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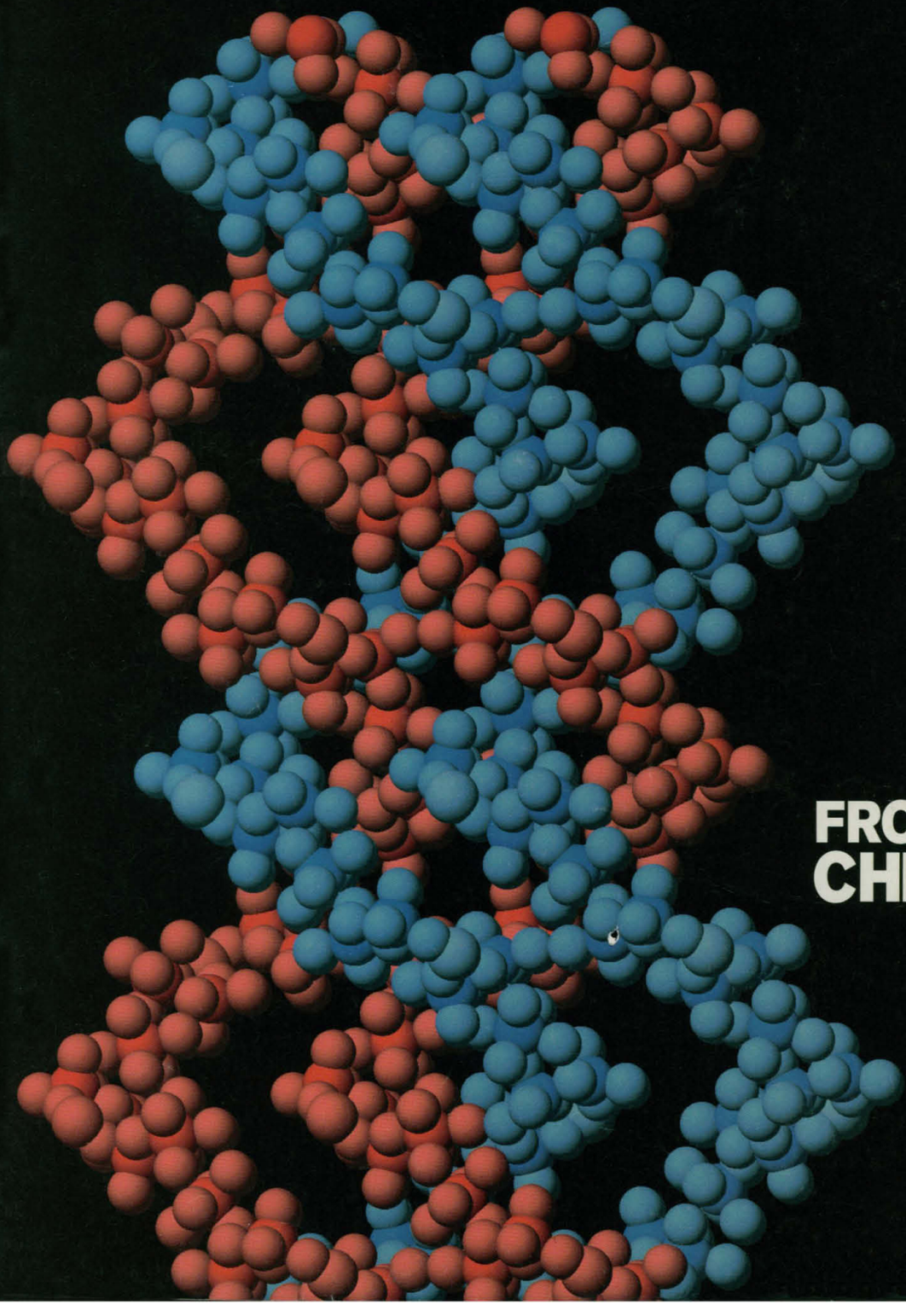

