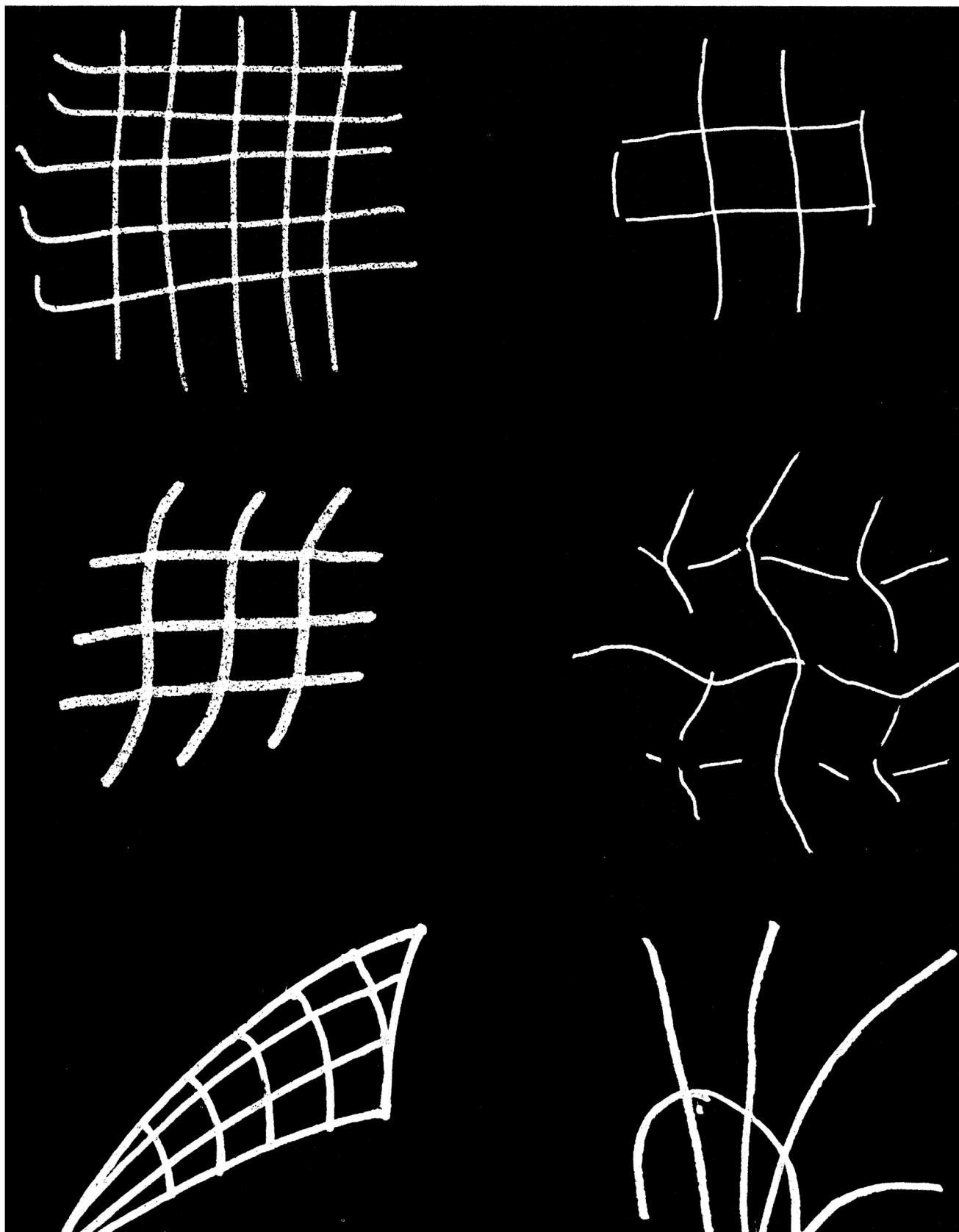


SCIENCE

13 August 1976

Volume 193, No. 4253

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



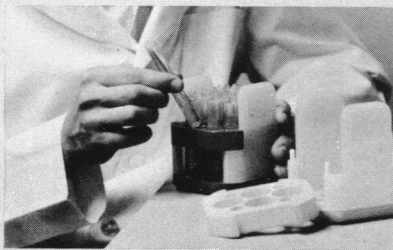
