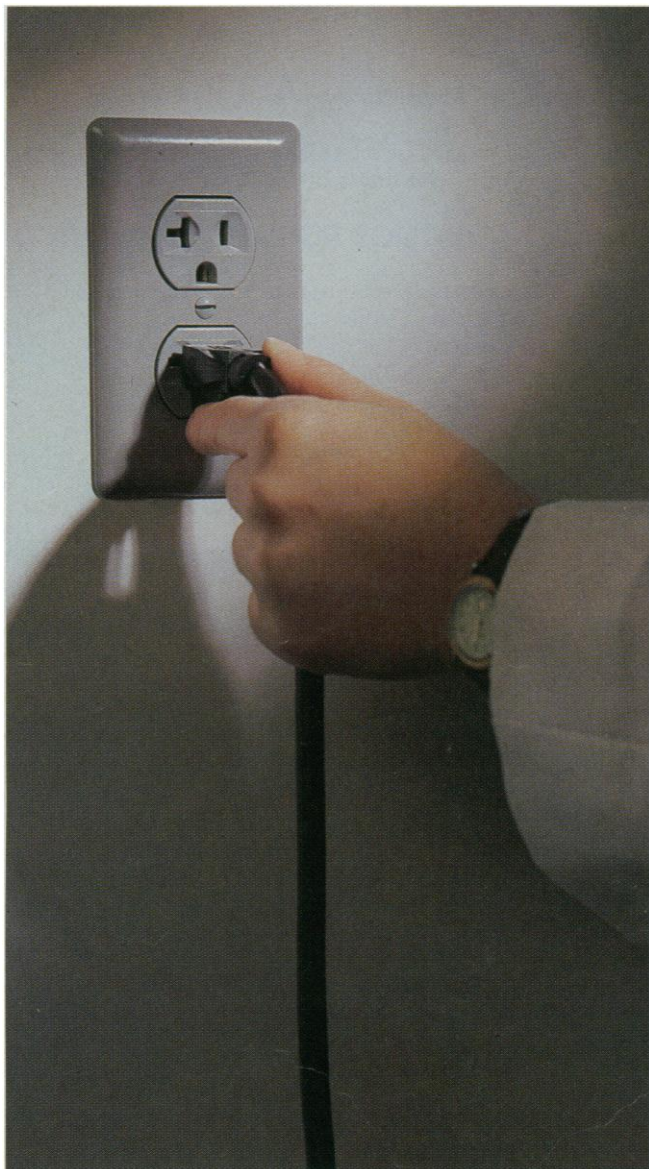
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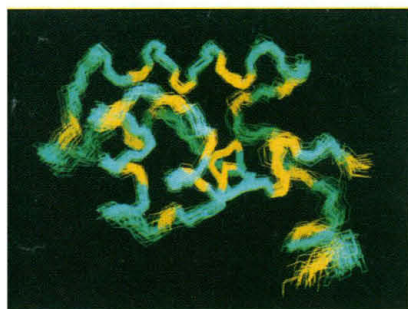
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Tetramethyladamantane (green) is encapsulated by two molecules of a self-complementary synthetic receptor. An array of weak intermolecular forces are balanced to produce the assembly in solution. (Red

spheres, oxygen atoms; blue spheres, nitrogen atoms.) See page 1485. [Image: Michael Pique, The Scripps Research Institute, on a Sun Workstation with software by Michael Connolly and AVS, Inc.]



