30 June 2000

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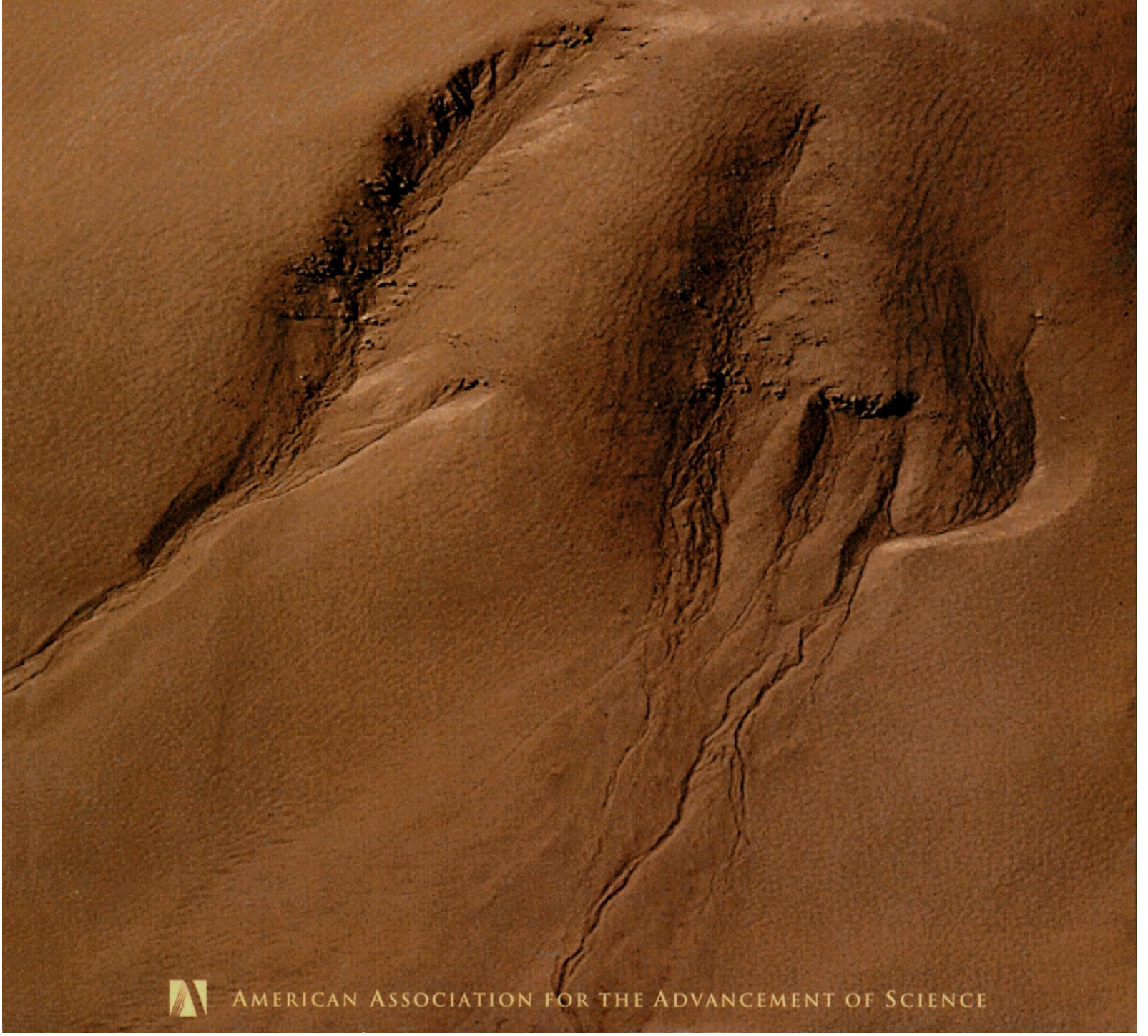

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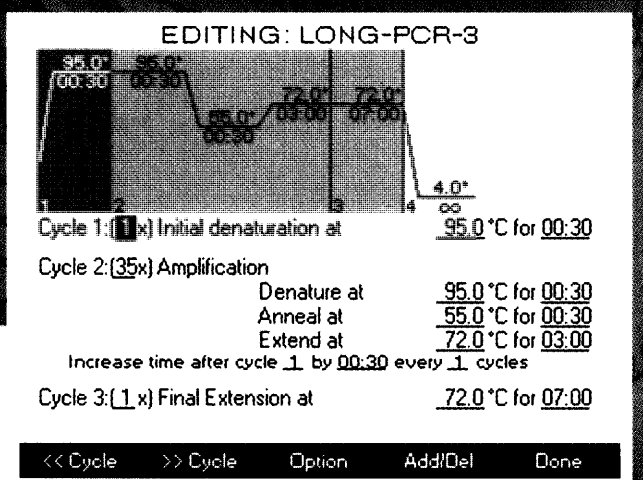

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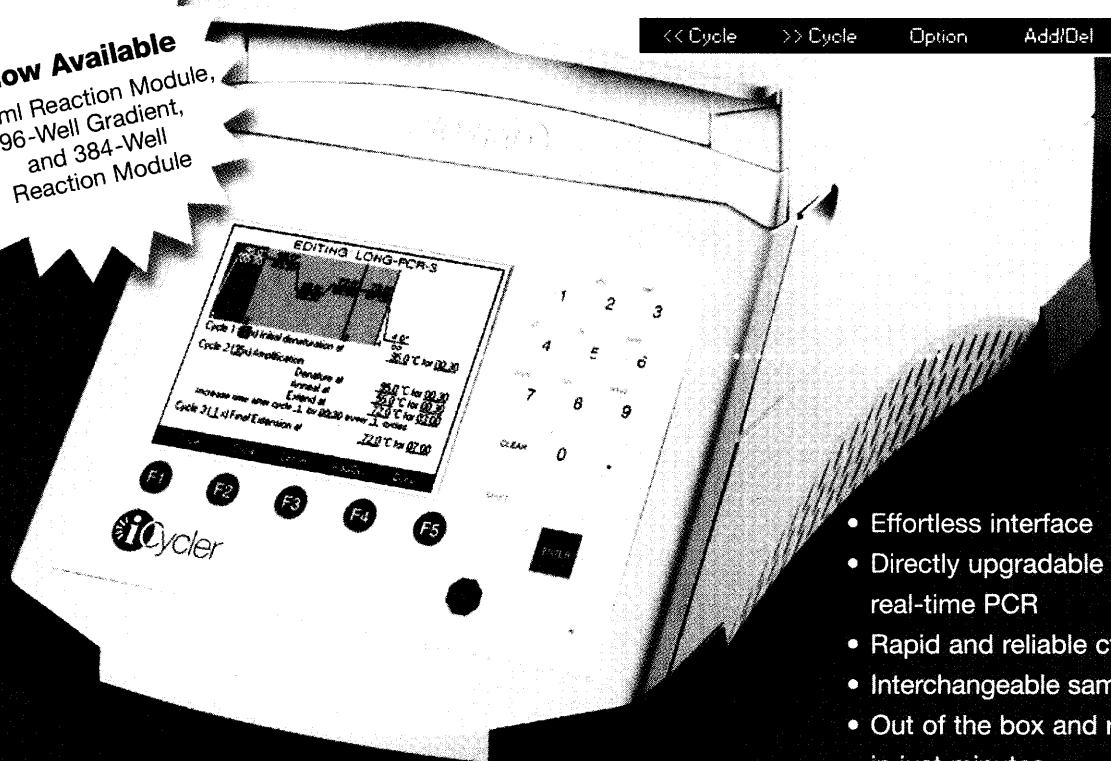