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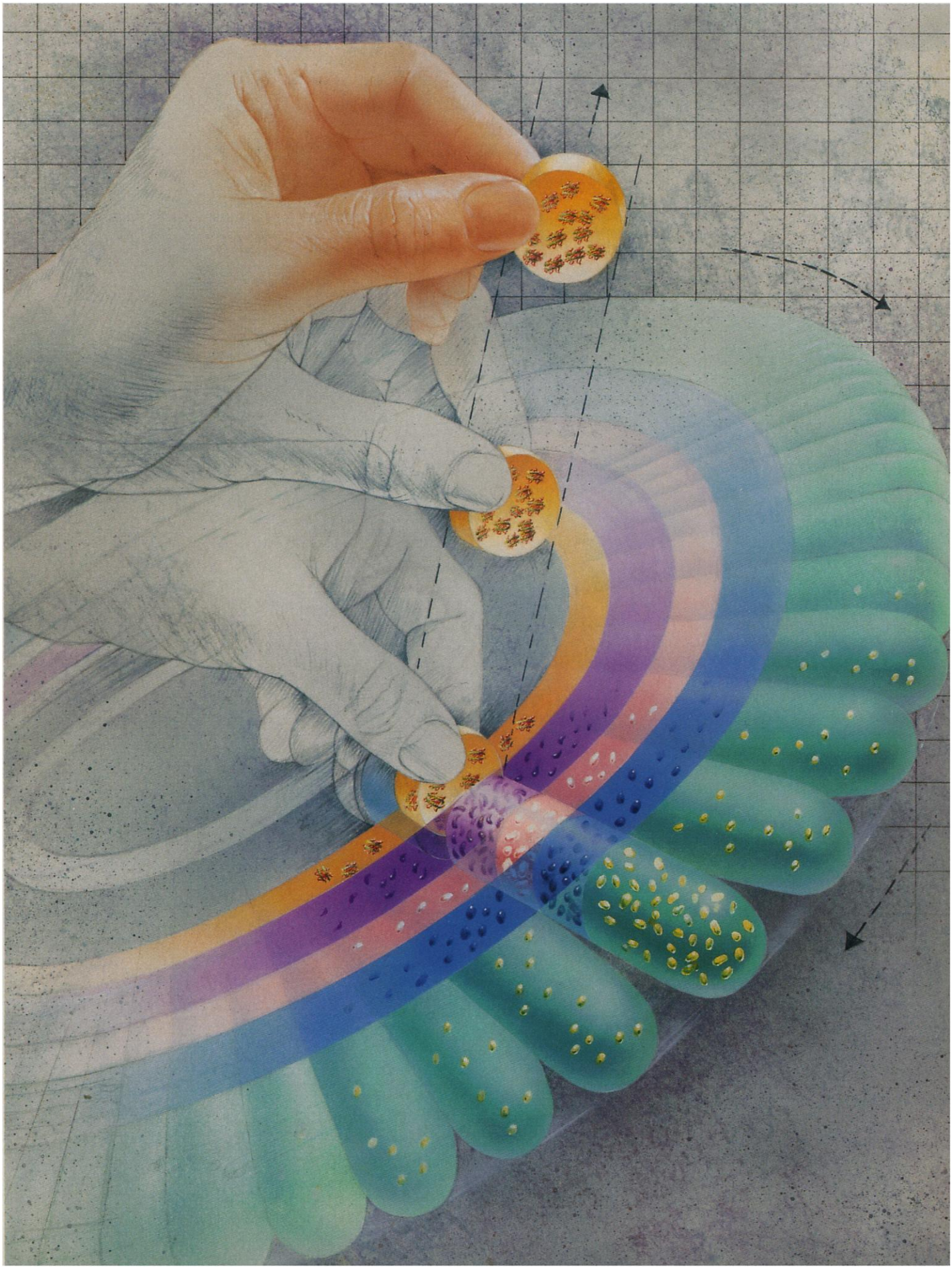

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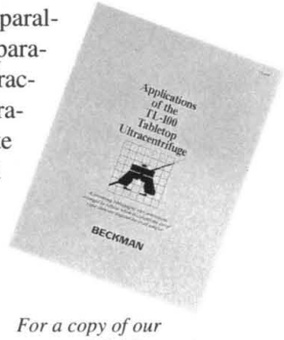