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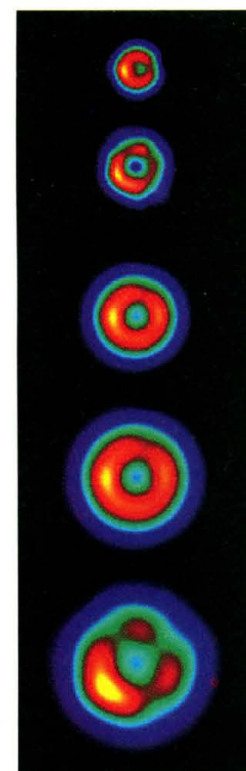
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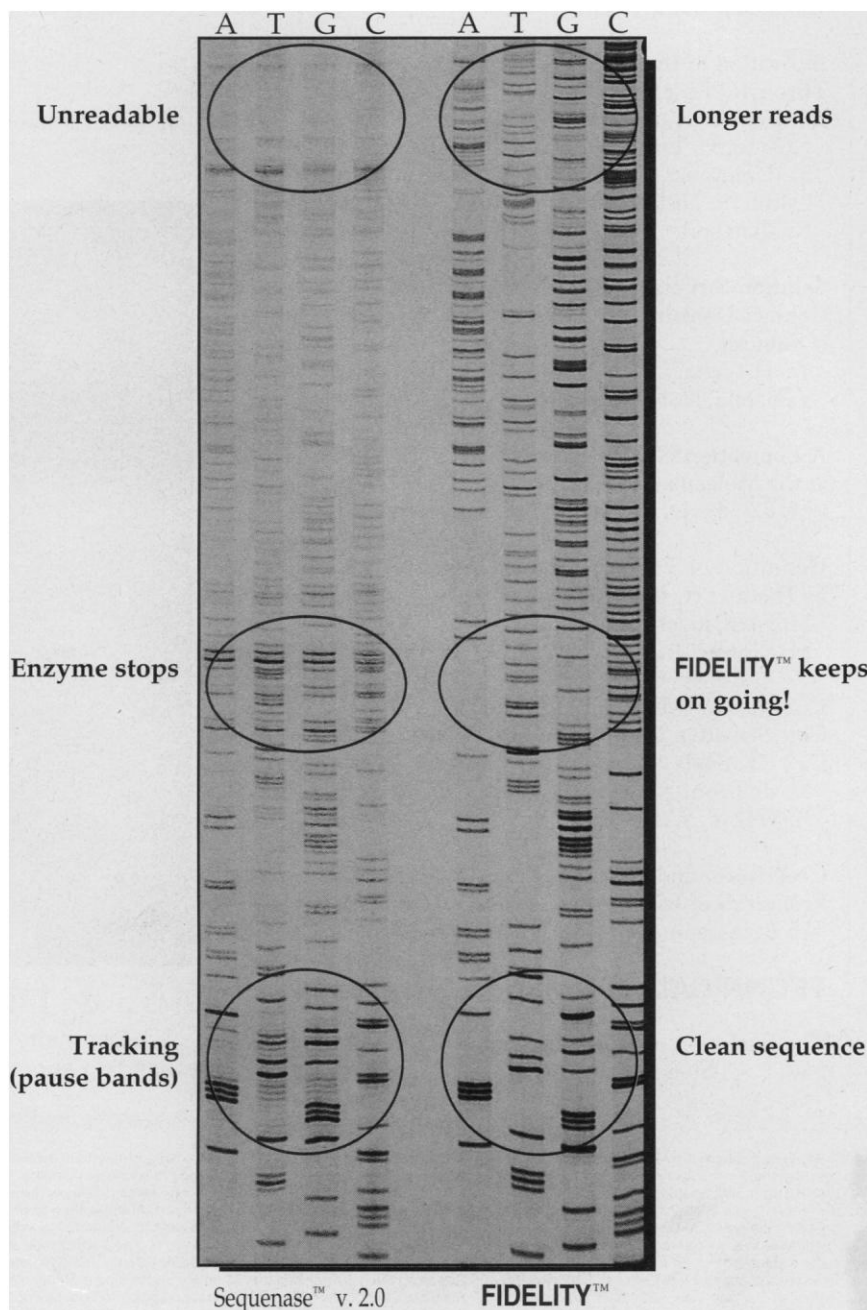
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Abundant carbon

It is often assumed that the solar system was formed from matter that is representative of the galaxy as a whole, and thus solar carbon abundances can be used to gauge the abundance of carbon in other stars and in interstellar dust. Snow and Witt (p. 1455) review evidence which shows that carbon in the sun is significantly more abundant than in other stars. This overabundance of carbon has important implications for models of nucleosynthesis in supernovae and for models of interstellar dust formation.

