

A detailed microscopic image of a starfish cross-section, showing numerous radial arms with green internal structures and pinkish outer layers, arranged in a circular pattern around a central point.

Science

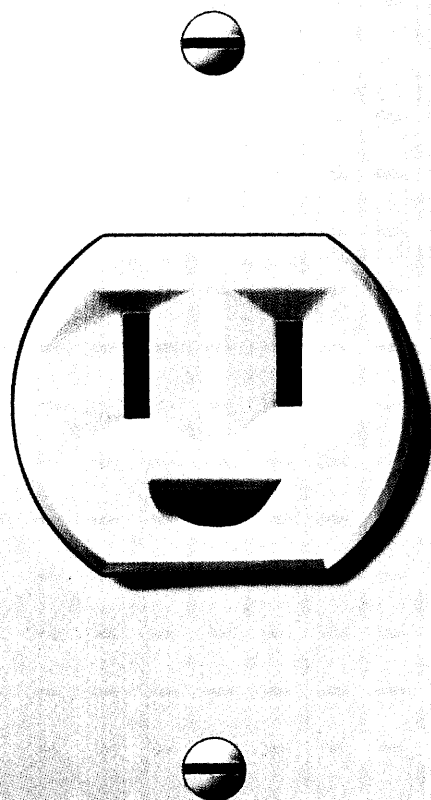
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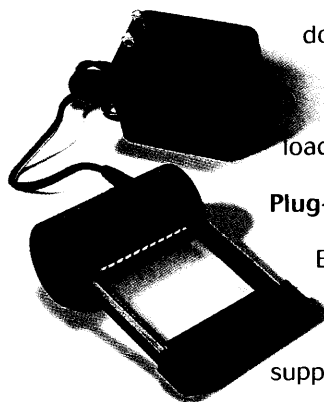
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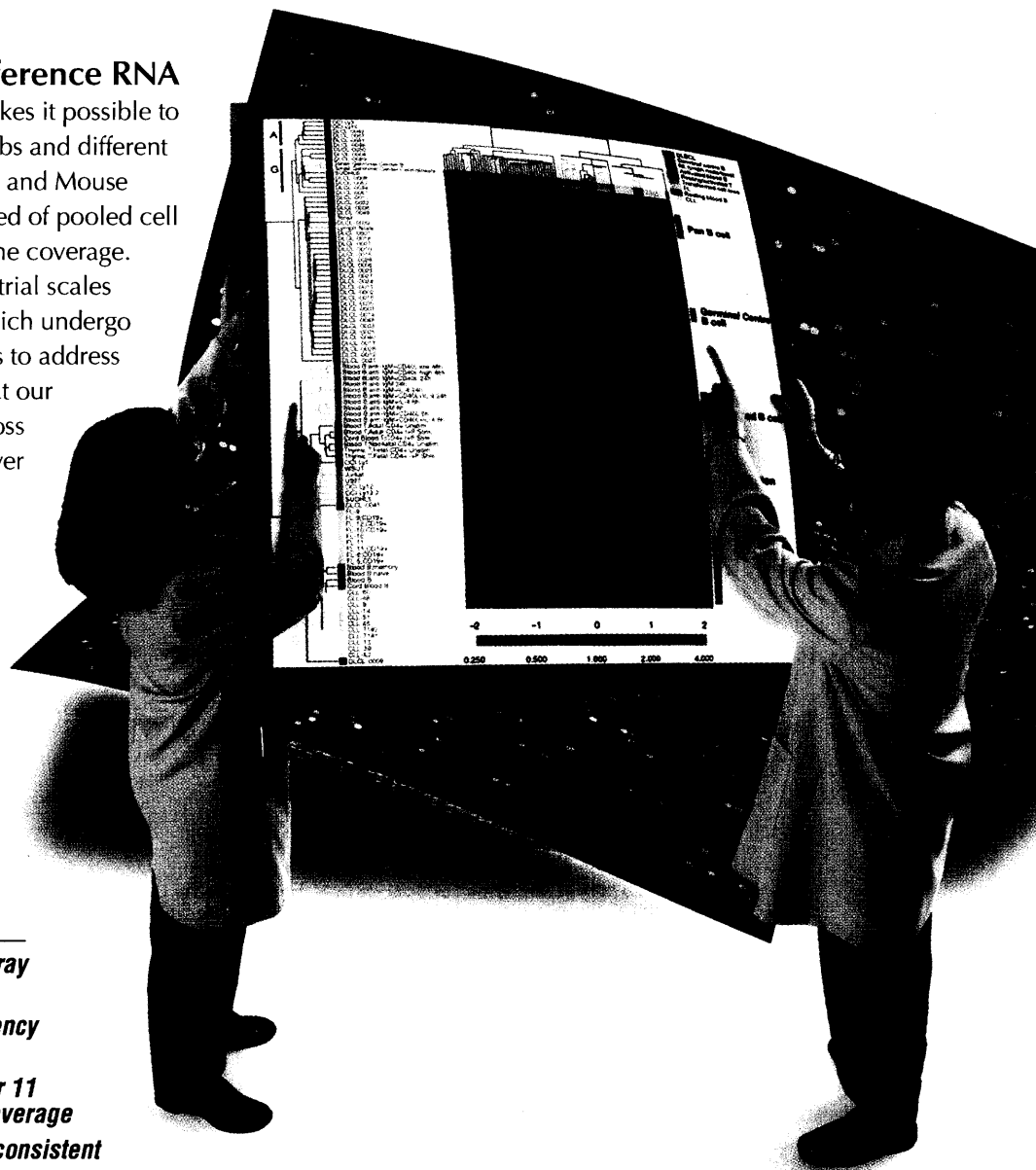
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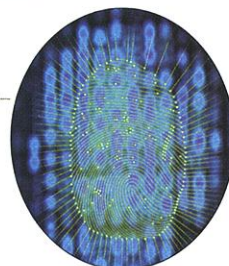