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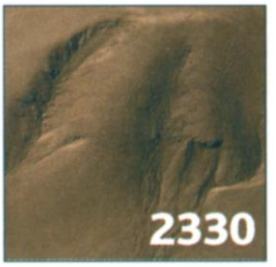
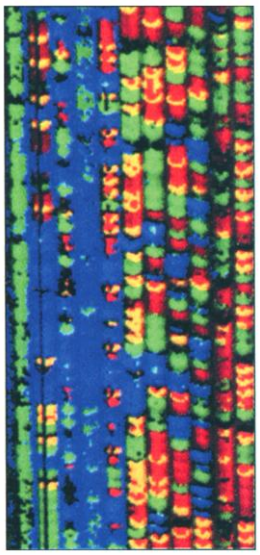


COVER This high-resolution image of the surface of Mars shows a 3-km-wide area of an impact crater's south-facing wall (54.8°S, 342.5°W). The gullies seen here may have formed by groundwater seepage and surface runoff, and the location and youth of these gullies suggest that liquid water may exist in the shallow martian subsurface today. This image was acquired in September 1999 by the Mars Global Surveyor Mars Orbiter Camera. [Image: Malin Space Science Systems/Jet Propulsion Laboratory/NASA]

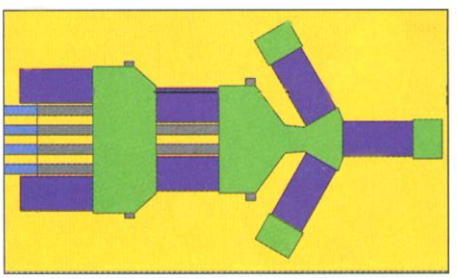


2304
Reading the genome

NEWS

RESEARCH

2335
Manipulation with microrobotic arms



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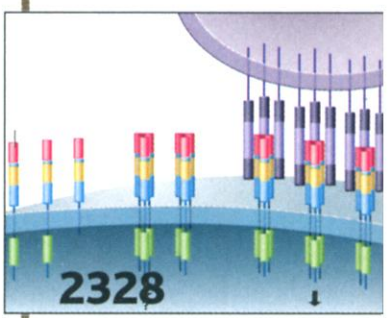

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TECHNICAL COMMENTS

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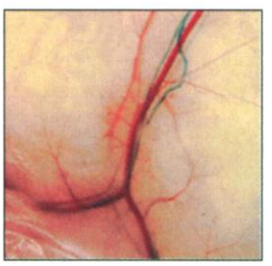

2369

No nodes in nuclear receptor knockout

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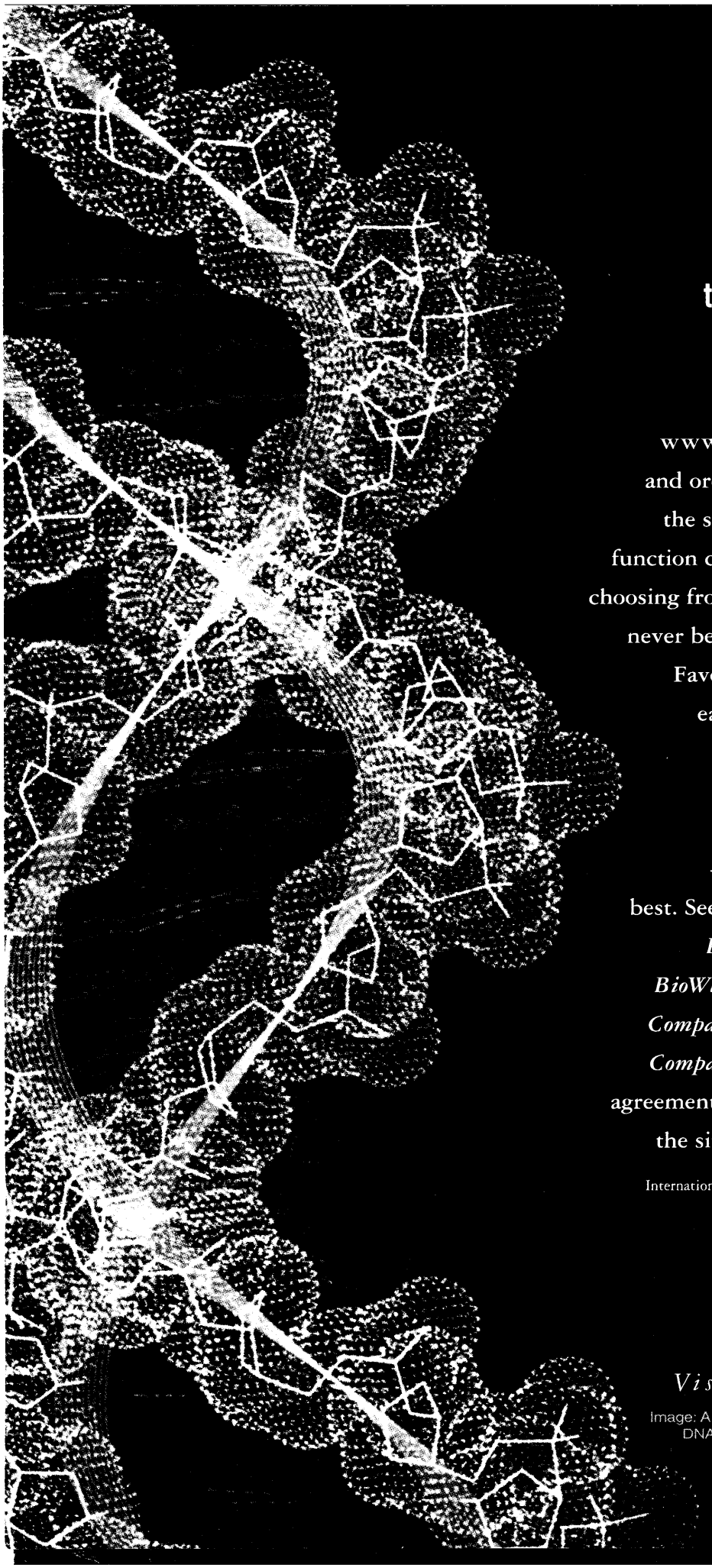

Watson and Crick unlocked the secret of DNA in 1953.

