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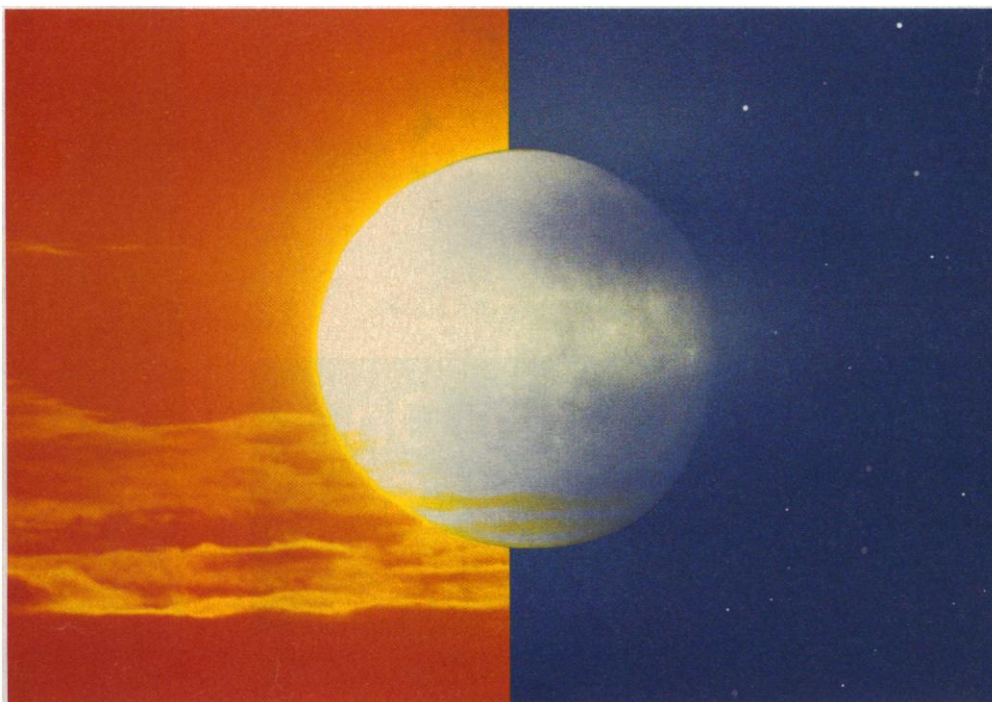


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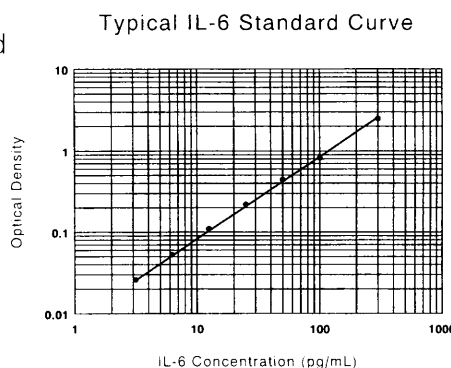


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COVER

Head of a fruit fly, *Drosophila melanogaster*, viewed by scanning electron microscopy (approximate magnification, $\times 380$). Targeted expression of the *eyeless* gene induced the formation of eye facets on the antenna (to the lower right of the eye), which are very

similar to the facets of the normal eye, identifying *eyeless* as the master control gene of eye morphogenesis. See page 1788 and the News story on page 1766. [Photo: Andreas Hefti and Georg Halder]



RESEARCH ARTICLE

Induction of Ectopic Eyes by Targeted Expression of the *eyeless* Gene in *Drosophila*

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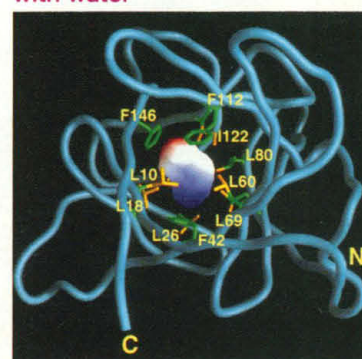
1/f Noise in Human Cognition