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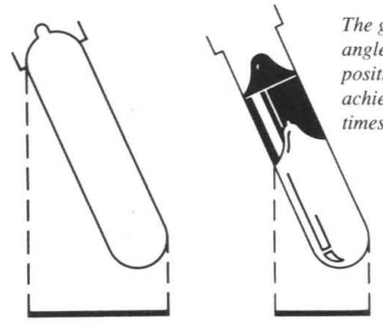

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COVER

Representation of chiral, intertwined double helices in a portion of the vanadium phosphate $[(CH_3)_2NH_2\text{-}K_4[V_{10}O_{10}(H_2O)_2(OH)_4(PO_4)_7] \cdot 4H_2O$, a complicated inorganic solid that self-assembles from structurally simpler reactants. The two different colors represent the two types of intertwined, crystallographically independent spirals that are composed of vanadium oxo pentamers bonded together with P^{5+} cations. See page 1596. New developments in chemistry are featured in a special section of this issue beginning on page 1552. [Image: Yoko Ozawa and Brad Gianulis, generated by CAChe software, Tektronix]

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Lightning-bolt buckyballs

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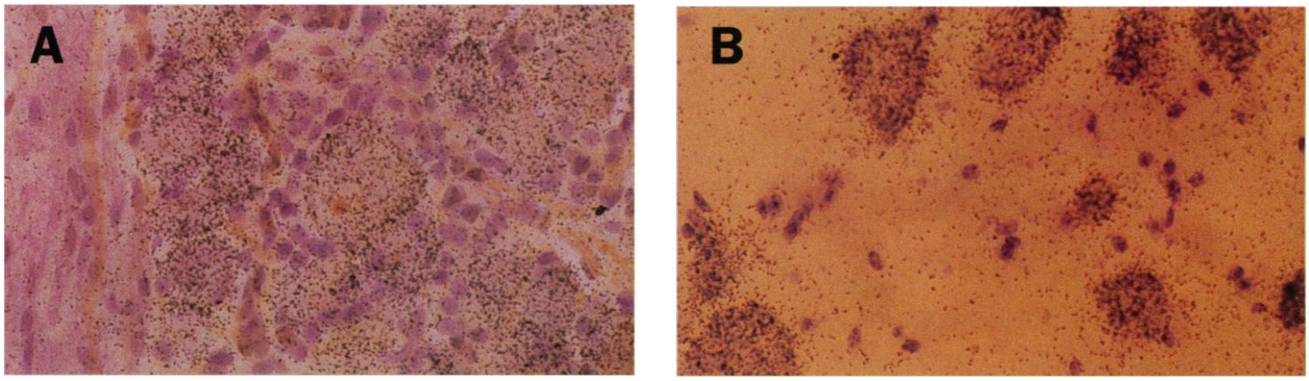

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A Rat dorsal root ganglia were hybridized to a ^{33}P-labeled ß-tubulin cDNA probe. Only the neurons (stained yellow) show labeling. The glia cells (stained purple) display no apparent expression of ß-tubulin mRNA. Exposure time: 1 day.

B A ^{33}P-labeled ß-tubulin cDNA probe was used to detect presence of ß-tubulin mRNA in neurons from rat facial motor nucleus brain stem (heavily labeled large cells). The smaller, purple stained glia cells do not show any apparent labeling. Exposure time: 2 days. Data courtesy Dr. Monica Oblinger, Chicago Medical School.

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DUPONT

THIS WEEK IN SCIENCE

edited by PHIL SZUROMI

Carbon's forms

Thirty years ago growth of synthetic diamond was made possible by the use of transition metal catalysts such as iron, cobalt, and nickel; no elemental catalysts have been reported since then. Akaishi *et al.* (p. 1592) have found that diamond can be synthesized from graphite in the presence of elemental phosphorus at high pressure and temperature. When diamond seed crystals were used as the substrate, single crystals could be grown. Graphite itself exhibits unusual growth habits in the presence of trace metal impurities, according to Krajnovich *et al.* (p. 1590). Sputtering of highly oriented pyrolytic graphite by excimer laser radiation resulted in ejection of carbon atoms and clusters with unusually high energy. The sputtered surface exhibited a pattern of small cones, which the authors attribute to the heat-shunting effect of the trace impurities.