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Image: A false color scanning tunnel micrograph of a double-stranded DNA molecule taken at the Lawrence Livermore Laboratory.

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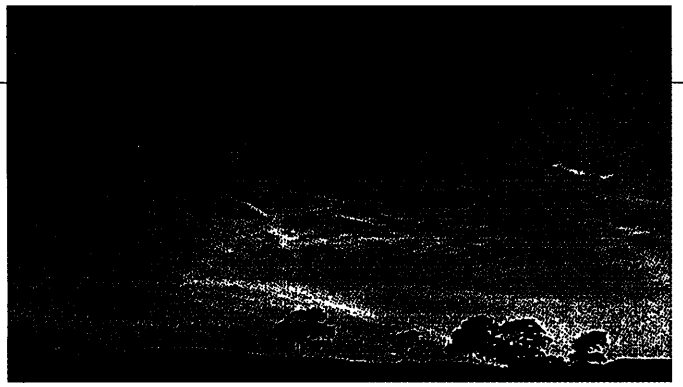

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COOL IMAGES

Glow-in-the-Dark Clouds

These glowing wisps high in the Scottish sky are no ordinary clouds: They're noctilucent clouds, a name that means "shines at night." Thought to be made up of ice crystals illuminated by the sun, these mysterious clouds form about 82 kilometers above Earth in the frigid upper atmosphere—far above storm clouds and nearly as high as the aurora. Noctilucent clouds appear at twilight in summer, usually at high latitudes in places like Russia, Scotland, and Canada. In recent decades they've been spotted more often and farther south. That intrigues atmospheric scientists, as it suggests that the clouds might be tied to the buildup of humanmade greenhouse gases. For more info and photos, visit the Noctilucent Cloud Observers' Home Page run by amateur astronomer Tom McEwan, who snapped the shot above in July 1997 from Glengarnock.
www.kersland.u-net.com/nlc/nlchome.htm

HOT PICKS

Corpus to cosmos. Bone up on body parts with the classic *Gray's Anatomy*, or read Einstein's popular explanation of his ideas in his 1920 *Relativity: The Special and General Theory* at this site posting free online books. Other science tidbits can be gleaned from an online encyclopedia and book of quotations. www.bartleby.com

Jell-O science. So-called "sol-gel" chemistry involves drying a solution into a gel to make everything from glasses to insulators and biomaterials. The Sol-Gel Gateway offers articles on new research and methods, a researcher directory, links to tutorials and books, and forums. www.solgel.com

Crossing the channel. This Web textbook on nerve impulses is packed with interactive simulations of ion channels—the proteins that shuttle ions across the nerve cell membrane. Click to see demos of diffusion across membranes, a propagating action potential, sodium and potassium channels in action, and more. Reach related sites through the linked ion channel Web ring. pb010.anes.ucla.edu

NET NEWS

Animal Activists Win Domain Name Battle

PETA—that is, People Eating Tasty Animals—has lost its domain name (peta.org), the culmination of a 4-year battle with the better known People for the Ethical Treatment of Animals (PETA). A federal judge in Alexandria, Virginia, ruled on 12 June that the site owner, Mike Doughney, was guilty of trademark infringement and cybersquatting—snapping up someone else's name in hopes of selling it.

In 1996, Doughney, a suburban Maryland Internet entrepreneur, set up what he calls a "parody" Web site, which describes itself as "a resource for those who enjoy eating meat, wearing fur and leather, hunting, and the fruits of scientific research (and more!)" (*Science*, 19 January 1996, p. 297). PETA, presently at www.peta-online.org, promptly complained, and the name "peta.org" was put on hold by the domain name registrar, Network Solutions Inc. Then last year, PETA sued under the newly passed Anticybersquatting Consumer Protection Act, arguing that Doughney was misleading people and profiting from the PETA name.

Doughney, co-founder of a group called the Domain Name Rights Coalition based in Herndon, Virginia (www.domainname.org), says this is a free speech matter, and he's appealing the ruling. He's not all that interested in animal rights these days, he says. But his PETA site, now at mtd.com/tasty, still gets hits even though he hasn't updated it for 4 years.

NETWATCH

edited by JOCELYN KAISER

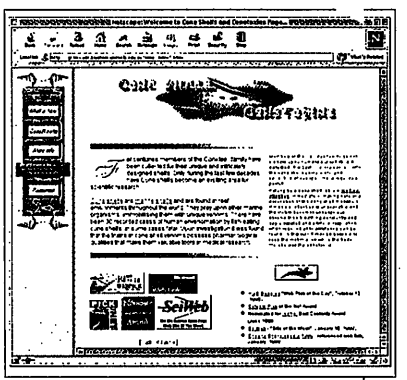
SITE VISIT

When Snails Attack

No mere garden grazers, the tropical marine snails called cone shells are hunters that launch harpoons tipped with a paralyzing poison at their prey and enemies. Long collected for their elaborately patterned shells, these mollusks have attracted a new set of fans among biochemists and molecular biologists, who are finding benign uses for cone shell venom. One toxic snail protein is being tested in clinical trials, for instance, as a stroke treatment and a nonaddictive alternative to morphine for relieving severe pain.

For a fascinating roundup of cone shell biochemistry, ecology, lore, and links, pay a visit to the Cone Shell and Conotoxins Home Page, created 5 years ago by neurochemist Bruce Livett of the University of Melbourne in Australia. Researchers may want to seek out a growing bibliography of cone shell papers, pages offering molecular structures of snail toxins, or the site's discussion group. Also valuable is the "What's New" section, where Livett posts everything from abstracts and meeting notices to links to popular articles and online museum exhibits.

grimwade.biochem.unimelb.edu.au/cone



Cone shell poisonings are rare—only about 30 deaths are known—but the site offers plenty of info about this intriguing topic, which Livett says is "a painless death." Don't miss the video clips of cone shells, including a sequence in which the snail's mouth opens like an umbrella to engulf a squirming fish. For a more sedate experience, browse photos of striking specimens.