D. L. Gilden, T. Thornton, M. W. Mallon

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Filling a cavity with water



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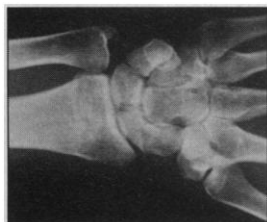
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Jumpy cables

Very thin wires, a few angstroms across, show a wide range of quantum effects not seen in macroscopic conductors. Pascual *et al.* (p. 1793) created tiny metal conductors by driving the tip of a scanning tunneling microscope into a metal surface, then pulling it back to draw out a wire. They find quantized conductivity variations in the wires that correlate well with order-disorder transitions predicted by molecular dynamics simulations. As microelectronic devices and their interconnections become smaller, such effects may assume practical importance.

Bone glue

Some bone fractures, such as of the wrist, may require implanted pins or braces as well as casts to hold the bones in place during healing. As an alternative, Constantz *et al.* (p. 1796; see



also news by Pool, p. 1772) have developed an injectable paste that hardens in minutes to form the mineral phase of bone, dahllite. Animal studies suggest that bone cells remodel the material in vivo, and clinical trials have established that it is strong enough to hold wrist bones together as they repair themselves.

Undersea uprush

Megaplumes are sudden, voluminous, and unexplained discharges of hydrothermal waters from mid-ocean ridges, places

where injection of hot magma drives hydrothermal circulation. Lowell and Germanovich (p. 1804) suggest, through modeling of heat and fluid flow, that these events follow emplacement of dikes. Emplacement of the dikes may enhance permeability, producing the megaplume, and cooling of the system results in a return to normal black smoker venting.

Arachnid invasion

Increasing human mobility has increased the intentional and accidental introduction of alien organisms into established habitats, with effects that are hard to predict. Schoener and Spiller (p. 1811) introduced spiders onto Bahamian islands they had not previously occupied, and found that for the spiders to form stable populations it was necessary not only that their natural predators, lizards, should be absent, but that the island should not be too small.

Water in holes

The interiors of protein structures are generally compact, so as to minimize empty space or

colliding atoms, both of which might destabilize the structure. Nonpolar interactions predominate in the interior, with polar residues mostly clustered on the protein surface, where they interact with solvent water. Ernst *et al.* (p. 1813) use nuclear magnetic resonance to examine an internal nonpolar cavity in the protein interleukin-1 β . They find evidence for the existence of several water molecules that are not stably bound to any specific portions of the protein, and suggest that there is an energetic advantage to the presence of water molecules in such cavities.

Dangerous deletion

Because simian immunodeficiency virus (SIV) from which the *nef* gene has been deleted causes no disease in adult macaques, and protects against infection by pathogenic SIV, *nef*-deleted viruses have been proposed as potential AIDS vaccines. Baba *et al.* (p. 1820) demonstrate, however, that oral administration of *nef*-deleted SIV causes infection and disease in neonatal rhesus monkeys. The authors argue that *nef* primarily affects viral replication, rather

than pathogenicity, and that any factor increasing viral replication in adults could potentially make *nef*-deleted virus dangerous if used as a vaccine.

Hitching a ride

Vesicles are transported for long distances within certain cells, relying on molecular motors that move them along microtubules to their correct destinations. The two most common motors for vesicle movement are kinesin and dynein. Kumar *et al.* (p. 1834) show that a vesicle membrane protein, kinectin, acts to bind the vesicle to the motor kinesin, attaching the motor to the vesicle so as to promote transport toward the cell periphery. The ability of a vesicle to bind specifically to one or other of the two motors, which mediate opposite transport directions, is thus an essential factor role in deciding the destination reached by a particular vesicle and its contents.