■

Nailing down the core

Knowledge of the phase diagram of iron at high pressures and temperatures is key for prediction of the temperature and composition of Earth's core. Yoo *et al.* (p. 1473) obtained in situ x-ray diffraction measurements from samples in a laser-heated diamond-anvil cell to identify phases of iron directly. The results show that hexagonal close-packed iron (ϵ -Fe) has a wide stability field at high pressures and temperatures and is the likely stable phase at conditions of the solid inner core.

■

Surfactants on surfaces

Surfactants adsorbed on atomically smooth surfaces might be expected to form simple monolayers and bilayers. Manne and Gaub (p. 1480) found instead a variety of morphologies in their atomic force microscopy studies of quaternary ammonium cationic surfactants. Half-cylinders formed on hydrophobic surfaces, full cylinders formed on mica, and spheres formed on amorphous silica. Such variations could find use in surface patterning.

A cool brown star

The nuclear reactions that light up the sun can only occur if a star's mass exceeds 0.08 solar masses; objects smaller than this are called brown dwarfs. Oppenheimer *et al.* (p. 1478; see the news story by Glanz, p. 1435) report spectroscopic measurements of an unusually low-luminosity brown dwarf, the recently discovered Gl 229B, that has a mass approximately 20 times that of Jupiter. Absorption features in the spectra indicate the presence of methane and water vapor, which implies a surface temperature below 1000 K. The spectra are quite different from those seen in stars and instead bear a greater resemblance to the spectra of Jupiter. The characterization of such objects is necessary to understand whether they could constitute a dominant species in the galaxy.

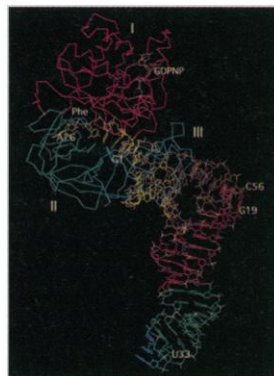
Closing the trap

Processes such as self-assembly and molecular recognition, hallmarks of many biomolecules, can also be performed by synthetic analogs. Meissner *et al.* (p. 1485; see cover) have designed and synthesized a molecule which, in the presence of suitable guest molecules, self-assembles to form a dimeric spherical complex that can encapsulate rather large guest molecules, such as derivatives of adamantane and ferrocene. Such complexes could find use as reaction vessels or drug delivery systems.

■

Tu complex

Elongation factor Tu (EF-Tu) is a guanosine triphosphate (GTP)-binding protein that delivers the aminoacylated transfer RNA to the empty A site on the ribosome, a key step in chain elongation during protein synthesis. Nissen *et al.* (p. 1464; see the Perspective by Moore, p. 1453) present an x-ray structure of EF-Tu in a complex with phenylalanine transfer RNA and a GTP analog. The overall shape of the complex is similar to that on the translocation factor, EF-G-GDP, suggesting a type of "molecular mimicry" between protein and



nucleic acid counterparts in the translational apparatus.

■

Enhancing estrogen

Efficient coordination of cellular responses to hormones requires cross-talk between various signaling pathways. Kato *et al.* (p. 1491) report that mitogen-activated protein (MAP) kinase, which is activated in cells treated with peptide growth factors such as insulin and epidermal growth factor, can phosphorylate the receptor for the steroid hormone estrogen. Activation of MAP kinase in transfected cells resulted in increased estrogen-induced transcriptional activity of the estrogen receptor. In this way, regulation of transcription by estrogen can be modulated by growth factors or other agents that influence the activity of MAP kinase.