Science ONLINE

In this week's issue, Jager *et al.* report the development of what may be the world's tiniest robot yet: a microfabricated arm that can manipulate objects the width of a human hair. *Science* Online features five video clips of the microrobot arm in action—flexing its minuscule fingers, rotating at the "wrist," and grasping glass beads a mere 100 micrometers in diameter. www.sciencemag.org/cgi/content/full/288/5475/2335

Send Internet news and great Web site suggestions to netwatch@aaas.org

MARTIAN GROUNDWATER

It has been thought that Mars had abundant surface water at times early in its history. Now an analysis by Malin and Edgett (p. 2330; see the cover and the Perspective by Tanaka) of images from the Mars Global Surveyor Mars Orbiter Camera at 2 to 12 meters per pixel resolution implies that groundwater has even recently seeped and run off onto the surface in a few regions, mostly in the southern hemisphere. These sites are concentrated along the walls of impact craters, in the south polar region, and in several small valleys. The fresh morphology of the gullies and their common occurrence on the poleward-facing walls of craters and valleys suggest that they were formed by transport of water from small aquifers or reservoirs toward vertical cliffs where the water could have reached the surface. Some of the escaping water may have initially frozen, but eventually it seeped out in a slurry of sediment, ice, and liquid that traveled only a short distance to form the observed gullies and other structures.

MAGMA SUPPLY RATES AT KILAUEA

Kilauea volcano, Hawaii, is in the midst of its longest continuous eruption cycle, which started in 1983 at Pu'u O'o along the east rift zone. Cayol *et al.* (p. 2343) modeled the deformation and seismicity associated with the 1975 (magnitude 7.2) Kalapana earthquake to estimate the rate of magma supply between this large event and the longest eruption cycle. They found that rift zone spreading was greater, which led to higher magma supply rates than were previously estimated after the large earthquake. Thus, the current eruption is probably a direct consequence of increased magma storage after the large earthquake.

UNDERWATER MICROROBOTS

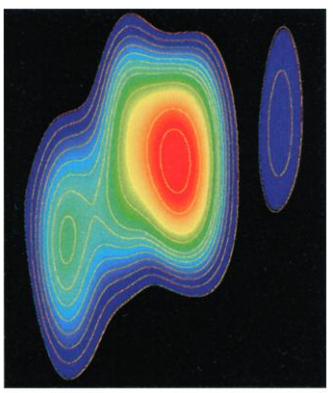
Microrobots are millimeter- to submillimeter-sized devices with individual parts of micrometer size. Silicon has been used in micromachining technology for making such devices, but silicon parts are not water-tolerant, which precludes their use in many applications, particularly in biology. Jager *et al.* (p. 2335) have built microrobotic arms that can pick up, move, and place micrometer-sized objects. The microrobots have individually addressable microactuators consisting of polypyrrole-gold bilayers and can be operated in water. The robots may be used, for example, in single-cell manipulation and characterization.

ORGANIC MEMBERS OF THE QUANTUM HALL FAMILY

The quantum Hall and fractional quantum Hall effects result from the correlated interaction of charge carriers whose motion is confined to a two-dimensional plane in the presence of a magnetic field. The effects are usually seen only in high-quality inorganic semiconductors and at temperatures in the millikelvin range. Schön *et al.* (p. 2338) now extend these observations to organic semiconductors—pentacene and tetracene. Moreover, the effects can be observed at the relatively high temperature of 2 kelvin.

QUASAR JETS AND GAMMA RAYS

Recently, several stellar x-ray binaries (also called microquasars) have been discovered near the sun. Paredes *et al.* (p. 2340; see the Perspective by Fender) combined radio, x-ray, and optical observations of the newly recognized



microquasar LS 5039 in order to determine its structure and the mechanism for energetic ejections. They found two strong radio jets that may be associated with the gamma ray burst found by the Energetic Gamma Ray Experiment Telescope (EGRET). The jet structure and the high-energy releases from this system indicate that the companion of the normal star LS 5039 is probably a black hole or a neutron star. These results and the continued discovery of nearby microquasars suggest that compact sources such as black holes and neutron stars may be more common in the local neighborhood than previously thought.

UP A WRONG TREE—OR NOT?

The advent of vast quantities of DNA sequence information has brought analysis of evolutionary trees to bear on a great variety of organisms for which fossils are nonexistent or not useful. However, the frequent disagreement between trees inferred from fossils and those inferred from sequence information indicates that both systems are susceptible to certain errors. Using the evolution of the horned soldier caste in aphids as a test case, Huelsenbeck *et al.* (p. 2349) now demonstrate the value of estimating the uncertainty of a phylogenetic tree and mechanisms for adjusting the evolutionary conclusions appropriately.

A DIATOM'S LIFE

Diatoms, which form a large proportion of the unicellular marine phytoplankton, are a crucial element in marine food webs and the global carbon cycle, but little has been known about how they perceive and respond to changes in their local environment. Using technologies to measure single-cell signaling, Falciatore *et al.* (p. 2363) reveal exquisite sensing mechanisms for responding to a range of environmental signals, including iron, which has been proposed as the key nutrient for growth control in phytoplankton.

WHEN RECEPTORS LIE IN WAIT FOR LIGANDS

A fundamental biological question that remains largely unresolved concerns the mechanism by which binding of ligands to receptors on the cell surface causes transmission of a signal through the plasma membrane. One appealing explanation has been that ligand binding brings receptors together into multimeric complexes. Three reports describe cases in which the opposite approach is taken, and the receptors are bound and lie in wait for the ligand (see the Perspective by Golstein). Siegel *et al.* (p. 2354) and Chan *et al.* (p. 2351) have examined how the Fas and tumor necrosis factor receptors signal. They define a protein interaction domain in these receptors that mediates assembly of the receptors into complexes in the absence of ligand. Such association is shown to be necessary for ligand binding and subsequent signaling. The results also explain how abnormal forms of Fas can dominantly prevent Fas-induced signaling in the human disease known as autoimmune lymphoproliferative syndrome. When bound to their cognate receptors, interferons (IFNs) induce cellular resistance to viral infection. Takaoka *et al.* (p.