Making spheres from rings

Mechanistic insights into the formation of fullerenes such as C_{60} and C_{70} have been obtained by producing these compounds from cyclic precursors. McElvany *et al.* (p. 1594) synthesized a series of cyclic carbon oxide compounds. When these compounds undergo laser desorption, they lose CO to form cyclic polyenes with 18, 24, or 30 carbon atoms. The major end product for laser desorption of the 18 and 24 carbon atom species is C_{70}; relatively little C_{60} is produced. The larger 30 carbon atom species, on the other hand, preferentially produces C_{60}. Mass spectrometric results suggest that fullerene formation occurs through the assembly of larger units and not just through addition of smaller carbon species such as C_2 and C_3.

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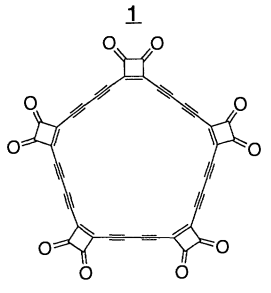


Activating transcription through phosphorylation

The transcription factor PU.1 is found in macrophages and B cells. In order to activate transcription, PU.1 forms a complex with the nuclear protein NF-EM5. Pongubala *et al.* (p. 1622) provide evidence that phosphorylation of PU.1 regulates formation of the active complex and hence activation of transcription. Dephosphorylated PU.1 could bind to DNA, but NF-EM5 interacted with PU.1 and bound to DNA only when PU.1 was phosphorylated with casein kinase. Mutation of the site of phosphorylation in PU.1 reduced the ability of PU.1 to stimulate transcription of a reporter plasmid.

Solids with a twist

Crystalline materials do not always form close-packed arrays; under certain conditions, open-framework materials, such as zeolites, can be formed. Soghomonian *et al.* (p. 1596) describe the hydrothermal synthesis of a vanadium phosphate compound that contains chiral double helices (see cover). These double helices are further entwined and form tunnels and cavities. This material self-assembles from simple starting materials, such as elemental vanadium and phosphoric acid, at relatively low temperatures (200°C). It is also unusual in that it is both chiral and has strong magnetic properties. Further developments in low-temperature routes for the synthesis of materials are presented in a review article by Stein *et al.* (p. 1558) that forms part of this special issue on Frontiers in Chemistry.

Buckytube growth

Electron microscopy studies of buckytubes have revealed the formation of bent tubes and nested structures. Dravid *et al.* (p. 1601) present evidence which suggests that these buckytube structures form through a helical growth mechanism similar to the process of crystal growth through screw dislocations. They argue that buckyballs may be the precursors for buckytube formation and show that the yield of buckytubes can be increased if some fraction of the graphite is replaced by fullerenes in the starting material.

Glucagon receptor

The hormone glucagon is essential for control of glucose metabolism. It regulates production of glucose by interacting with receptors on the surface of liver cells. Glucagon stimulates the production of two biochemical "second messengers," cyclic adenosine monophosphate and calcium. Therefore, it had been suggested that two receptor types might exist. Clarification of this question required the cloning of the glucagon receptor, which has now been accomplished by Jelinek *et al.* (p. 1614). The amino acid sequence of the glucagon receptor from rat is similar to those of the calcitonin and parathyroid hormone receptors. Expression of the cloned glucagon receptor revealed that it can stimulate both signaling pathways.

Hair cell regeneration

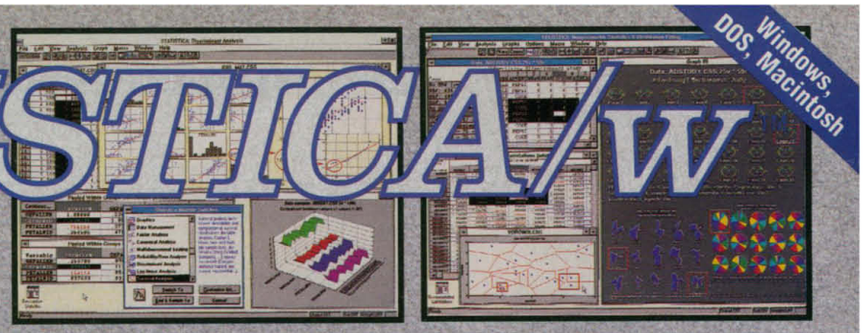
Hair cells are necessary for the transduction of mechanical stimuli involved in hearing and balance. Loss of hair cells has been thought to be irreversible in mammals and is a major cause of human deafness. Two reports demonstrate that hair cells can be regenerated in mammals. Forge *et al.* (p. 1616) observed hair cell regeneration in vivo in guinea pigs after loss induced by antibiotic treatments. Warchol *et al.* (p. 1619) found that epithelial cell layers from the inner ears from guinea pigs and humans in which hair cells had been destroyed could regenerate immature hair cells in culture.