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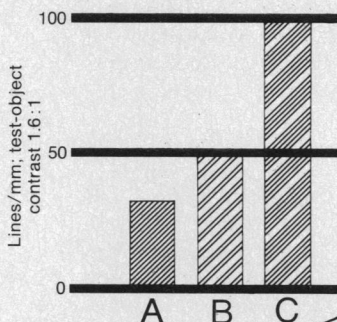
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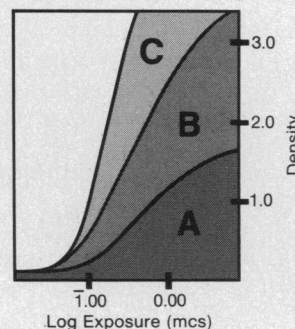
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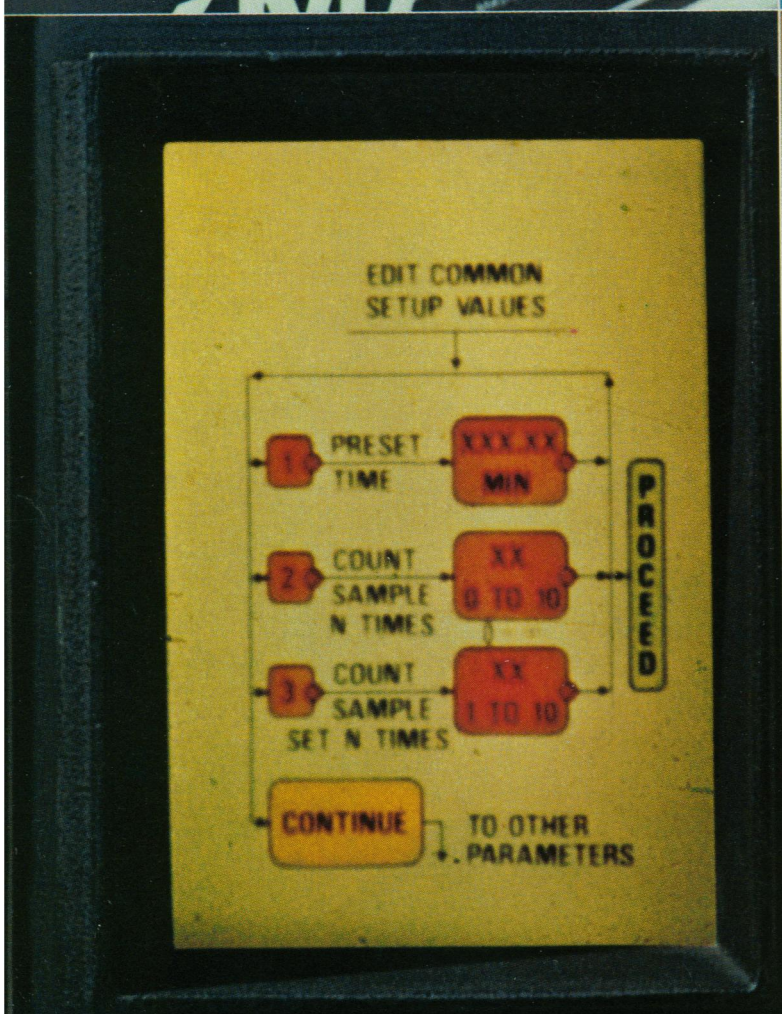
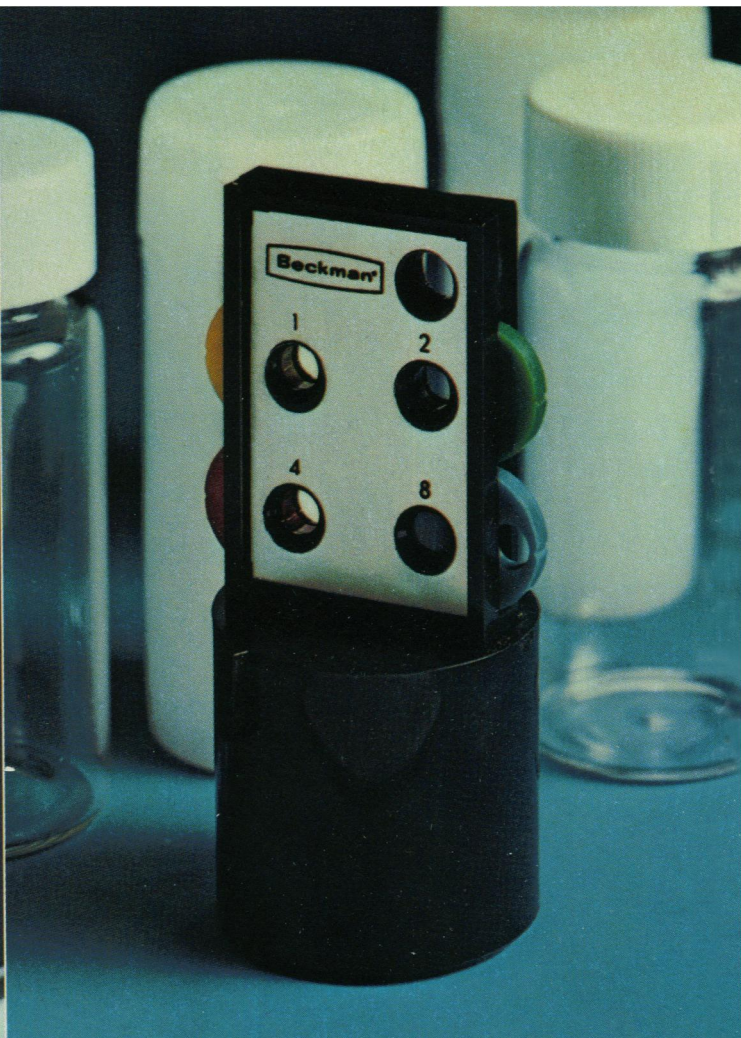
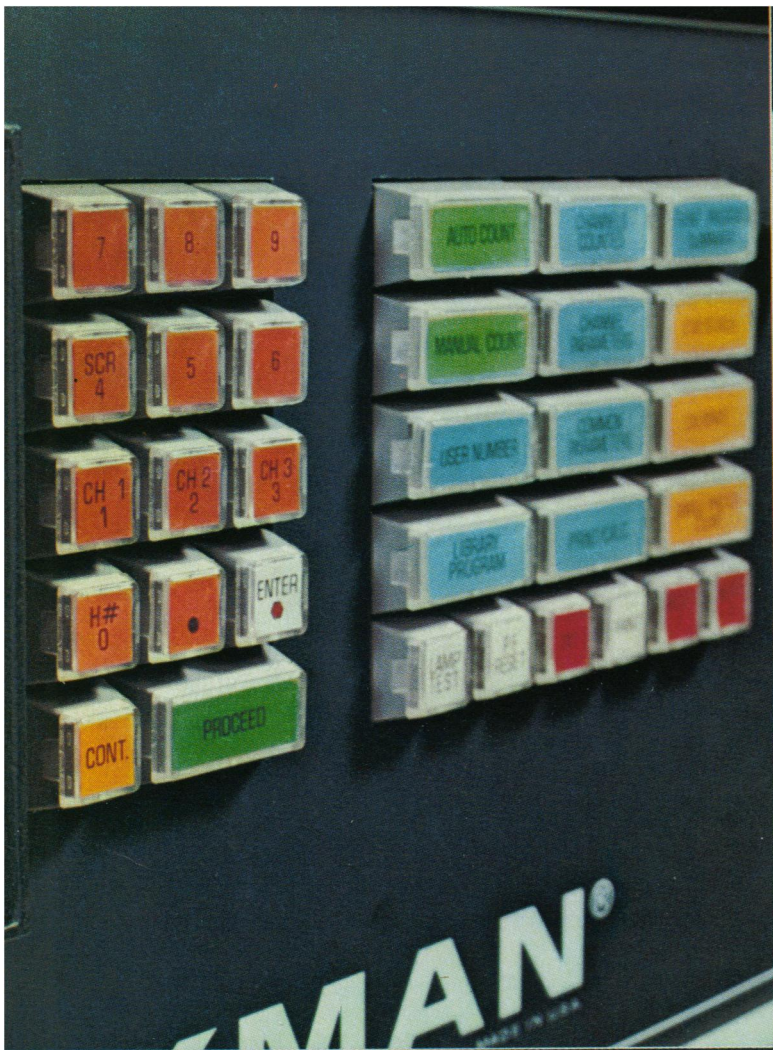
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COVER