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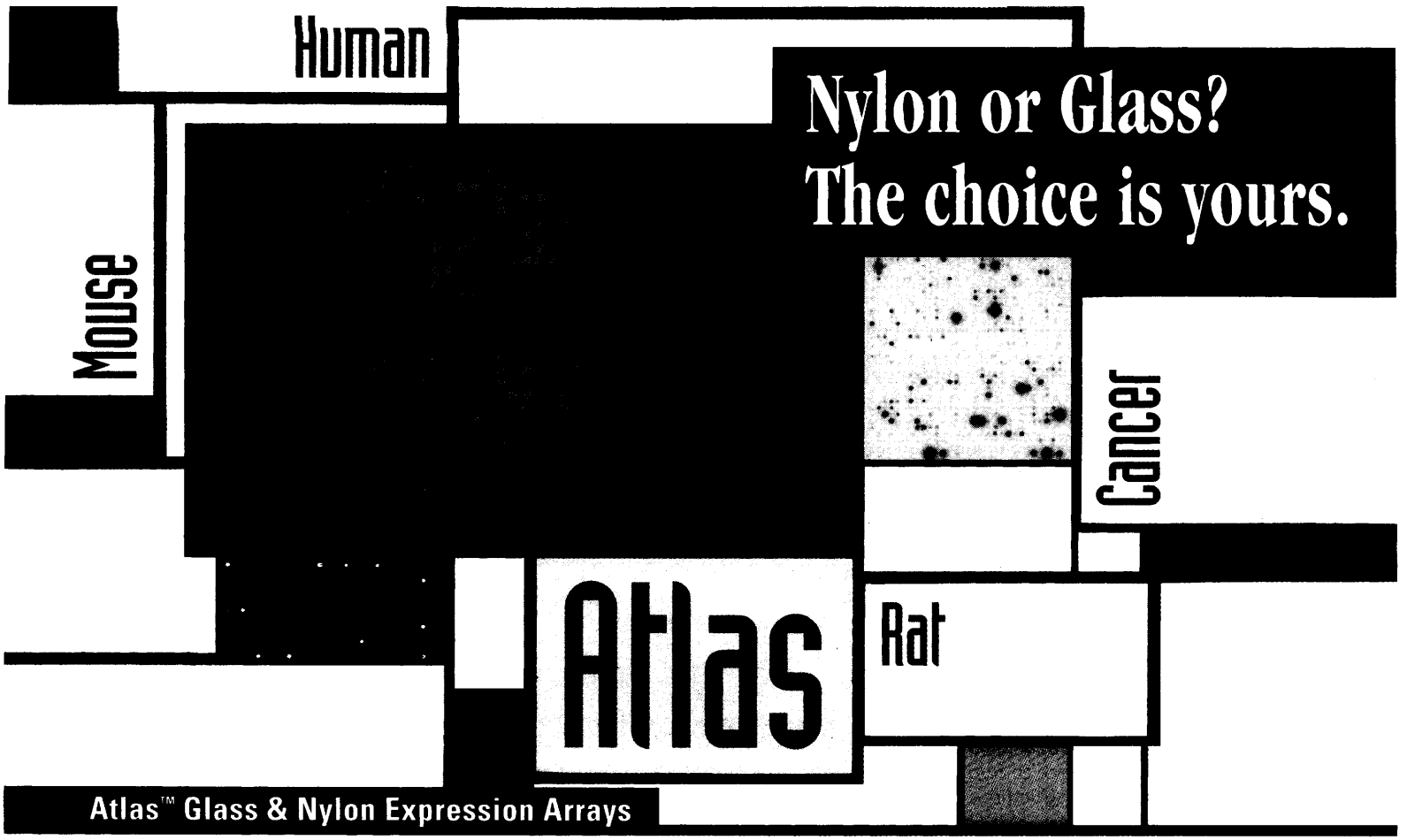

Illustration inspired by the art of Piet Mondrian (1872–1944).

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THIS WEEK IN *SCIENCE*

CONTINUED FROM PAGE 2281

2357) show that certain cells, if they are to maximize this response when exposed to the cytokine IFN-γ, must express not only a functional IFN-γ receptor but a functional IFN-α/β receptor as well. Before these cells are even stimulated with IFN-γ, the IFN-γ receptor is preassociated with the IFN-α/β receptor. The IFN-α/β receptor brings a transcription activator to the complex that is poised to become activated upon stimulation with IFN-γ. Crosstalk between two IFN receptor subtypes appears to increase the efficiency and strength of a cell's antiviral response to IFN-γ.

READY TO LISTEN

Even before hearing becomes active, there is a transient cholinergic innervation in the developing mammalian inner ear. The physiological significance of these synapses has never been demonstrated. Glowatzki and Fuchs (p. 2366) show that the novel neuronal nicotinic acetylcholine receptor α9 is functionally present in neonatal cochlear inner hair cells and behaves like a true acetylcholine receptor. Its stimulation results in the activation of a fast calcium-dependent potassium channel. Acetylcholine thus inhibits afferent activity and acts to impose rhythmicity onto the immature auditory pathway.

IMMEDIATELY EARLY

Human cytomegalovirus (HCMV) is an important pathogenic herpesvirus of humans. Its genome had been thought to be composed entirely of DNA, but Bresnahan and Shenk (p. 2373; see the Perspective by Roizman) have discovered that HCMV packs RNA transcripts into its virion. When a new cell is infected, the virus can generate protein without transcription and thereby avoid inducing early adverse cellular responses. Packaging RNA, rather than mature protein, could allow retention of signal sequences on the viral protein so that proteins will be targeted to the correct cellular compartment, and thus possibly prime cells for efficient virus replication.

A PERFECT HOST?

The protozoan parasite that causes malaria spends a critical portion of its life cycle in the mosquito host. Schneider and Shahabuddin (p. 2376) investigated how the innate immune system in a non-host combats the parasite by identifying experimental conditions that allowed the parasite to grow in the fruit fly *Drosophila*. Because the fruit fly is so genetically well defined, this model should provide new insights into the pathogenesis of malaria, which may lead to new ideas for prevention and treatment.

FAS(T) ROUTE TO WEIGHT LOSS

The increasing recognition of obesity as a serious and costly public health problem has resulted in intensified efforts to understand the physiological mechanisms that regulate food intake and body weight. Loftus *et al.* (p. 2379; see the news story by Gura) have identified an unexpected link between appetite control and anabolic energy metabolism. Treatment of mice with a synthetic compound (C75) inhibited fatty acid synthase (FAS), an enzyme that catalyzes synthesis of long-chain fatty acids under conditions of energy surplus, and led to rapid weight loss due primarily to inhibition of feeding. C75 was well tolerated by the mice and appeared to act in a leptin-independent manner by inhibition of neuropeptide Y in the hypothalamus.