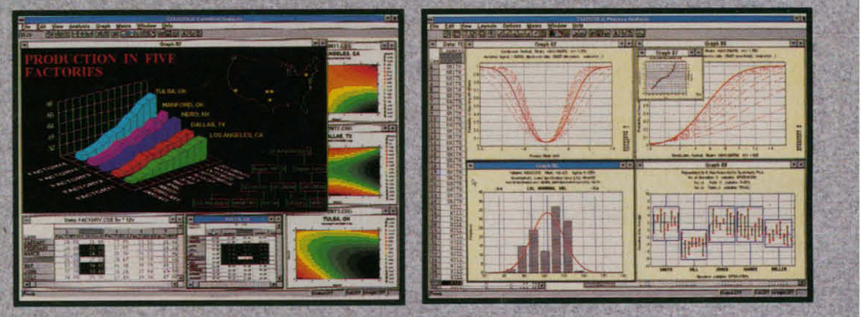
Devils Hole date debate

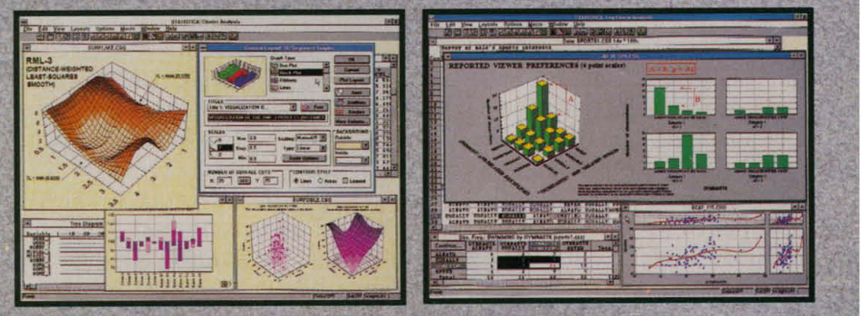
Isotopic analysis and dating of calcite growth from Devils Hole has yielded a detailed record of climate changes during the past 600,000 years in the southwest United States. This record seems to be inconsistent with the Milankovitch theory of climate change. The numerous uranium-series dates are one of the keys to the record. In a technical comment, Edwards and Gallup (p. 1626) suggest a process that might bias the ages to old values—absorption of thorium-230, which is produced in ground water, into the slowly growing calcite. Ludwig *et al.* (p. 1626) reply by presenting additional data that specifically evaluate this process.