Waveform distortion patterns for six subjects with (top row) both 20/13 visual acuity, (middle row) 20/20 and 20/25, and (bottom row) 20/50 and 20/800 (conical cornea) visual acuity. Diagram of top right and that immediately below it are for same eye with and without contact lenses. See page 580. [Bradford Howland and Howard C. Howland, Cornell University, Ithaca, New York]

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LETTERS

Kepone: Hazard to Aquatic Organisms

Rudolph J. Jaeger (Letters, 9 July, p. 94) reports the chronology of mammalian toxicity tests with Kepone (chlordecone) and the exposures of workers at the Life Science Products Company of Hopewell, Virginia. Initial concern has properly been focused on the results of toxicity and carcinogenicity tests on rats, rabbits, dogs, and mice and on the disease that Kepone produced in exposed workers. We would like to document our concern about the hazard of Kepone to aquatic organisms in the James River and the Chesapeake Bay.

On-site tests of organisms taken from the James River showed significantly high Kepone concentrations. These tests, conducted at the Virginia Institute of Marine Science and funded by the Environmental Protection Agency (EPA), revealed that concentrations in edible tissues of most fresh and estuarine fin- and shellfish commonly ranged from 0.1 to more than 1 microgram per gram. These concentrations exceeded allowable health limits for commercial and sport fisheries and forced closure of the river to some commercial and sport fishing. This year Kepone concentrations have increased in anadromous fishes as they spent more time in the river.

Further, after laboratory exposures at the EPA laboratory in Gulf Breeze, Florida, we found that Kepone, like other chlorinated insecticides, is highly bioaccumulative and persists in estuarine organisms. Oysters, grass shrimp, and fishes have bioconcentrated Kepone from 425 to 20,000 times the concentration in the surrounding water. Therefore, action levels for edible seafoods now in force might be reached by as little as 5 parts of Kepone per trillion parts of water (nanograms per liter). In Kepone-free water, oysters can depurate about 90 percent of the accumulated Kepone in 4 days, but fish may require more than 3 weeks to lose 30 to 50 percent. Five weeks after fertilization of sheepshead minnow eggs containing Kepone, the juvenile fish retained as much as 46 percent of the Kepone present in the eggs. Kepone can be accumulated by fish to concentrations that exceed those in their food.

Kepone is acutely toxic to estuarine organisms, but long-term bioassays reveal that the hazard to these organisms is greatly underestimated by the 96-hour tests. The concentrations in micrograms per liter, estimated to be lethal to 50 percent of the test animals in 96 hours

(LC_{50}), were 6.6 for spot, 70 for sheepshead minnows, 10 for an estuarine mysid, 121 for grass shrimp, and more than 210 for blue crabs. Kepone was lethal to adult sheepshead minnows exposed to 0.8 microgram per liter for 28 days. A significant number of embryos from adults exposed to 1.8 micrograms per liter were abnormal and died. When embryos were exposed to 0.08 microgram of Kepone per liter of water, 36 days later, resulting juvenile fish were shorter than control fish and some exhibited scoliosis. Mysid shrimp exposed for 20 days to about 0.2 microgram per liter produced fewer progeny; with greater concentrations, their growth and survival were reduced. We are concerned because all concentrations tested thus far in long-term exposures of sheepshead minnows and mysids have reduced survival, reproduction, or growth.

The threat of an even greater impact of Kepone to aquatic organisms in the James River and expansion of this impact into the Chesapeake Bay, therefore, is real and it may continue for some years to come. It is essential that we use knowledge now available to attempt to make decisions that may minimize the future impact of this insecticide on the aquatic environment.

DAVID J. HANSEN, ALFRED J. WILSON
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*Environmental Protection Agency,
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Structured Water or Pumps?

In her reporting of the ion-water controversy (Research News, 18 June, p. 1220), Gina Bari Kolata is to be commended for her attempt to achieve a balanced presentation of opposing views on a hot argument. All the same, rebuttals to some lines of evidence disputed by the ion "pump" enthusiasts were incorrectly represented, while other telling data, rarely considered, did not surface.

According to the *Science* article, critics claiming that pumps are still feasible despite the thermodynamic conflict, continue to cling to the argument that Minkoff and I have not accounted for the radioactive labeling of the cellular phosphate pool even though we have shown that labeling of this pool occurs instantaneously (1). That the "pool would limit the rate at which the labeled phosphate would be