TECHNICAL COMMENT SUMMARIES

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/288/5475/2283a

Late Cretaceous True Polar Wander: Not So Fast

Analyzing the pattern of 27 paleomagnetic poles calculated from Pacific plate seamount anomaly modeling (SAM), Sager and Koppers (Research Article, 21 January, p. 455) inferred a possible event of rapid true polar wander (TPW), on the order of 3° to 10° per million years, at approximately 84 ± 2 million years ago. Cottrell and Tarduno object that the study underestimated potential errors implicit in SAM paleopole data and "may not have adequately taken into account alternative explanations," such as overprint magnetizations and local tectonic complexities, in explaining the observed data. They also argue that a "well-studied, highly regarded pelagic sedimentary section of the same age," in the Umbrian Apennines of Italy, shows no evidence of the proposed shift. Sager and Koppers respond that SAM poles "are useful, if employed with proper caution," when alternative high-quality data are scarce. They add that tectonic complexities "should cause random errors in SAM pole locations and thus do not explain the grouping of poles." And they conclude that the test based on the Italian data is "inconclusive" in view of the data's inclination scatter and the large uncertainty in the location of the TPW rotation pole.

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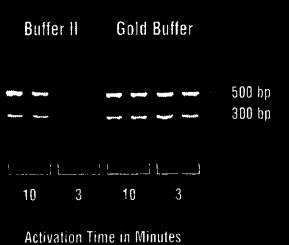

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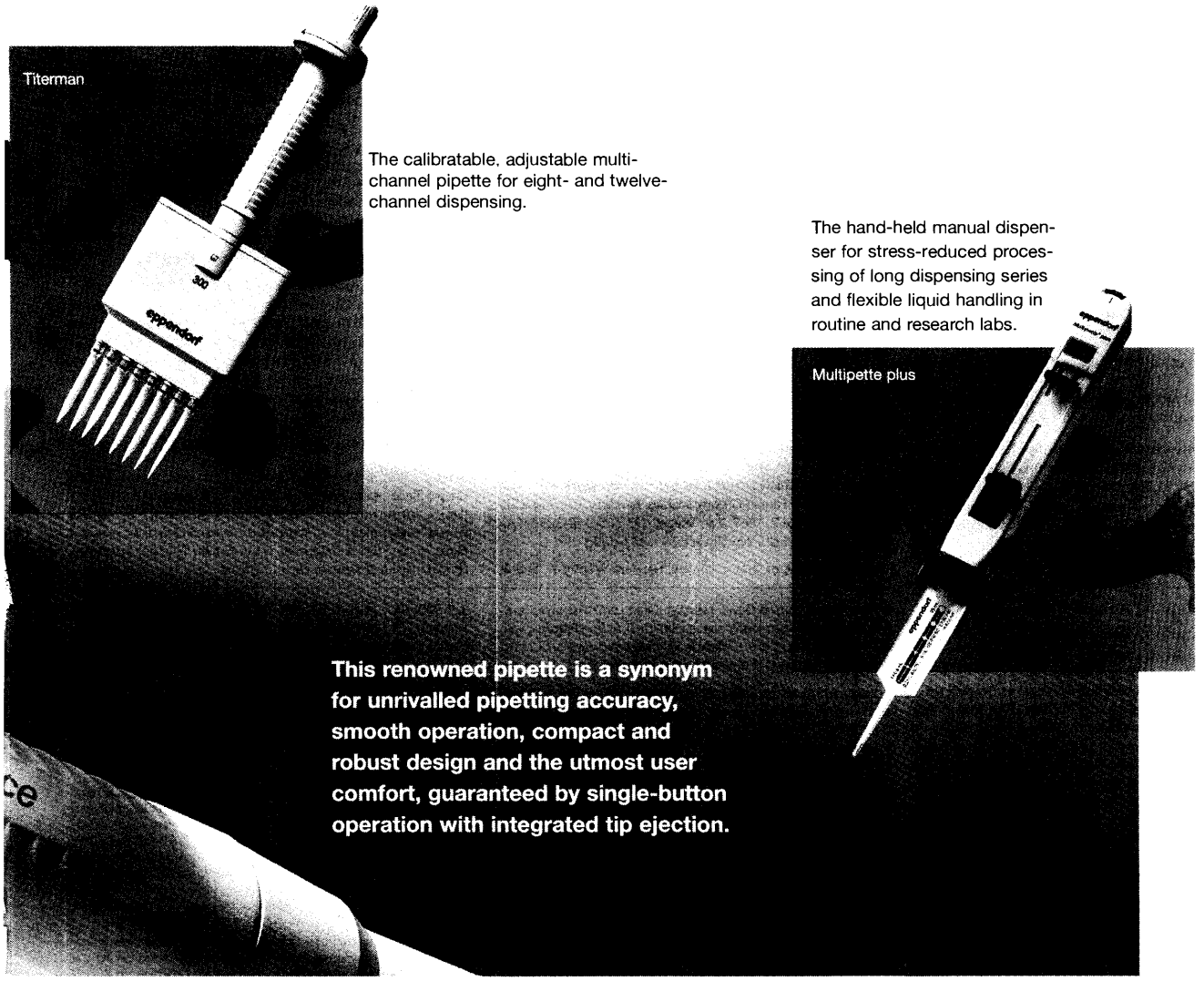