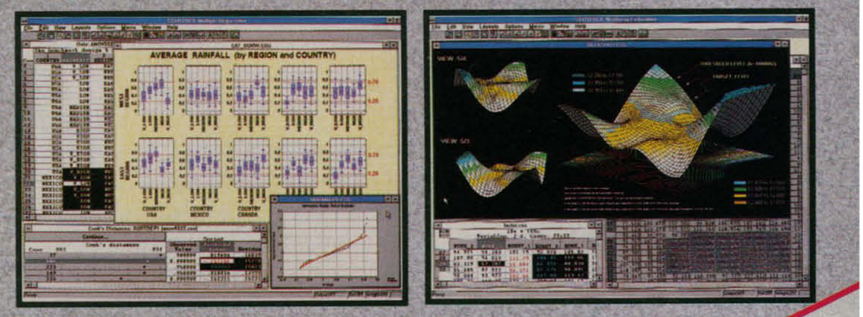
STATISTICA/w

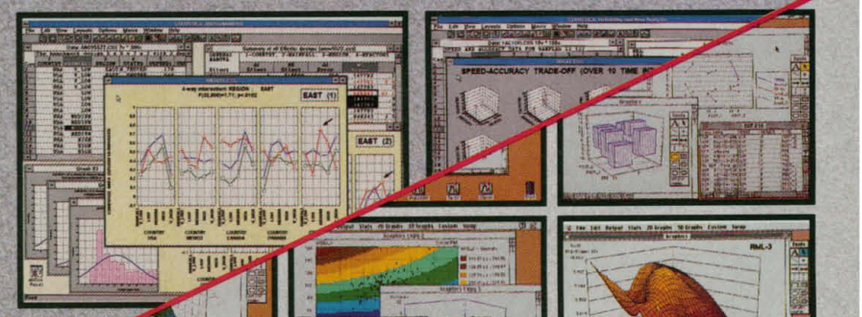
Windows, DOS, Macintosh

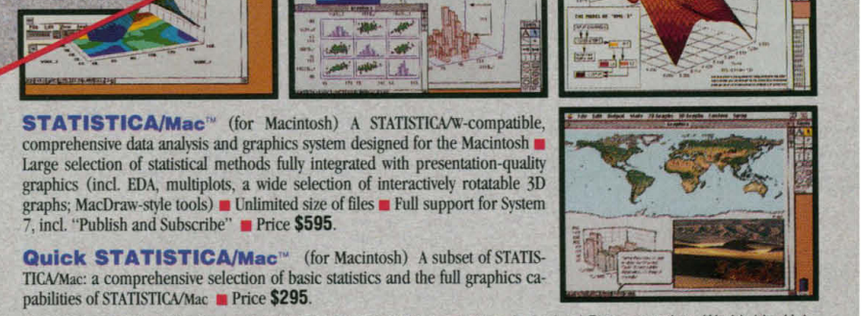












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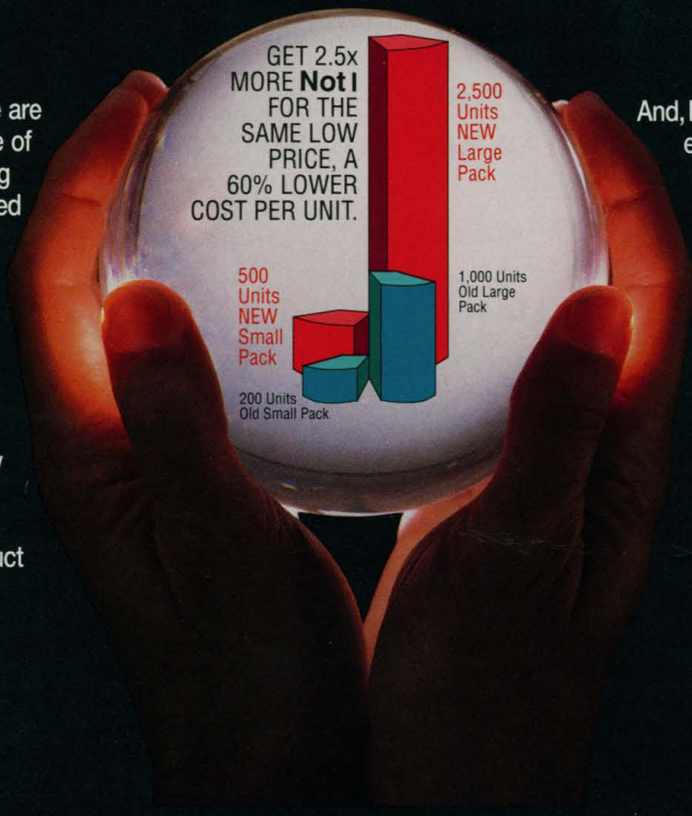