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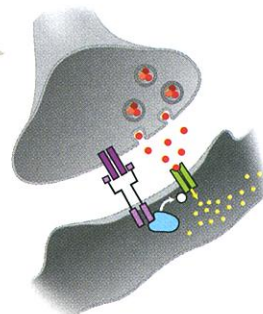
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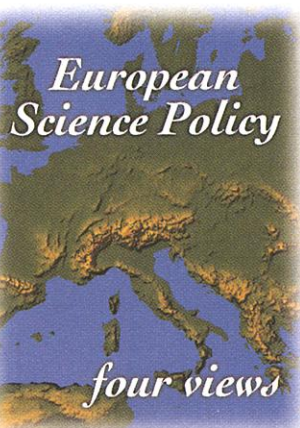
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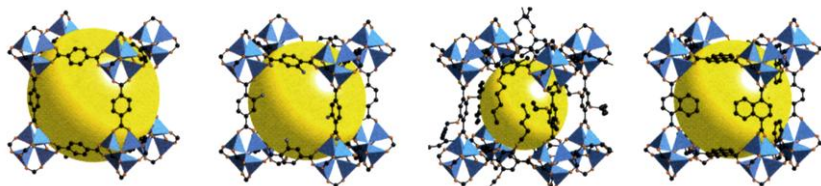
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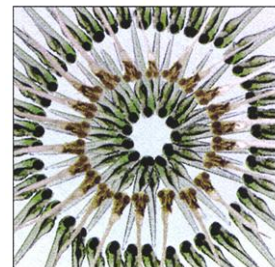
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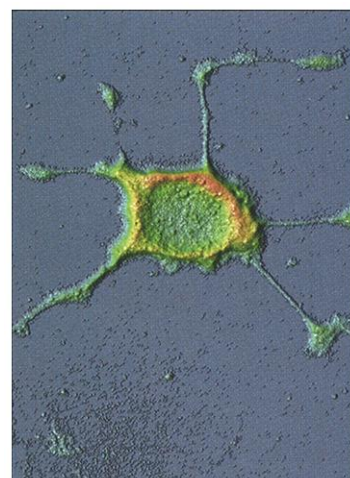
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Live zebrafish (*Danio rerio*) embryos 4 days after fertilization, with those in the middle ring stained for hemoglobin to detect blood cells. Zebrafish studies have advanced our understanding of heart and blood development. [Image: Alan J. Davidson]

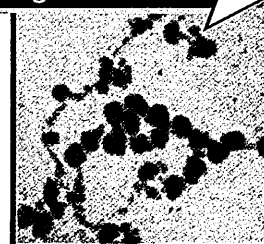


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Neurite mRNA
translocation
under stress

New on Science Express

Degradation products of
natural organic matter

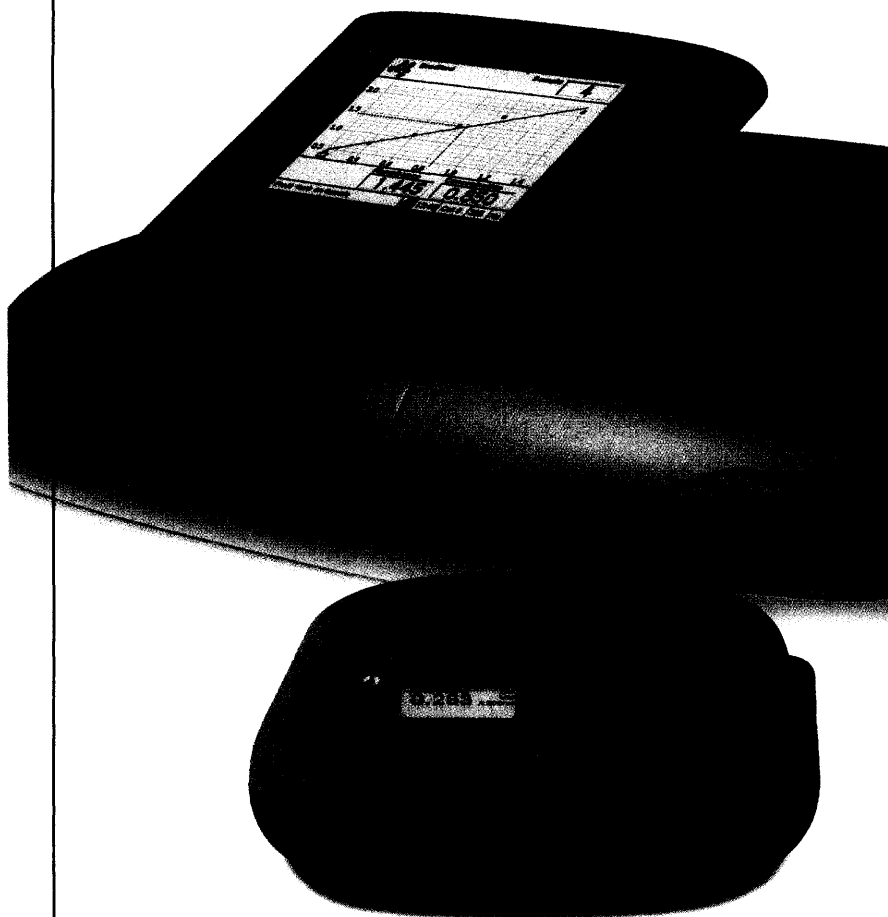


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Formation of Stable Chlorinated Hydrocarbons in Weathering Plant Material S. C. B. Myneni

PERSPECTIVE: The Fate of Chlorine in Soils W. H. Casey

A synchrotron x-ray study of global soil samples reveals that chlorinated organic compounds, thought to be pollutants, can also form naturally.



Retrograde Support of Neuronal Survival Without Retrograde Transport of Nerve Growth Factor B. L. MacInnis and R. B. Campenot

Neuronal survival does not depend upon transport of NGF.

Metabolic Enzymes of Mycobacteria Linked to Antioxidant Defense by a Thioredoxin-Like Protein R. Bryk, C. D. Lima, H. Erdjument-Bromage, P. Tempst, C. Nathan

Mycobacterium tuberculosis co-opts metabolic enzymes to aid in defending against reactive oxygen and nitrogen compounds generated by macrophages.