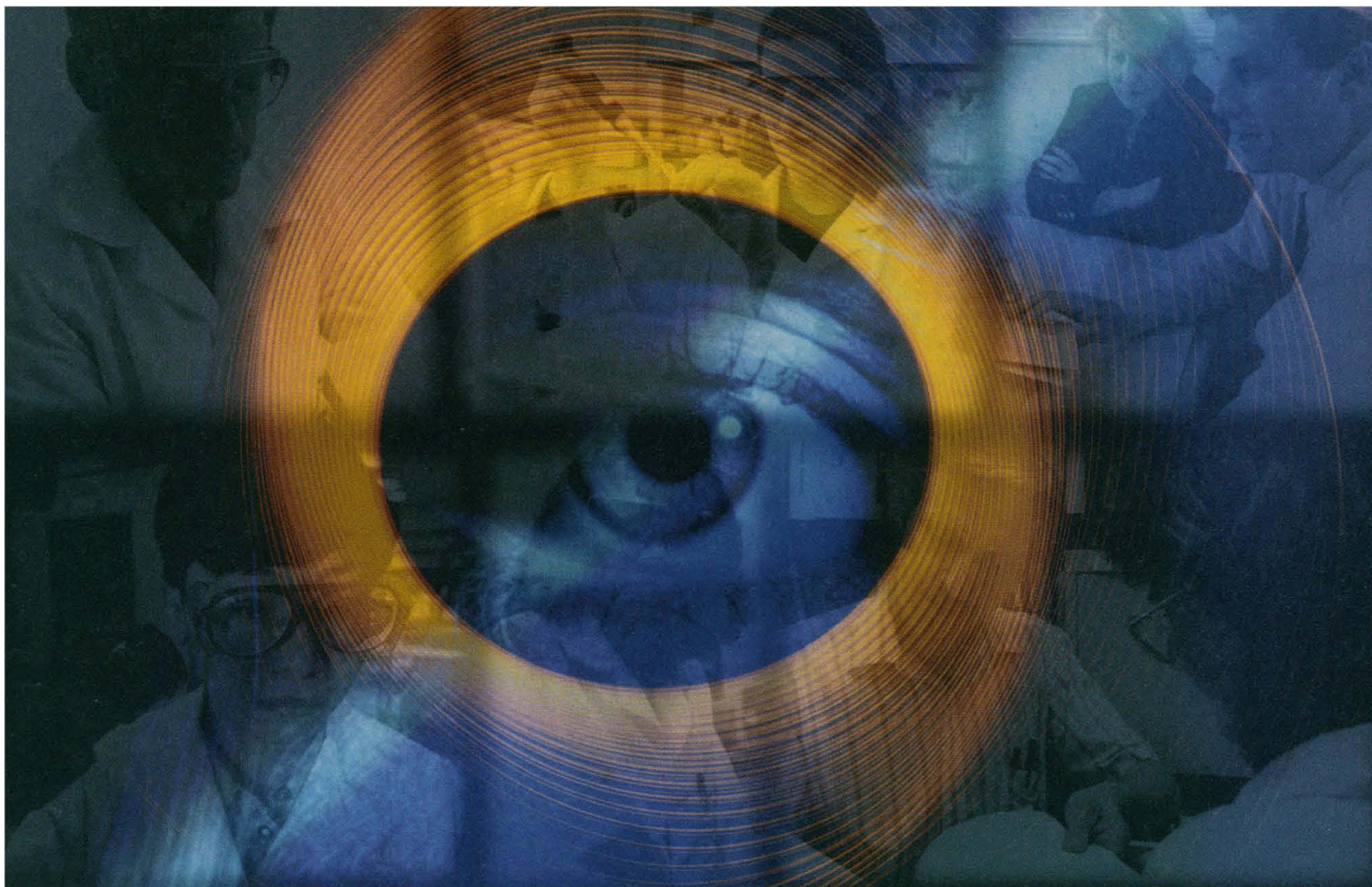
Calcium channel feedback

Unlike other voltage-gated ion channels, the L-type calcium channel is inactivated by a high concentration of the ion it transports, Ca^{2+} . This feedback inhibition controls the Ca^{2+} flux into many types of neuronal and muscle cells and is critical, for example, in the regulation of contraction strength in heart muscles. De Leon *et al.* (p. 1502) identify the likely molecular mechanism for this inactivation. A region in one of the subunits that make up the L-type calcium channel contains a Ca-binding motif—an EF hand—that is responsible for the sensitivity of the channel to Ca concentration. Donation of this domain to another channel that is insensitive to the surrounding Ca concentration confers Ca inactivation.