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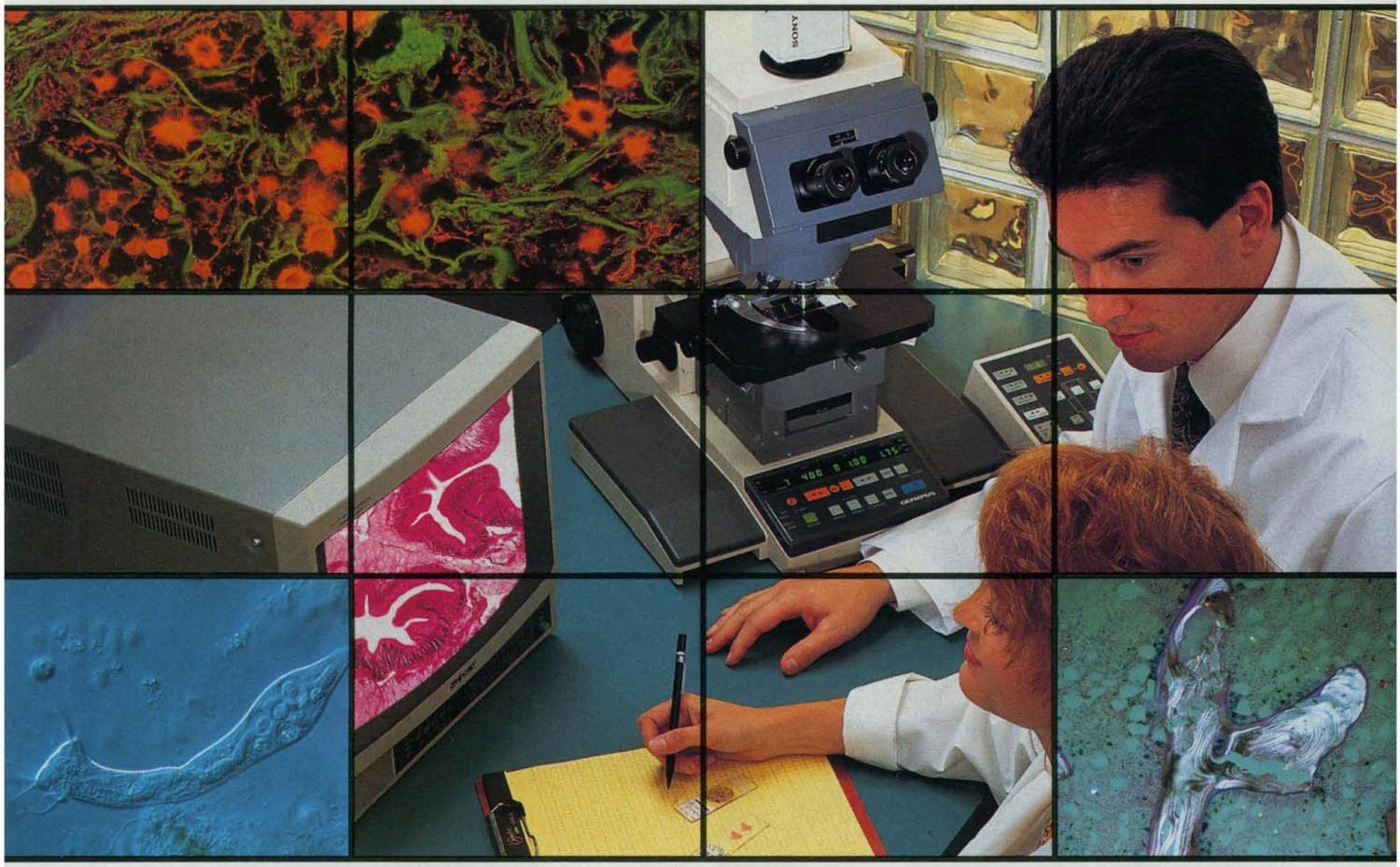

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$$pk_a = -\log k_a$$

$$E = mc^2$$

$$\frac{\partial^2\psi}{\partial x^2} + \frac{\partial^2\psi}{\partial y^2} + \frac{\partial^2\psi}{\partial z^2} + \frac{8\pi^2 m}{h^2}(E - V)\psi = 0$$

$$E = 0.76 - \frac{0.059}{2}\log_{10}\frac{(1)(1)}{(10^{-3})^2}$$

$$a^n + b^n = c^n$$

$$X_i = kP_i$$

$$\int_0^\infty \frac{a\,dx}{a^2 + x^2} = \frac{\pi}{2}, \text{ if } a > 0;\ 0, \text{ if } a = 0;\ -\frac{\pi}{2}, \text{ if } a < 0$$

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