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career resources for scientists

Canada: Clean Energy—Fuel Cell Research at the NRC Innovation Centre R. Mang

The Innovation Centre in Vancouver is a hub of fuel cell technologies research and development, and a growing area of employment opportunities.

Germany: Juwi-web.de—New Funding Information Portal E. von Ruschkowski

Next Wave takes a look at Juwi-web, a new initiative by German research funding bodies to provide grants information for young scientists.

Singapore: Riding the Wind of Change J. Wong

With rapidly changing economic trends, lengthening recession, and unprecedented unemployment levels, graduates seeking placements this year are in for a rough time.

UK: A Woman of Influence C. Sansom

On her appointment as the first-ever female head of a UK Research Council, Next Wave caught up with Julia Goodfellow to hear about the challenges of her new role—and of balancing work and family life.

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Break Dancing C. Seydel

Werner syndrome protein might keep rowdy enzymes from doing a number on tattered DNA ends.

Growing Old in Style M. Leslie

Ponce de León spoiled a fancy suit of armor searching the swamps of Florida for the fountain of youth. Have some long-lived plants and animals succeeded where he failed?

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Perspective: A New Gun in Town—The U Box Is a Ubiquitin Ligase Domain C. Patterson

Do U boxes confer substrate specificity?

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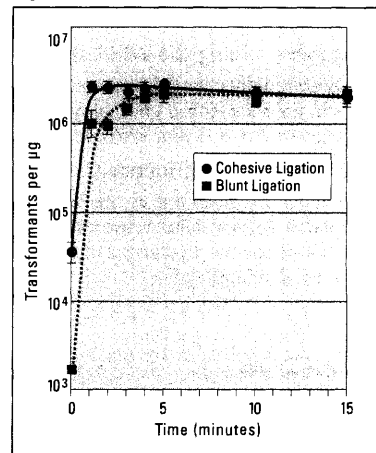
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THIS WEEK IN Science

edited by Phil Szuromi

Science in Europe

First aired 2 years ago by EU Commissioner for Research Philippe Busquin, the concept of a European Research Area to promote cross-border research projects and to help coordinate research across the continent has won acclaim. Now, four voices (see the Policy Forum section, p. 443) discuss its implementation. Banda describes ways in which a European Research Council can serve as a support structure and how the European Science Foundation can be involved. Wigzell believes that the Framework Programme itself needs to be split into a European Research Council and an Innovation Council to promote large projects. In counterpoint, Radda comments that scientific networking across Europe is proceeding well without the need for new administrative structures. Winnacker suggests strategies that will aid "small science" and provide a "bottom-up" approach.

Optimizing Organic Pores

Microporous materials such as zeolites offer a wide range of pore sizes, but even with sophisticated templating approaches, changes in pore size usually involve a change in framework connectivity. Eddaoudi *et al.* (p. 469) now report on a series of metal-organic framework compounds (16 in all) in which the pore size defined by octahedral Zn-O-C clusters and aromatic linking groups is increased systematically with the same topology from about 4 to 29 angstroms. They exploited these features to produce a material that shows an exceptionally high uptake of methane that may prove useful in fuel storage.

Engineering Spider Silk

The silk that spiders produce for their draglines has mechanical properties that rival the best aramid fibers and is much stronger than steel on a weight basis. Two challenges to making silk artificially are generating protein precursors with a high molecular weight and spinning the proteins from solution, preferably from a nontoxic solvent. Lazaris *et al.* (p. 472; see the news story by Service) used mammalian cells to express proteins similar in length to those found in a spider's silk glands. The proteins were then spun from aqueous solution into fibers that were stretched to improve their mechanical properties. The toughness and modulus values of these fibers were similar to those of native dragline silk, although the tenacity was somewhat lower.

483

Mud Energy

We can harvest the remnants of once-living organisms (oil) for energy, but present-day organisms in mud may offer a new source.

Using two-chambered "mud-water batteries," Bond *et al.* (p. 483; see the news story by Pennisi) discovered that several species of *Geobacteraceae*, which normally use insoluble iron (III) oxide as an electron acceptor, preferentially grow on graphite anodes inserted in anoxic mud. The anodes are used directly by the bacteria as electron acceptors, without any other mediator, to generate an electrical current via an external circuit with a cathode in the aerobic surface water. Various species have been found that operate optimally under diverse conditions, for example, a freshwater species that can live in sewage and another that can oxidize aromatic pollutants.

And in Brevia ...

Simian immunodeficiency virus (SIV) has been detected in a wild chimpanzee by Santiago *et al.* (p. 465) using noninvasive methods, which extends the natural range of this virus to East Africa.

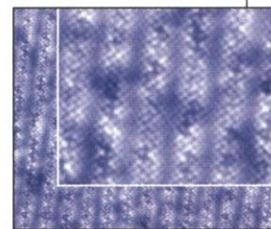
More Ice, Not Less

Over the past several decades, a number of studies have reported evidence suggesting that the rapid collapse of the West Antarctic Ice Sheet, which would raise sea level by 5 to 6 meters, could occur within an interval as short as several centuries or as long as 4000 years. One piece of evidence used to support ice sheet collapse scenarios is the observation of ice discharge from the Ross Ice Streams. Using more and better data of ice movements, Joughin and Tulaczyk (p. 476; see the Perspective by Alley) find that the Ross Ice Streams are now accumulating, not losing, mass. This suggests that the ice sheet may be advancing after having retreated for the past several thousand years and that the chance of rapid

collapse is lower than has been believed.

Order in a Vortex

The penetration of quantized magnetic flux lines, or vortices, into superconducting materials locally destroys the superconductivity. Understanding how this occurs may provide insight into how the superconducting state is formed, which remains a controversial issue for high-temperature superconducting cuprates. Using a scanning tunneling microscope to probe the electronic density of states surrounding a vortex core, Hoffman *et al.* (p. 466; see the Perspective by Sachdev and Zhang) seek out and identify a theoretically proposed feature that indicates that the vortex consists of an antiferromagnet ordered state, confirming recent neutron-scattering results that hinted at such an ordering.