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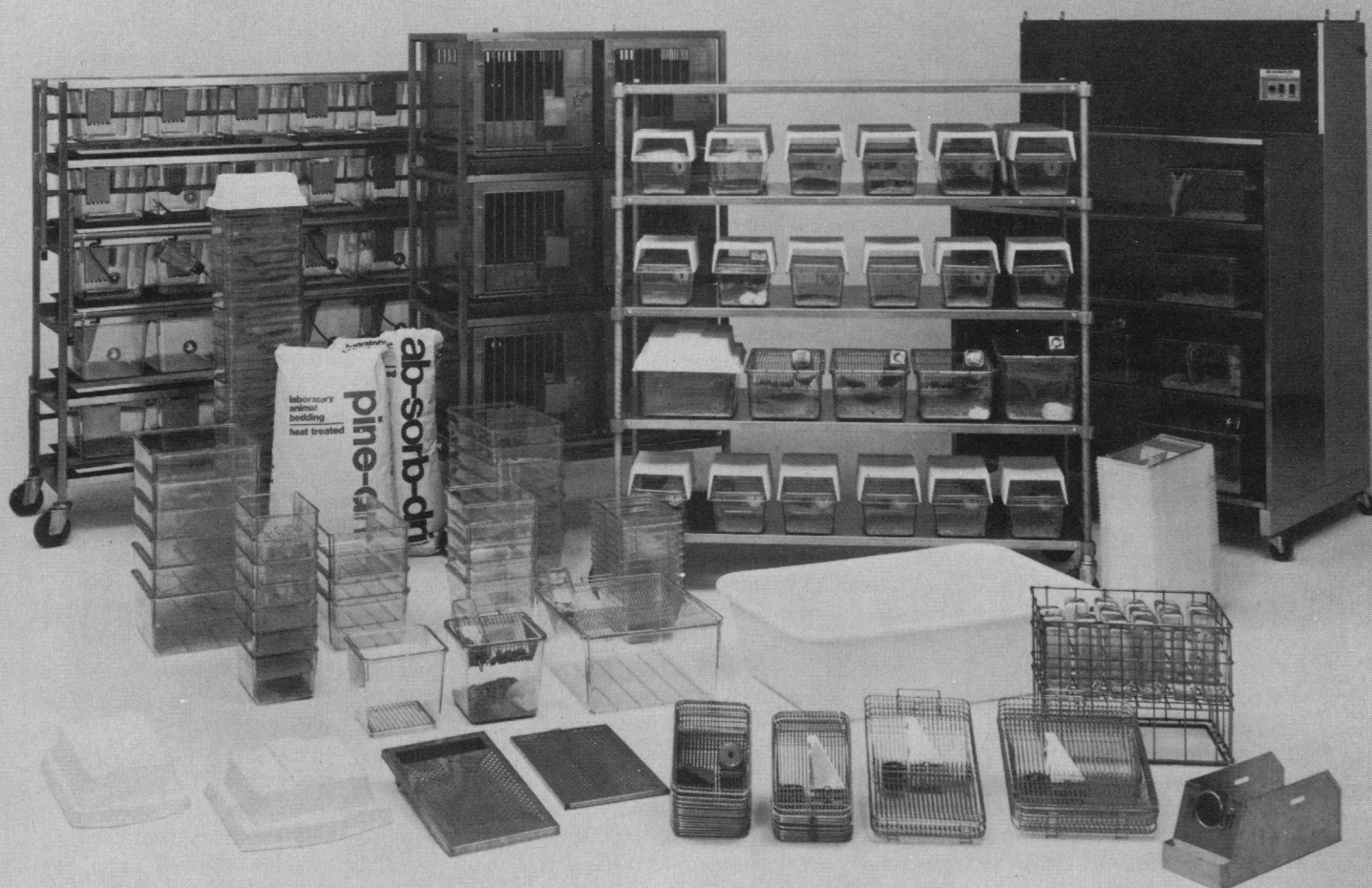
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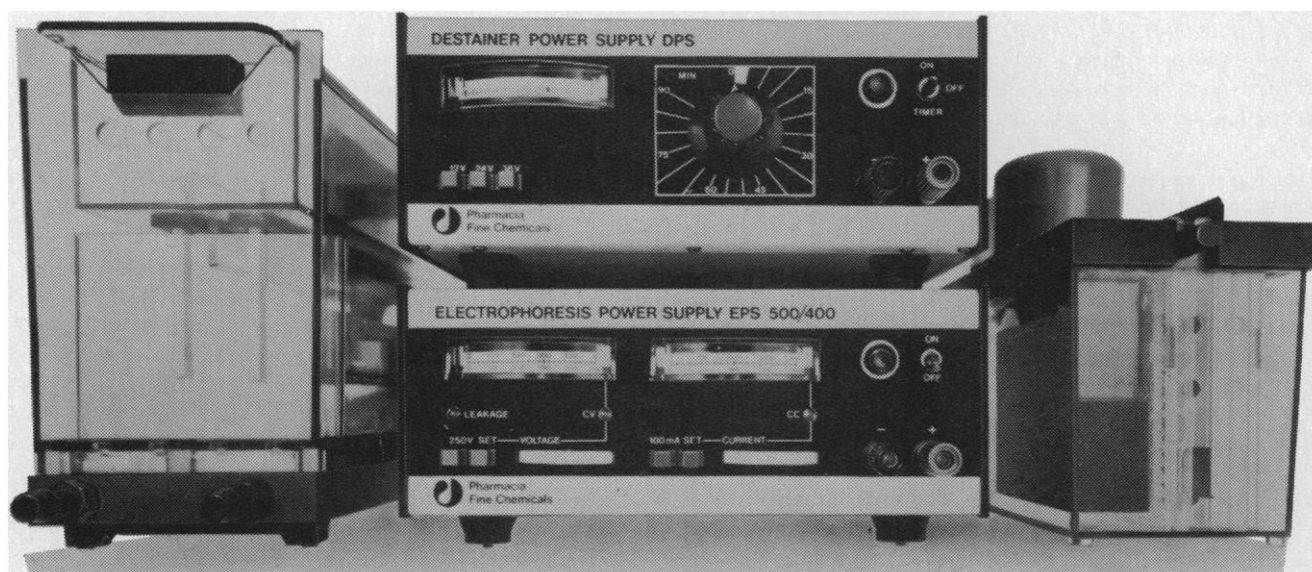