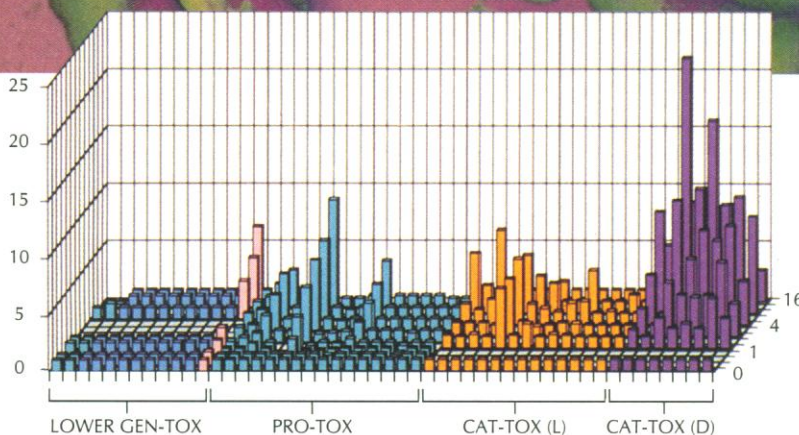
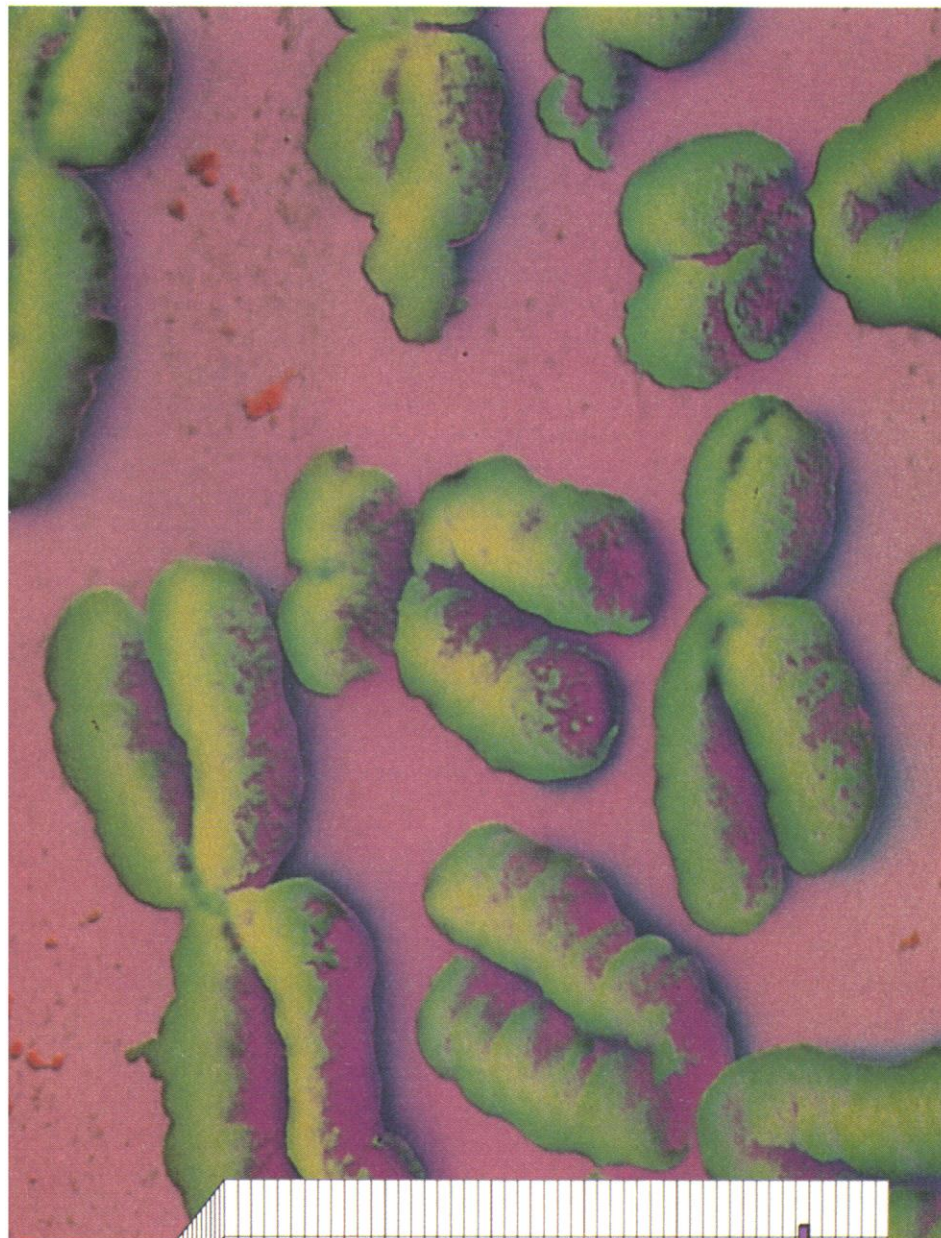
Errors of estimation