Coordinating Chromosome Segregation

The centrosomes provide organizing centers for the formation of the mitotic spindle and are thus critical for proper chromosome segregation during cell division. Matsumoto and Maller (p. 499; see the Perspective by Arlot-Bonnemains and Prigent) studied the control of centrosome duplication in an *in vitro* system derived from *Xenopus* eggs. They find that increased concentrations of intracellular calcium and consequent activation of the calcium/calmodulin-dependent protein kinase II (CaMKII) are required, which is consistent with oscillations in the concentration of intracellular calcium that occur with each cell cycle.

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INTENSIVE BENCH EXPERIENCE:

This intensive, two-week course emphasizes hands-on molecular biology laboratory work. About ten hours each day will be spent working at the bench and in lecture/discussions. All of the work is hands-on; there are no demonstrations.

EXPERIMENTS WILL INCLUDE:

Construction and screening of genomic and cDNA libraries, PCR, RT-PCR, PCR subcloning, purification of DNA and RNA, restriction enzyme digestion, gel electrophoresis, construction of recombinant DNA molecules, cloning in plasmid and phage vectors, cloning strategies, bacterial transformation, Southern and Northern transfer and hybridization, methods for labeling DNA, DNA sequencing, bioinformatics, etc. All of these techniques are woven into four cohesive research projects carried out by each participant during the two-week session. Lectures and discussion sessions will deal with all of the above topics and the application of these methods in molecular biology research.

INTENDED FOR BEGINNERS IN MOLECULAR BIOLOGY:

No previous experience in molecular biology is required or expected. Fifty participants per session will be selected from a variety of disciplines and academic backgrounds. Last year's participants included principal investigators, directors of programs, postdoctoral fellows, graduate students, and research assistants. Their fields of research included medicine, biochemistry, ecology, immunology, microbiology, pharmacology, plant biology, genetics, physiology, and others. They came from large universities, small colleges, medical schools, hospitals, industry, and private foundations; 75% came from the USA and 25% from overseas. With seven instructors, the student to teacher ratio is 7 to 1.

FEE:

\$3500 per participant includes lab manual, use of all equipment and supplies, and room and board (all rooms are singles). Fee includes the use of the libraries, computers and all campus athletic facilities.

APPLICATIONS MUST BE RECEIVED BY March 10, 2002.

Notification of acceptance status will be mailed by March 13, 2002. Late applications will be accepted for our wait list. Payment in full will be due by April 10, 2002.

Your application should include a brief C.V. and a one page statement explaining your reasons for taking the course. Please specify the session to which you are applying (1, 2, 3) and indicate one of the other sessions as a second choice. Women and minorities are especially encouraged to apply. **For additional information or to apply online, please visit our web site (<http://math.smith.edu/~sawlab/neb.html>) or contact us at (413) 247-3004.**

Coordinating Synaptic Development

Two different mechanisms guide the development of the central nervous system. Molecular signals initially guide developing neurons to the correct position and, once neuronal activity begins, repeated stimulation helps synapses form and mature. Takasu *et al.* (p. 491; see the Perspective by Ghosh) describe a signaling mechanism that may integrate these two processes. Ephrins and their receptors are cell-surface proteins that participate in interactions of developing axons and dendrites that are largely independent of neuronal activity. However, the activation of the EphB subtype of ephrin receptors in rat neurons potentiated signaling by *N*-methyl-D-aspartate (NMDA)-type glutamate receptors, which mediate activity-dependent effects on developing neurons. Activated EphB proteins associated physically with NMDA receptors and caused the activation of the Src tyrosine kinase, which apparently phosphorylates the NMDA receptor and thus modulates activity-dependent control of neuronal gene expression. **X**

Vigorous Immigrants

Fragmented populations have become an important topic in ecology, evolution, and conservation biology. Inbreeding and inbreeding depression have been linked to population survival and to the ability to adapt to local conditions. In an experimental study of water fleas in Finnish lakes, Ebert *et al.* (p. 485; see the Perspective by Ives and Whitlock) test the hypothesis that gene flow plays an important role in maintaining high fitness in subdivided populations where inbreeding is common. They find that hybrid vigor resulting from hybridization between residents and immigrants leads to an increase in the effective rate of gene flow. This is the first test of the phenomenon called "genetic rescue," which has been predicted to occur when local populations suffer from the consequences of genetic bottlenecks.

Keeping Blood Pressure Low

Estrogens are steroid hormones best known for their effects in female reproductive tissues. However, estrogens also have physiologically important roles in both sexes. Zhu *et al.* (p. 505) examined vascular function in mice lacking the β form of the estrogen receptor (ER β); instead of the relaxing effect normally seen, they observed an estrogen-induced constriction of blood vessel walls. In the ER β -knockout animals, estrogen increased expression of nitric oxide synthase, which produces the contractile agent nitric oxide. These animals also developed hypertension as they aged, which may yield new insights into the treatment of hypertension, particularly that associated with menopause.



Emergence of New Properties

Neurons in the visual cortex are highly selective for the orientation of a stimulus, a property that does not yet exist at the level of their input neurons. How does this orientation selectivity arise? Sharon and Grinvald (p. 512) addressed this question by using fast optical imaging of voltage changes in large populations of neurons in the cat visual cortex. They compared the dynamics of the response of selected cortical regions to their preferred versus their nonpreferred orientation. They found that the tuning curve widths stay constant, thus indicating that they are dominated by thalamic inputs, while

the modulation depth shows a characteristic temporal evolution. Two models, feedforward and cortical recurrent information flow, previously introduced to explain orientation selectivity, need to be integrated to explain the emergence of this phenomenon.

Trauma, Stress, and Consequences

Traumatic stress often causes long-term pathological changes. To elucidate the molecular basis of these stress-induced changes, Meshorer *et al.* (p. 508) analyzed the regulation of expression of acetylcholinesterase (AChE) splice variants at cholinergic synapses in the central nervous system. They saw a change from the dominant membrane-bound AChE-S form to the rare soluble AChE-R form. This switch could be triggered by various stresses, occurred very rapidly and could last for many weeks.