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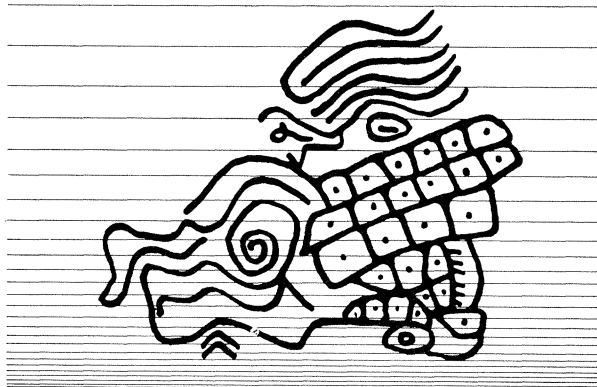
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Politics and Reason

A presidential campaign is a fine spectacle. If it is no more than that, for whatever reasons, it is time to ask why. When the republic was being arranged, the Federalist papers burrowed deeply into regions of political thought and meanings. Nearly two centuries later, the ordained rhythms of politics seem an end in themselves, concerned with a transition of parties and power but not a transition of reason or purpose. It is a troubling curtain raiser on our third century.

The function of elective politics is to choose leadership. This is a choice to be grounded on substance rather than on electronic and acoustic images. The characters and abilities of the potential leaders enter into making the choice, but it is the substance that defines the quality of the choice. What are the terms on which an affluent and technologically powerful nation proposes to conduct its affairs in a troubled world? For that matter, are affluence and power, together with the means to secure and preserve them, to be the continued goals of our public policies and the measure of effective leadership? If *not* affluence and power, then what? In the scramble for votes, who is going to speak of such matters, and who will listen?

It may be said fairly that this is a brimming century of information and knowledge. Science, technology, and humanism have all spread a feast of information before us for the taking. Our comprehension of the human condition and its dilemmas is not yet what it should be, but there is no denying that we know enough to grasp the dimensions of our responsibilities and the consequences of trifling with them. If the turmoil of the past decade has resulted only in giving issue politics a permanent bad name, we are in trouble. At the margins of one's memory there is an echo of Adlai Stevenson's advice to a Princeton senior class: to touch the truth and feel the hem of heaven.

For at least two decades, American science with good reason has argued for something resembling a national science policy framework. Some of the elements of such policy are now written into recent legislation. Even so, it seems more likely that the future directions of science and technology in the United States will be shaped by the working premises, values, and general mind-set of the country. If the accepted proposition were to be, for instance, the unconstrained economic growth is the consensus goal, then science and technology would be called upon to support it. If, instead, the common sense is that compulsive and unqualified growth will lead to new disorders and the exhaustion of both resources and human tolerance, then science and technology would have a very different agenda. How does knowledge get worked into so fundamental a choice as this?

It is a very large and real question. Rufus Miles, in a provocative book,* argues that we are close not only to the limits of growth but to the limits of political solutions. A hundred years ago Thomas Huxley saw what was coming and observed that "Size is not grandeur and territory does not make a nation. The great question is *what are you going to do with all this? What is to be the end of which this will be the means?*"

There is still time for a politics of reason. It has been in fashion to parade the costly failures of knowledge. Too little has been said of its indispensability. To pin the future simplistically to the idea that more is bound to be better, without recycling Huxley's questions, is to ignore the profound dilemmas in the relationship between power and responsibility. Nor is it enough to be content with assurances of the future health and exuberance of science and technology, apart from addressing their uses. This is what "science and public policy" ought to mean to us: a reach for higher ground in the partnership of knowledge with governance.—WILLIAM D. CAREY

*R. E. Miles, Jr., *Awakening from the American Dream* (Universe Books, New York, 1976).