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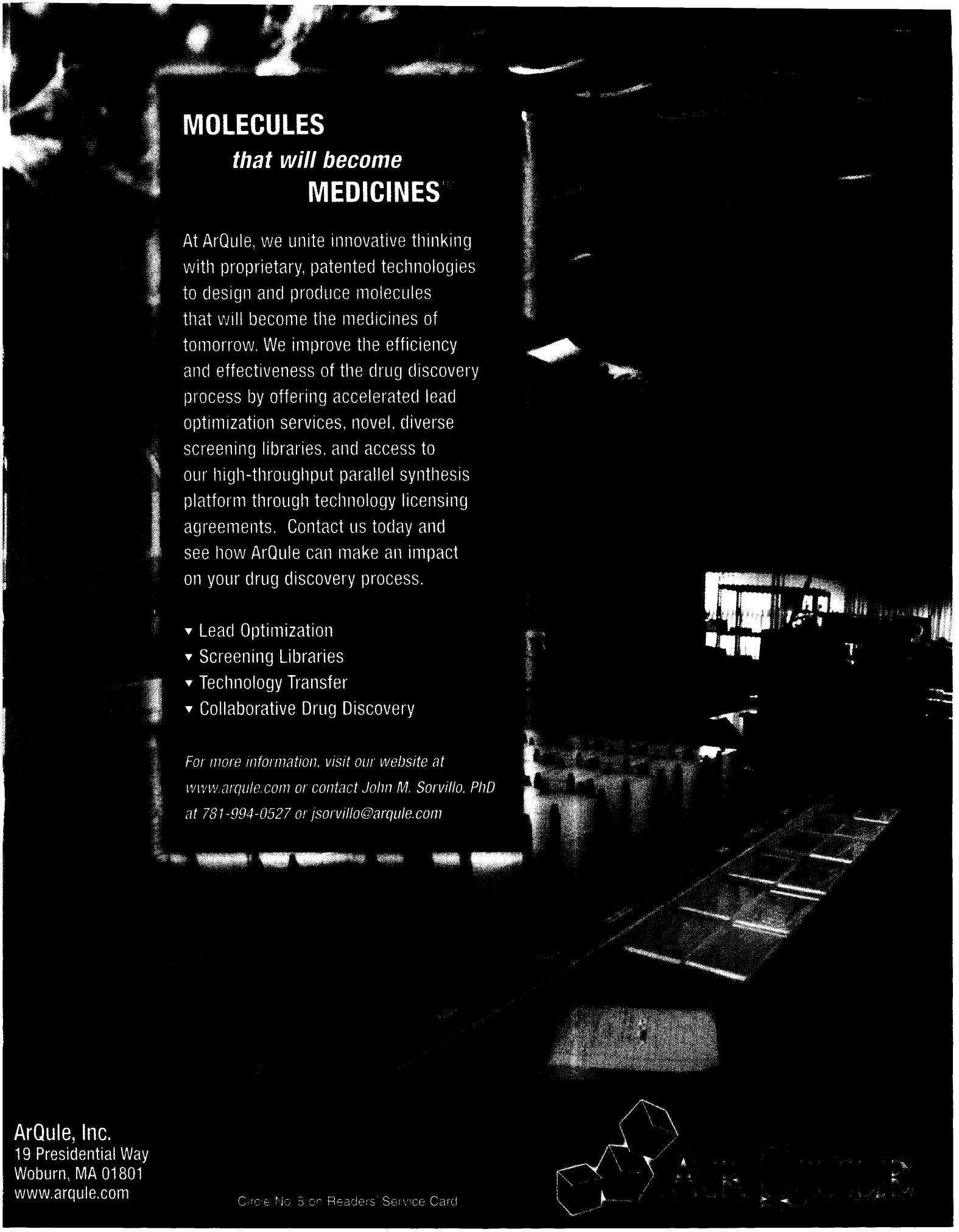

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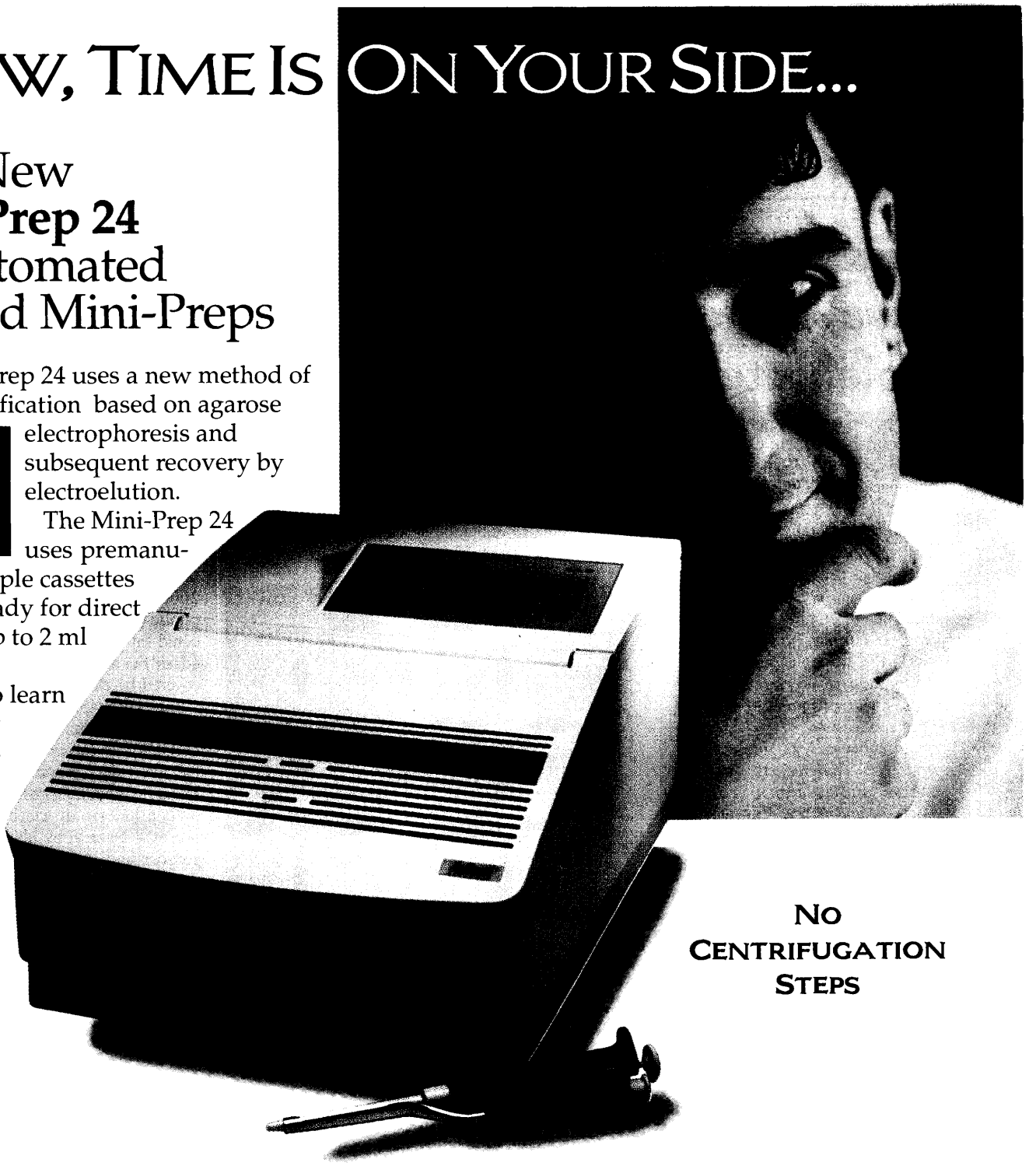

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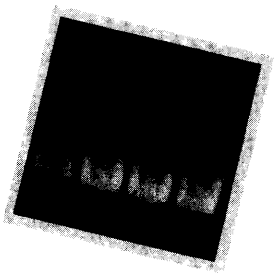