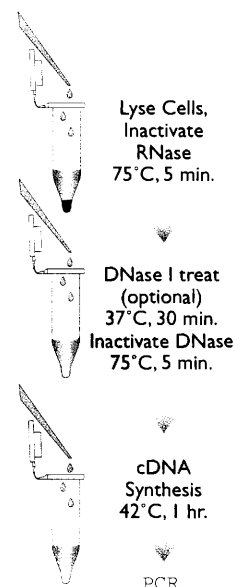
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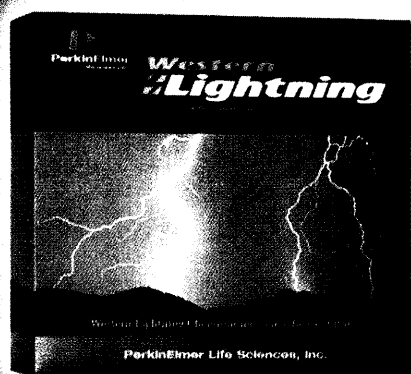
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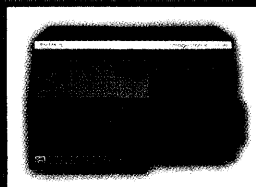
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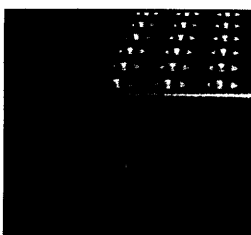
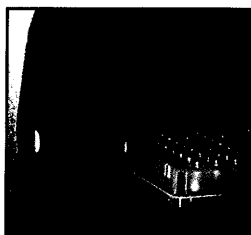
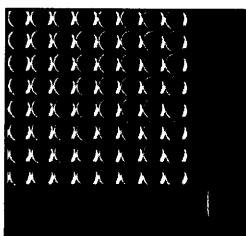
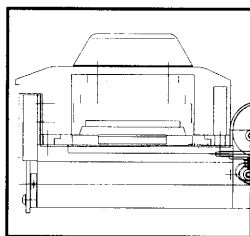
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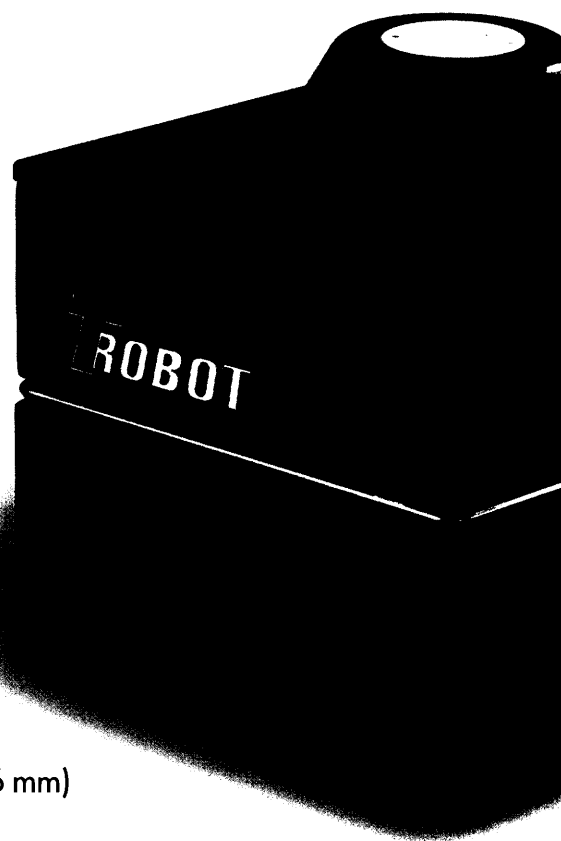
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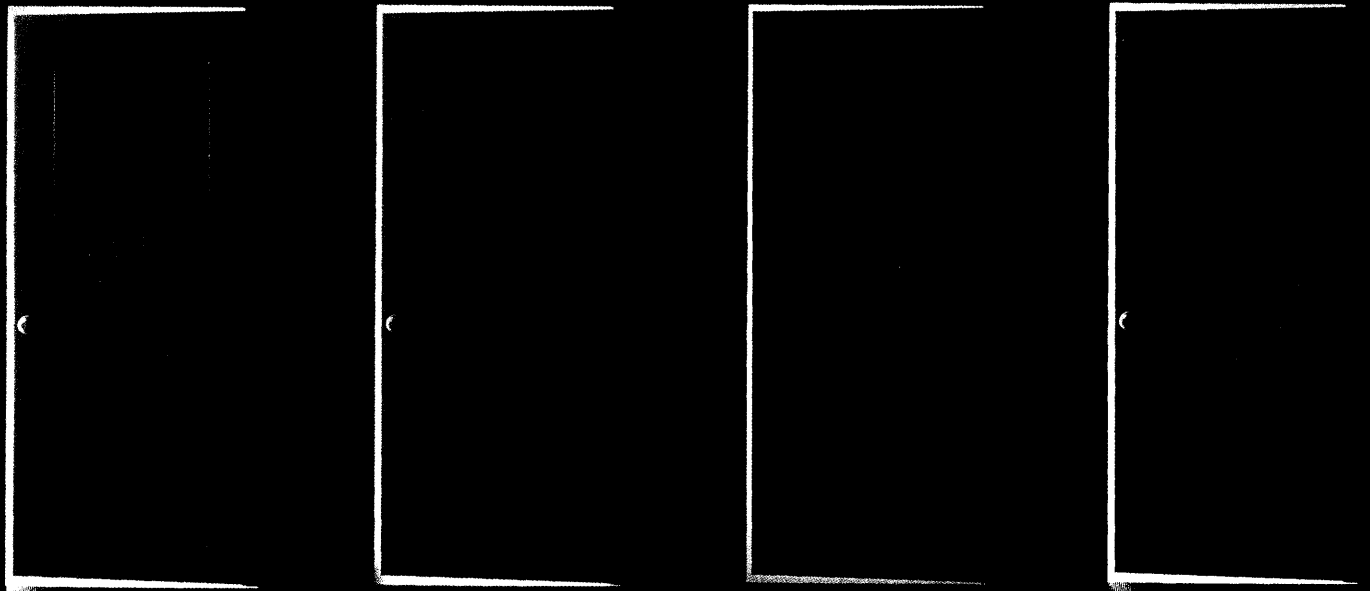
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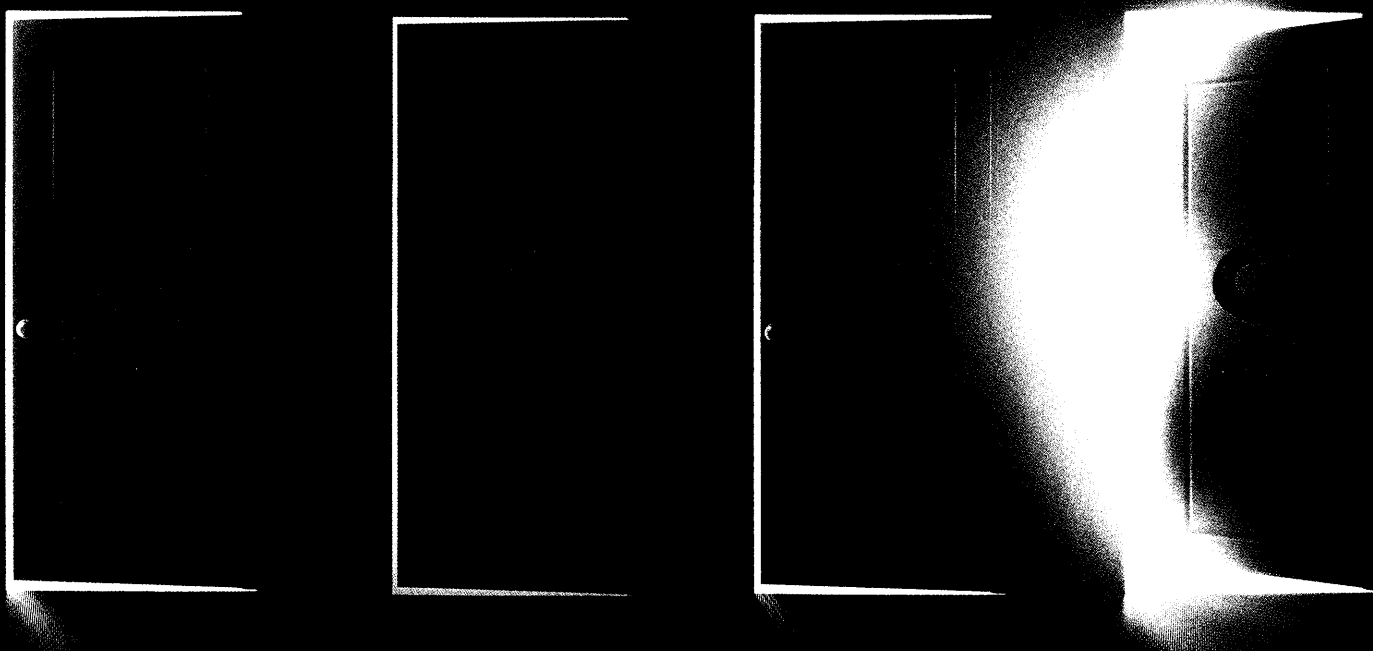