■

Natural selection

What role does natural selection play in setting up the patterns of variation among populations? Taylor *et al.* (p. 1497) looked for selection in field populations by using a combination of molecular genetics, evolutionary biology, and agricultural entomology. They examined the heterogeneity in a known insecticide resistance locus (a voltage-gated sodium channel) in a generalist crop pest (the tobacco budworm) at four different locations in the United States exposed to different levels of pesticide. The patterns of heterogeneity at the sodium channel locus differed markedly in the different populations, but a control allele did not. The correlation between insecticide resistance and allelic diversity suggests that differential (or natural) selection does indeed occur.



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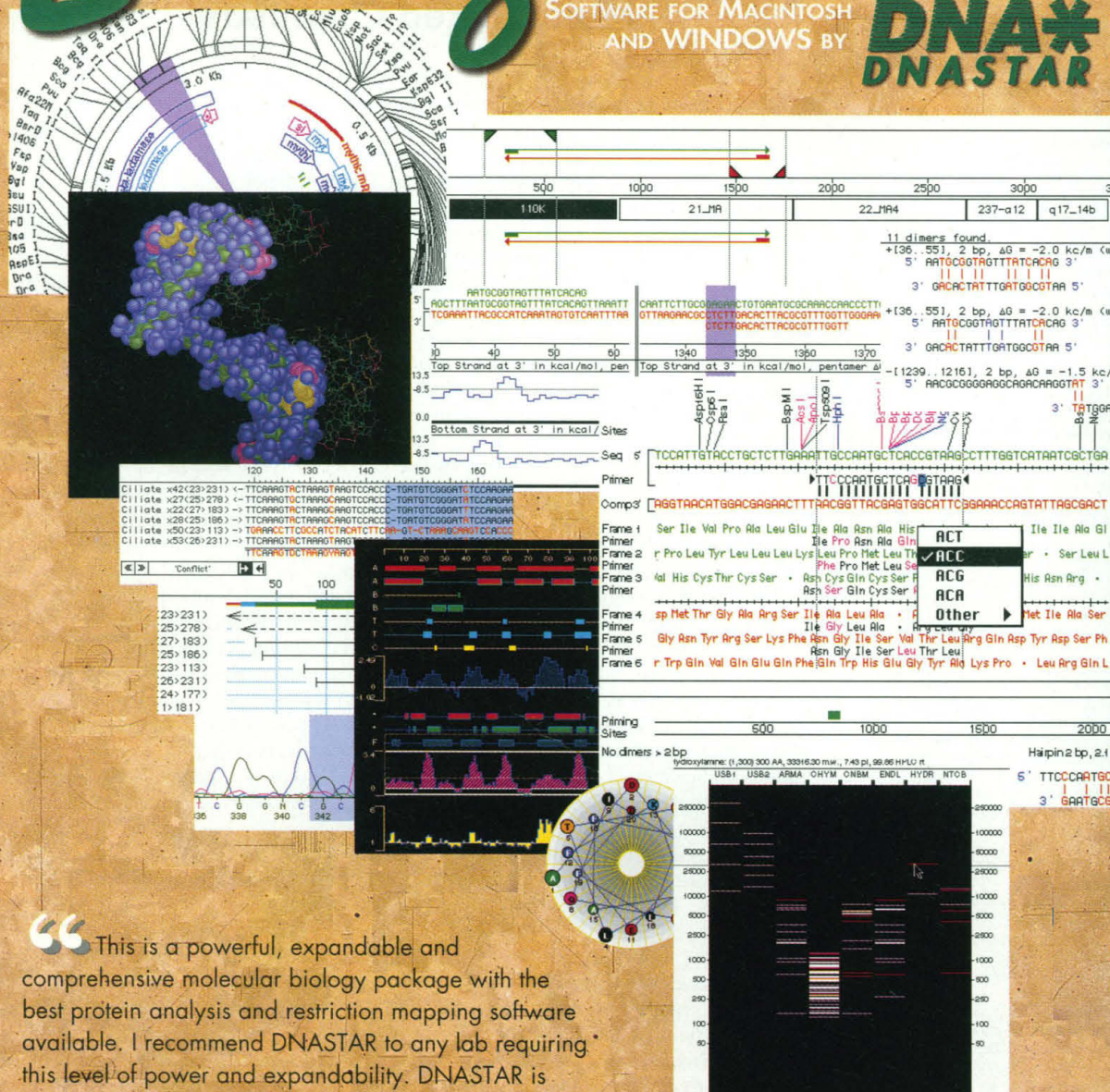
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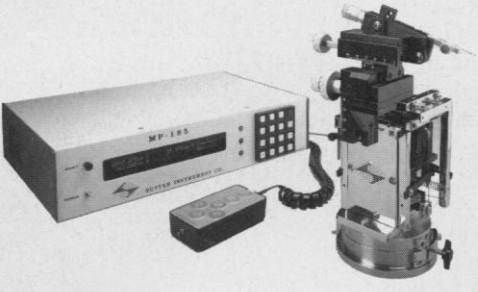
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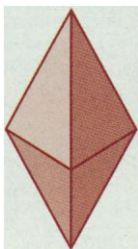