Noise of the $1/f$ variety, in which the power density is proportional to the inverse of the frequency, appears in many unrelated systems, such as traffic flow, quasar emissions, and DNA sequences. Gilden *et al.* (p. 1837) add to this list by documenting the presence of $1/f$ noise in a cognitive test. Humans were required to estimate temporal or spatial intervals in sequence by moving one of their hands. When trying to replicate intervals much longer than their reaction time, the subjects produced error sequences that displayed $1/f$ noise, while for shorter intervals, errors were proportional to $1/f^2$ and therefore strictly random.

Eyes everywhere

Homologs of the *Drosophila* gene *eyeless* have been found throughout the metazoa in groups as diverse as the vertebrates, ascidians, insects, cephalopods, and nemerteans. Loss-of-function mutations in *eyeless* and its homolog genes, *Pax-6* in mice or *Aniridia* in humans, lead to reduced or absent eyes, suggesting that the control of eye development uses a similar pathway even though the eyes of insects and vertebrates are morphologically very different. Halder *et al.* (p. 1788; see also news by Barinaga, p. 1766) show that *eyeless* acts as a master regulator of eye development. Ectopic expression of *eyeless* during development in *Drosophila* induced the formation of morphologically correct eyes at the sites of *eyeless* expression. Similarly, expression of the mouse *Pax-6* gene in *Drosophila* induced additional eyes, with the morphology of fly eyes, at the sites of *Pax-6* expression.

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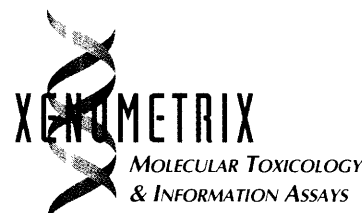
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Signed,
Searching for SigmaStat