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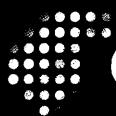
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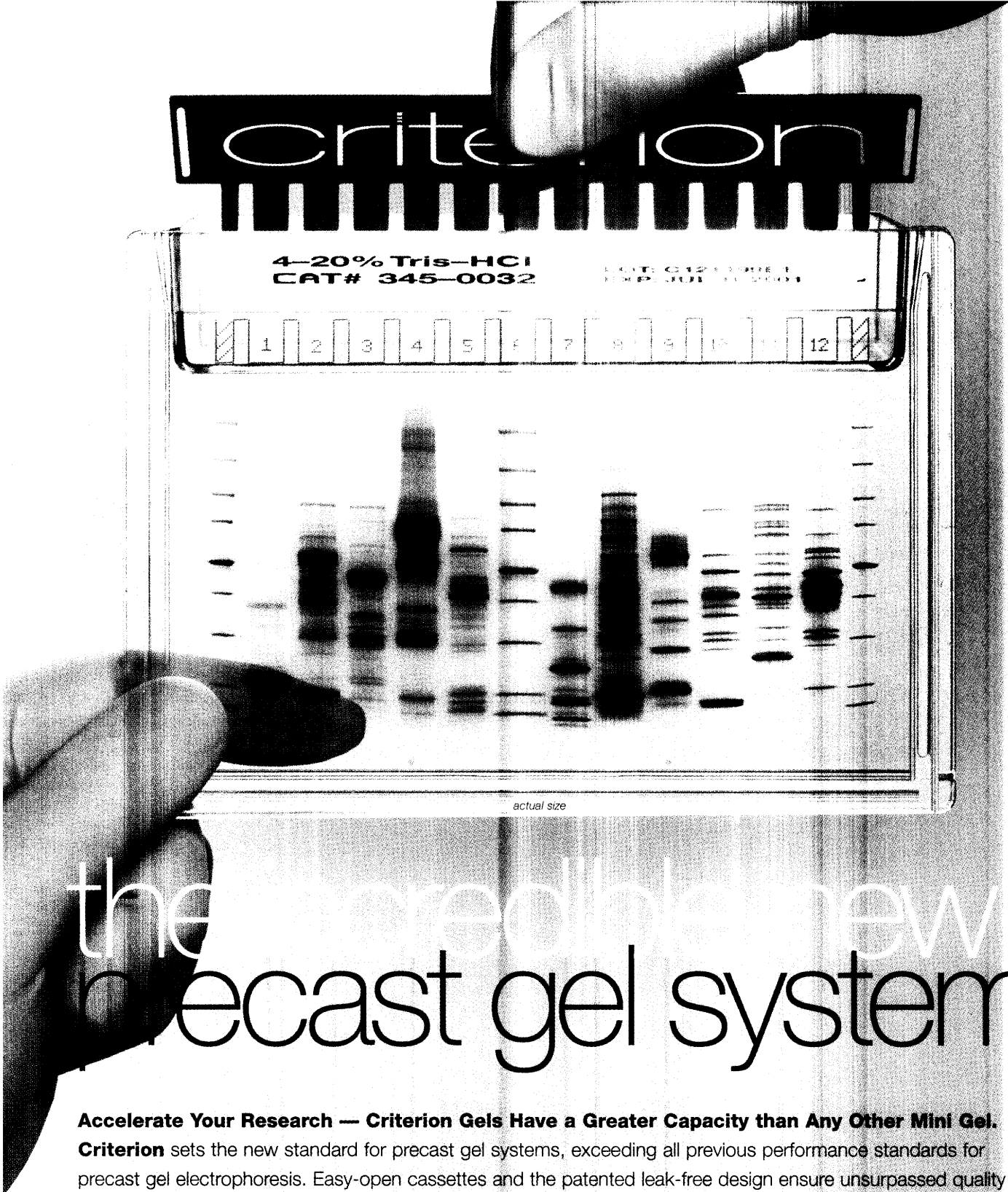
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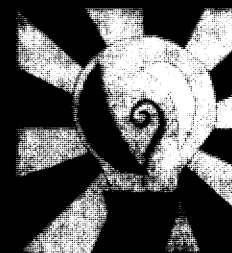
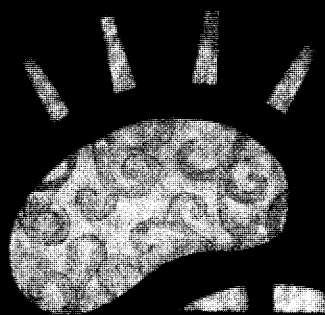
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► **Fred M. Donner**,
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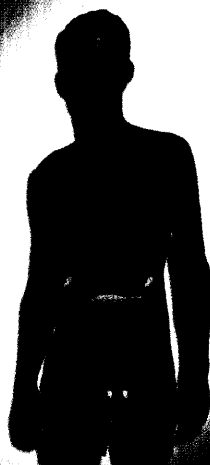
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1. Telencephalon/Diencephalon
2. Mesencephalon (Midbrain)
3. Rhombencephalon (Hindbrain)
4. Spinal cord