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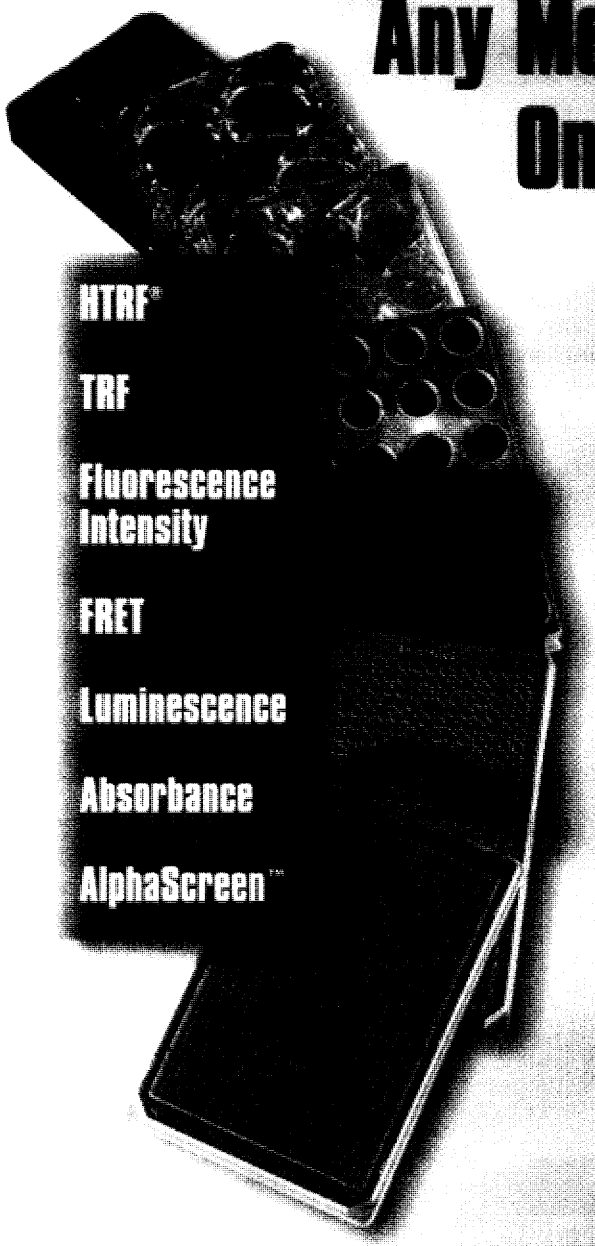

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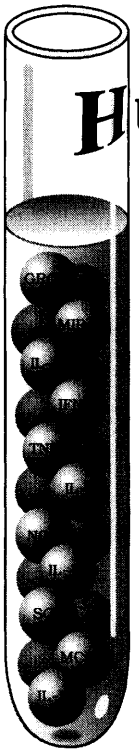

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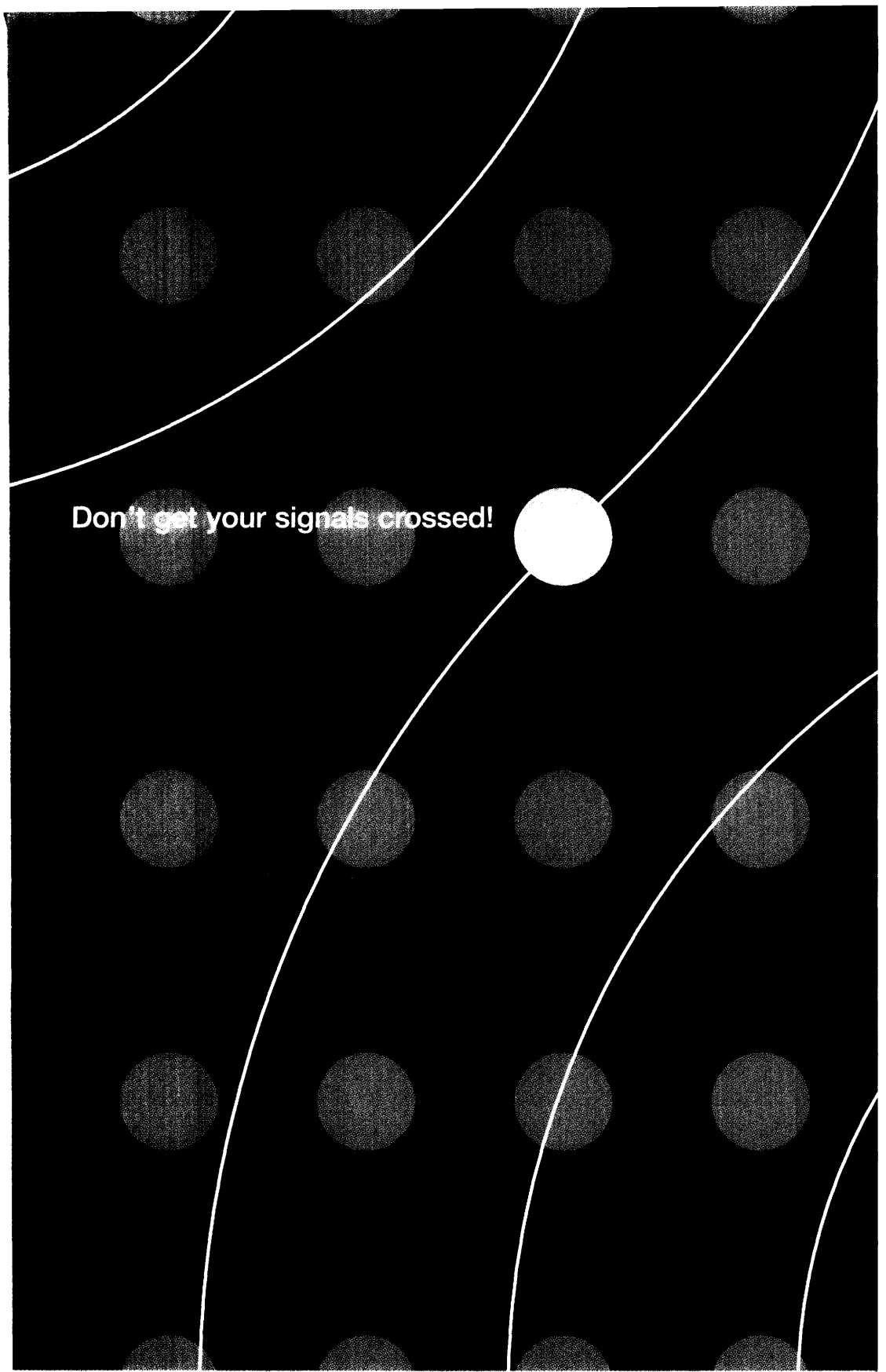

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