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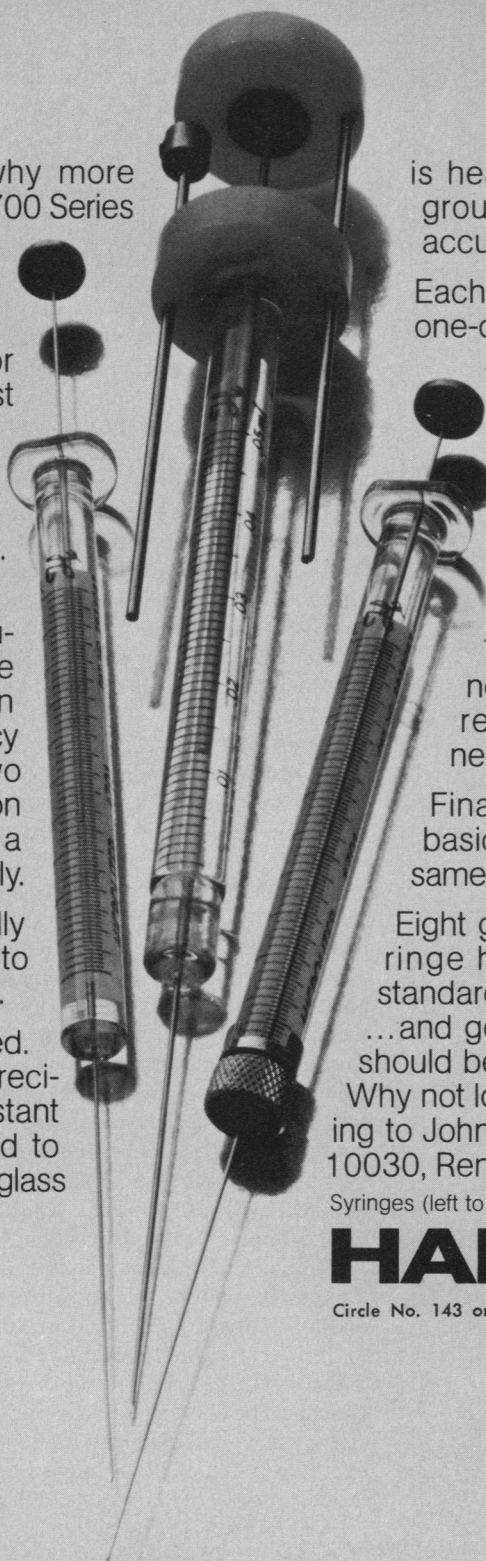
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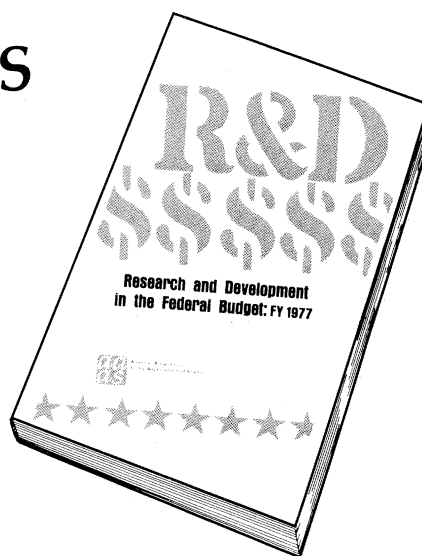
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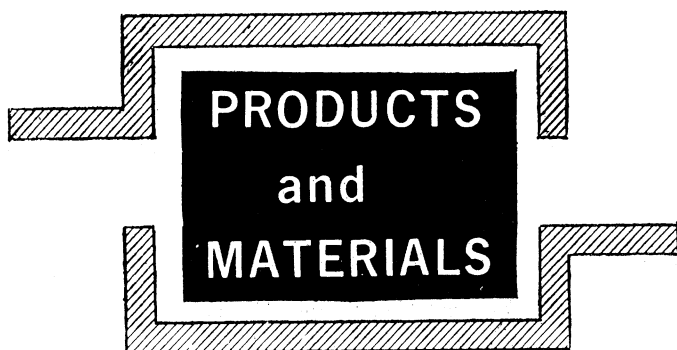
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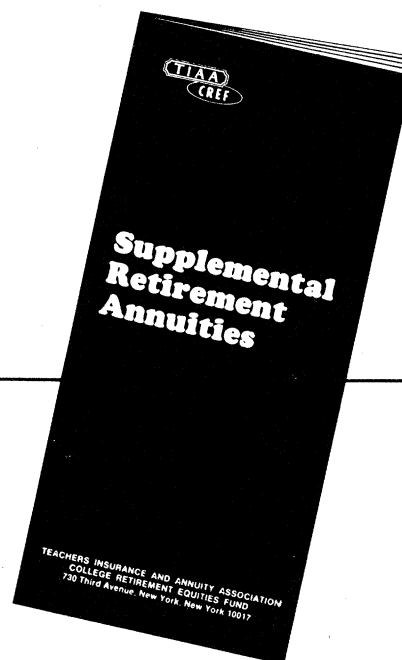
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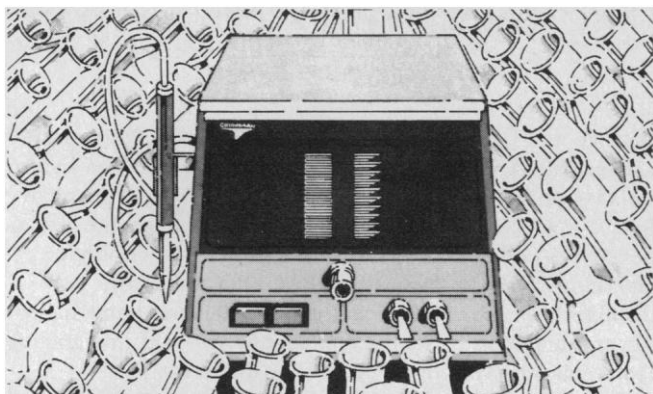
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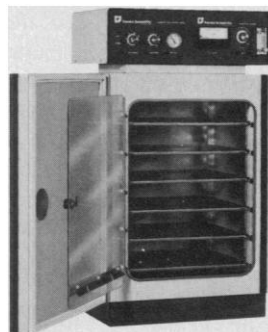
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LETTERS