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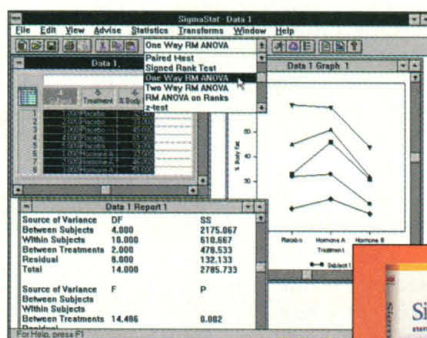
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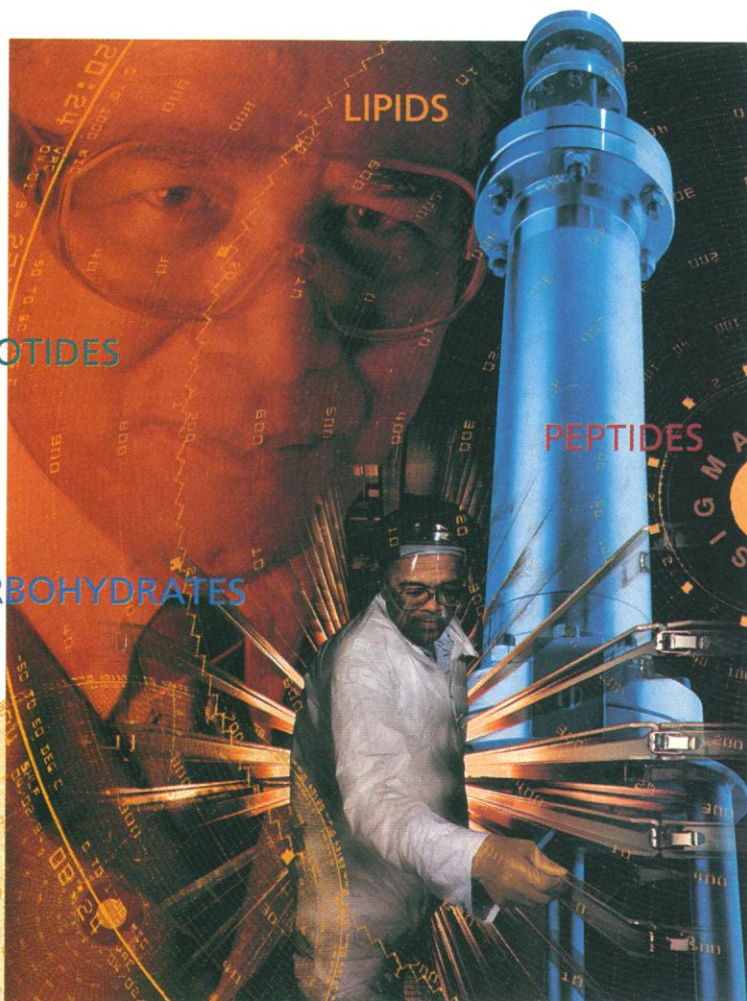