Embryo day 15

5. Telencephalon
6. Diencephalon
7. Midbrain
8. Pons
9. Medulla
10. Spinal cord

Embryo day 18

11. Frontal cortex
12. Posterior cortex
13. Entorhinal cortex
14. Olfactory bulb
15. Hippocampus
16. Striatum
17. Thalamus
18. Hypothalamus
19. Midbrain
20. Pons
21. Medulla
22. Spinal cord

HOX 3.1

Postnatal day 7

23. Frontal cortex
24. Posterior cortex
25. Entorhinal cortex
26. Olfactory bulb
27. Hippocampus
28. Striatum
29. Thalamus
30. Hypothalamus
31. Cerebellum
32. Midbrain
33. Pons
34. Medulla
35. Spinal cord

Adult 5 week

36. Frontal cortex
37. Posterior cortex
38. Entorhinal cortex
39. Olfactory bulb
40. Hippocampus
41. Striatum
42. Thalamus
43. Hypothalamus
44. Cerebellum
45. Midbrain
46. Pons
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24 - Tissue Mouse Panel

48 - Stage/Region Mouse Brain Panel

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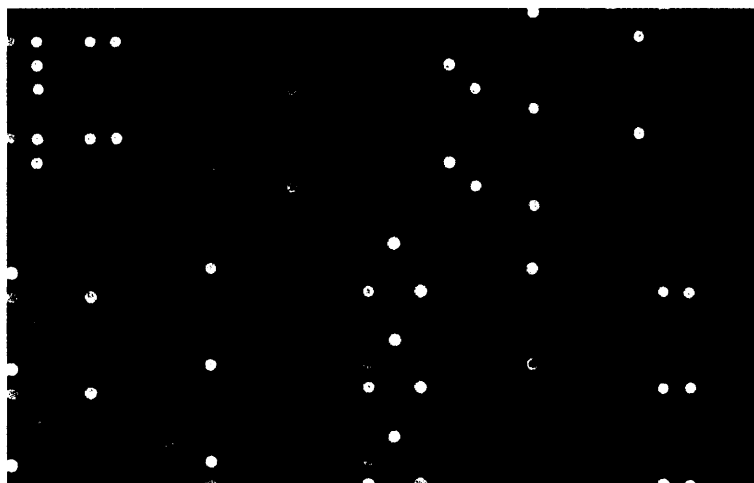
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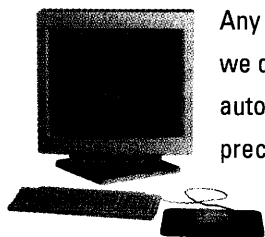
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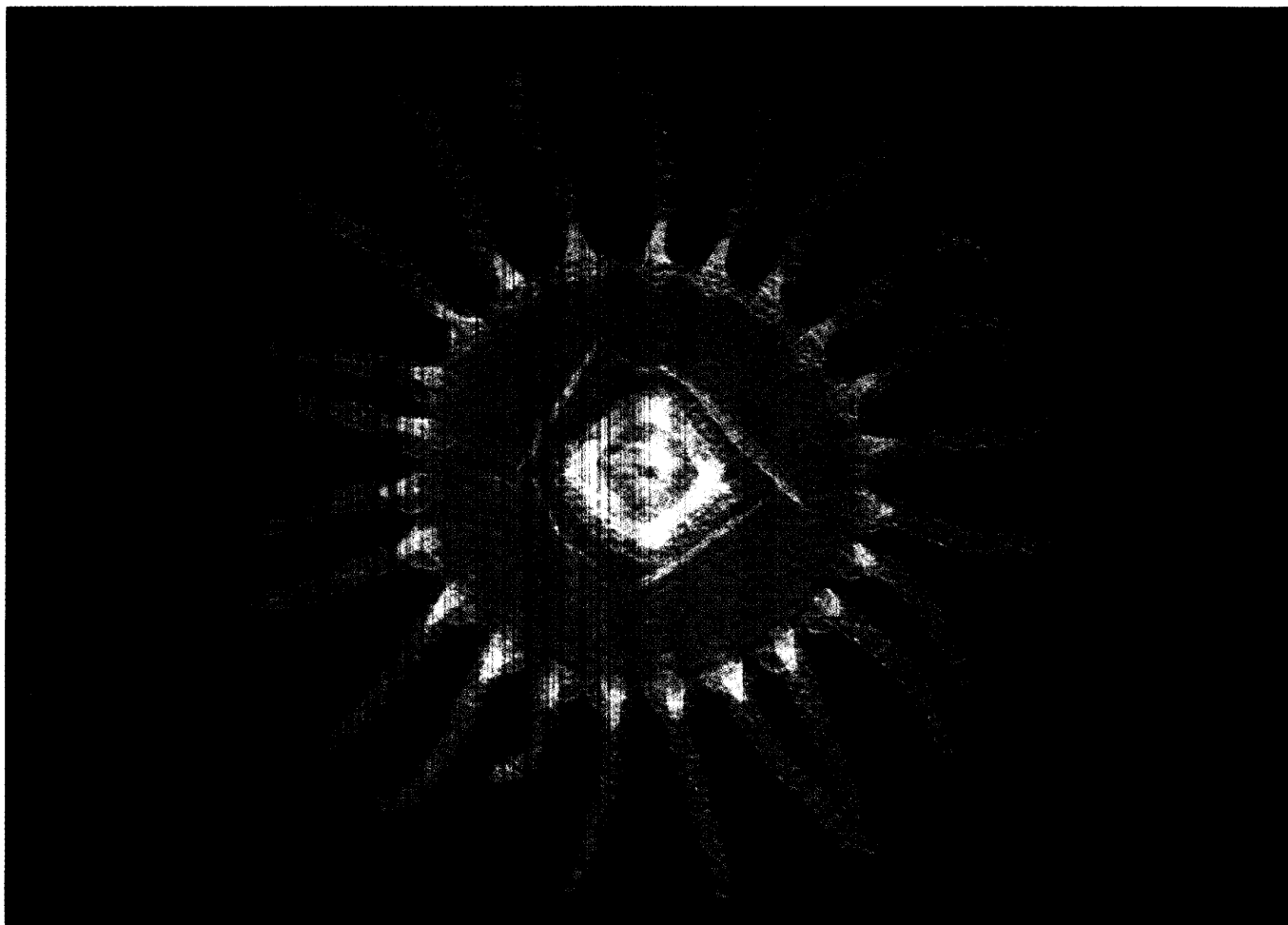
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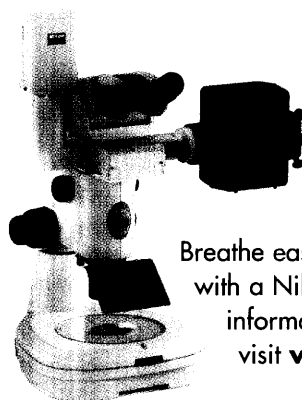
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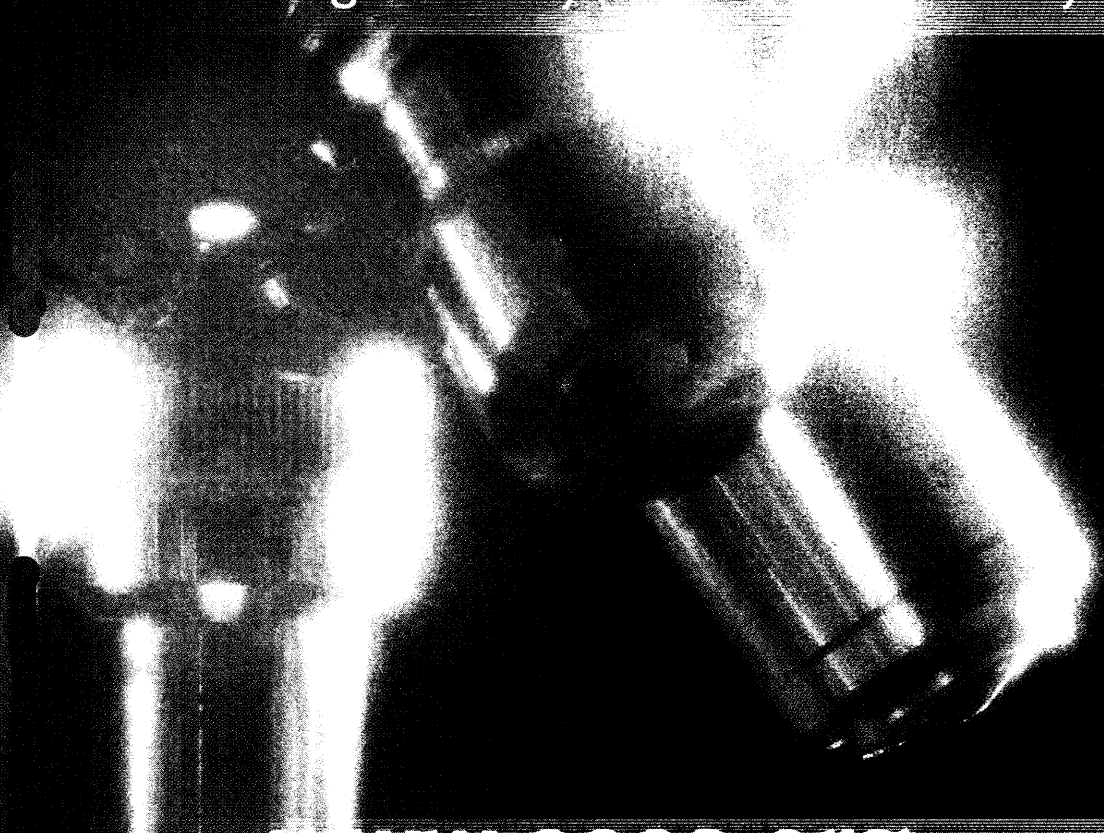
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