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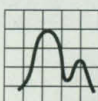
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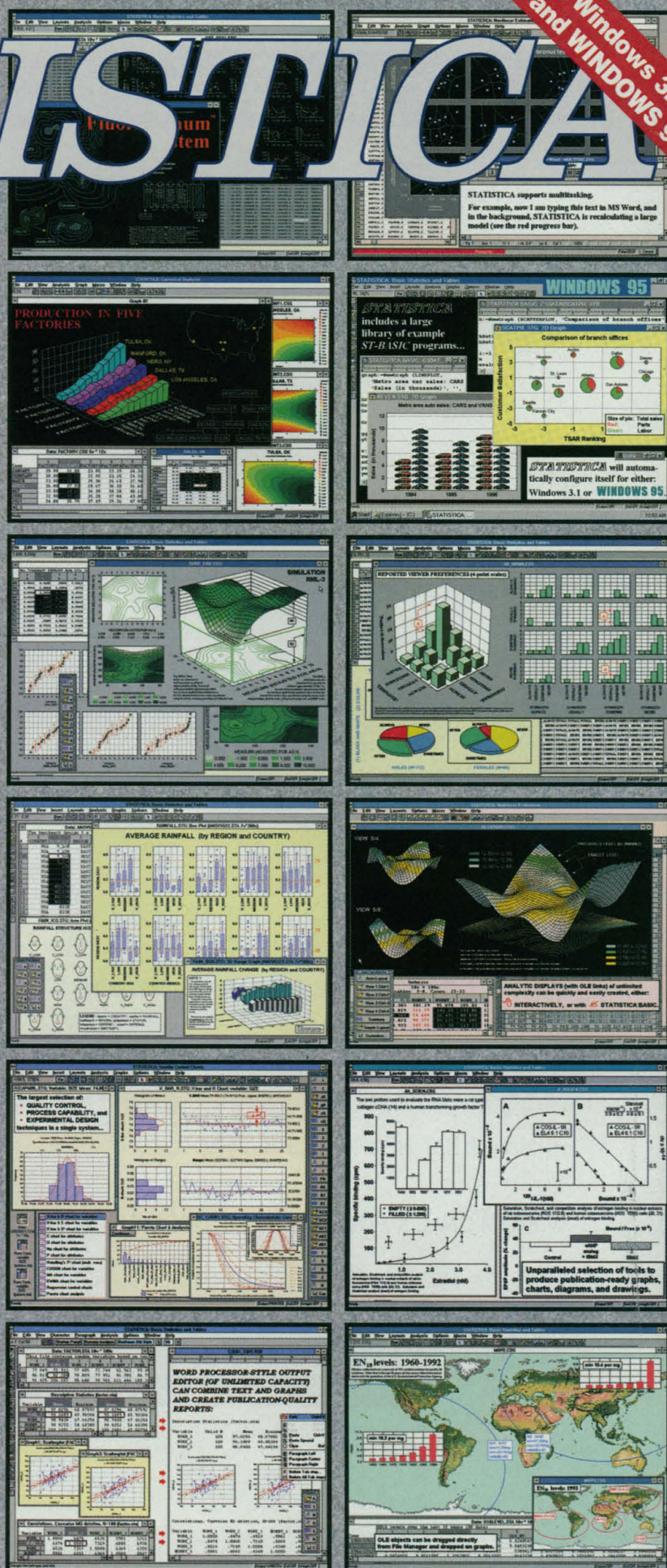
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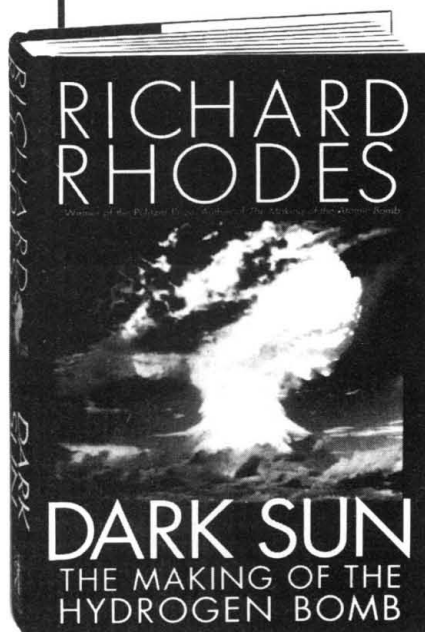
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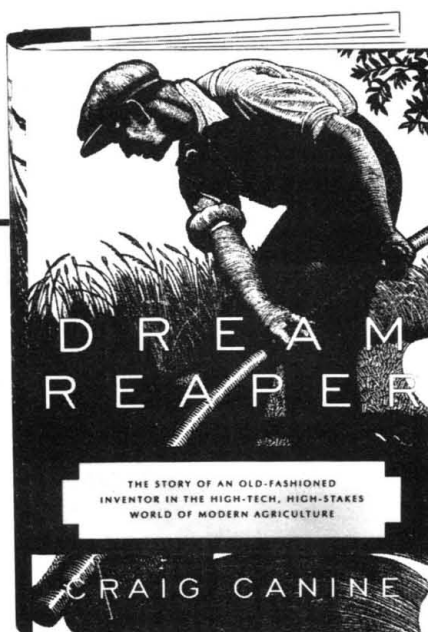
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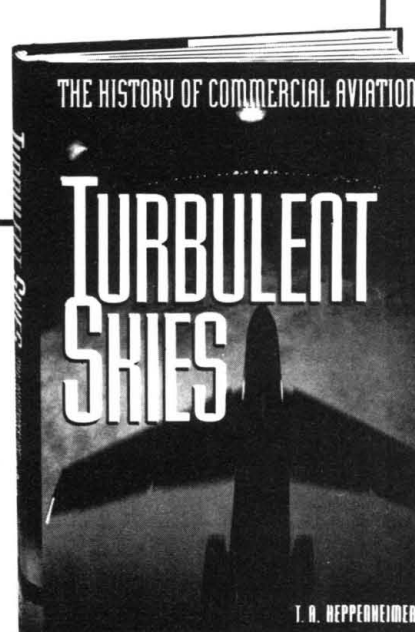


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