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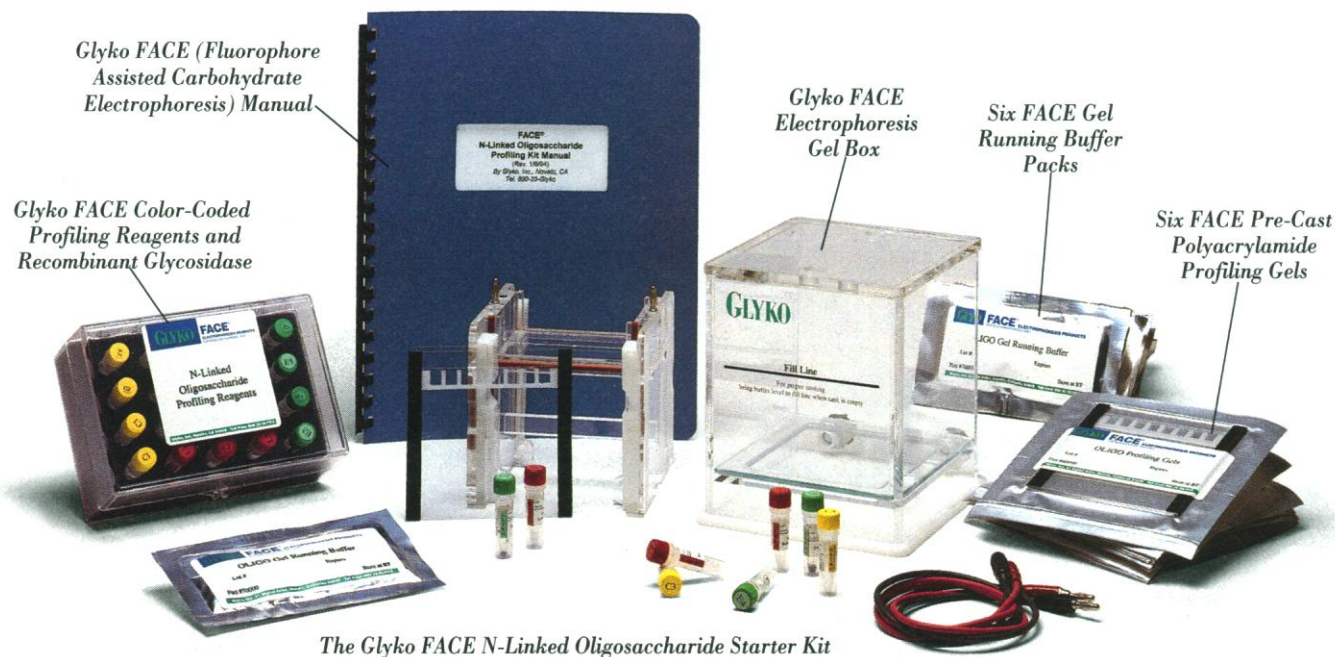
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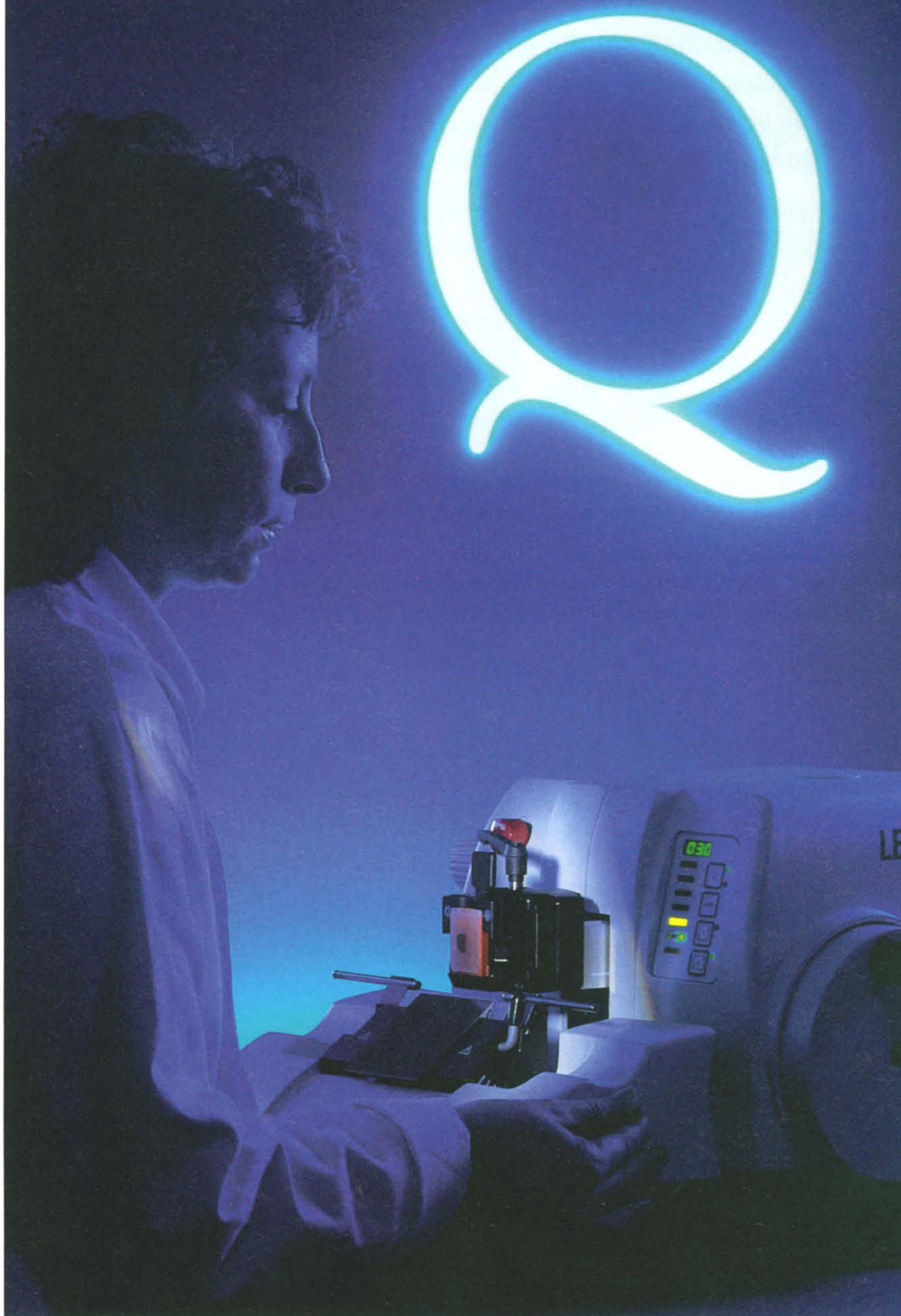
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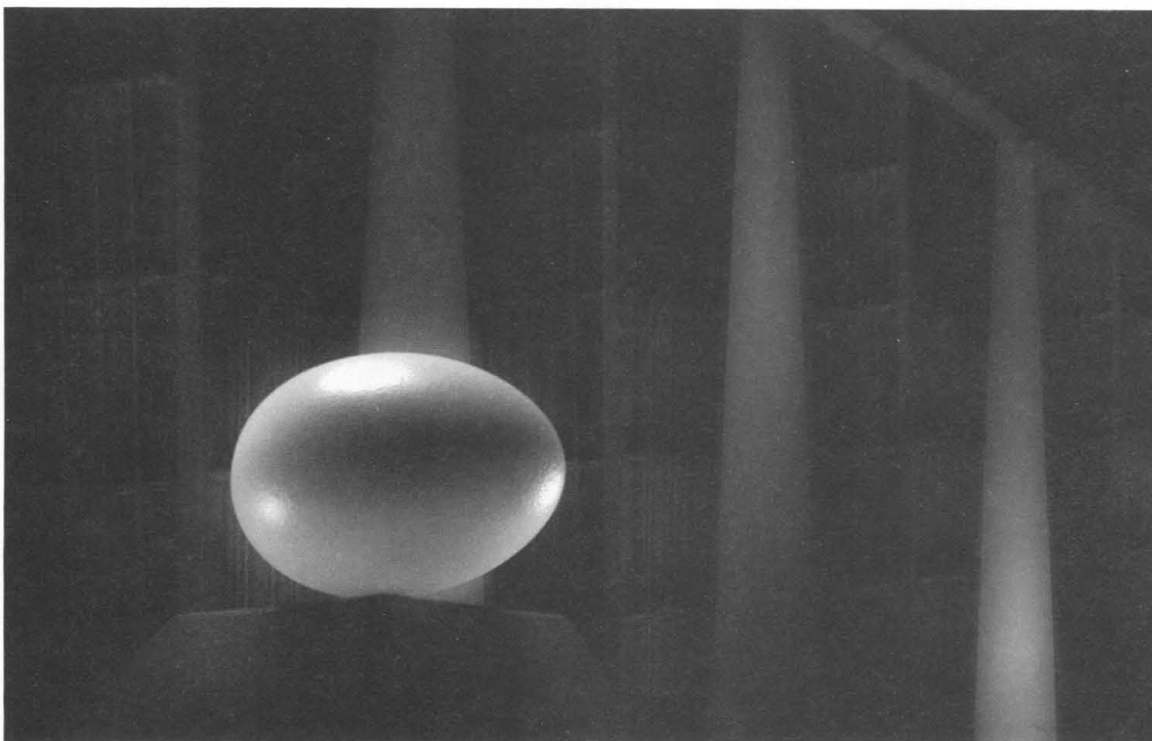


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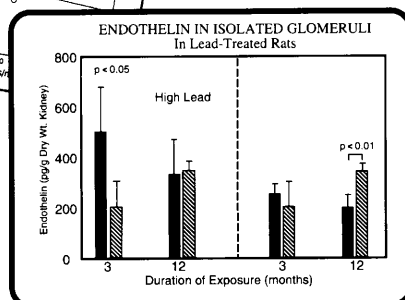
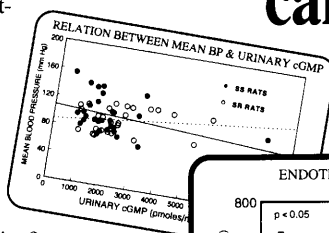
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