(Continued from page 532)

exist and are always passive (that is, down the electrochemical gradient). If there is no electrochemical driving force, there is no net Na or K flux.

The most direct evidence (2) comes from experiments on giant axons of the squid (up to 1 mm in diameter). These axons can be cannulated, and about 95 percent of the cell plasm replaced by solutions of known composition. Normal action potentials are generated when the internal solution has a composition similar to that of the axoplasm. The fluxes of Na and K ions vary with the composition of the internal and external solutions and with transmembrane voltage (voltage difference between inside and outside solutions) in the direction predicted from the electrochemical gradients for these ions. A perfused axon can generate 300,000 action potentials. It is difficult to attribute these results to the residual cell plasm, and one is forced to a membrane theory of action potentials powered by Na and K gradients across the membrane. This and much other evidence firmly establish that excitable cells have Na and K ion activities which are respectively lower and higher than these activities in the solution bathing the cells, that is, Na and K ions are *not* in thermodynamic equilibrium across the cell surface. The energy for generating action potentials comes from the concentration differences of Na and K ions and these differences are maintained throughout life. Thus the necessity for (but not the existence of) ion pumps in excitable cells is established.

Those who contend that the properties of structured water are the complete or major explanation of Na and K ion distributions between cells and bathing media must not only "prove" that ion pumps are energetically impossible in normal excitable cells but must also provide an alternative equilibrium explanation of how excitable cells can produce net flows of Na and of K across their surfaces in the absence of electrochemical gradients of these ions. The latter is difficult, since the second law of thermodynamics apparently has to be violated.

J. WALTER WOODBURY
*Department of Physiology,
University of Utah Medical Center,
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References

1. A. L. Hodgkin and A. F. Huxley, *J. Physiol. (London)* **117**, 500 (1952); *Proc. R. Soc. London Ser. B* **18**, 1 (1958); *Science* **145**, 1148 (1964); A. F. Huxley, *ibid.*, p. 1154.
2. P. F. Baker, A. L. Hodgkin, T. I. Shaw, *Nature (London)* **190**, 885 (1961); *J. Physiol. (London)* **164**, 330 (1962); *ibid.*, p. 355; W. K. Chandler and H. Meves, *ibid.* **180**, 788 (1965).

RESEARCH NEWS

(Continued from page 566)

contact the neuroblasts temporarily wrap themselves around the fiber before undergoing differentiation and the migratory movements needed for the development of the mature *Daphnia* optic system. Levinthal thinks that the contact between the lead fiber and the neuroblasts is somehow involved in signaling the neuroblast to differentiate.

He says that these observations would not have been possible without three-dimensional reconstructions of the developing neurons at different stages of development. For example, the investigators would not have been able to distinguish in electron micrographs the stage in which the neuroblast wraps around the nerve fiber from ordinary nerve fibers with myelin sheaths. These sheaths are also composed of cells wrapped around nerve fibers.

Sydney Brenner and his colleagues at the MRC Laboratory of Molecular Biology in Cambridge, England, are now using computers to study the anatomy of the nervous system of a simple roundworm. The investigators have produced genetic mutants of the worms that have unusual behavioral patterns. They hope to determine how the neuronal anatomy of the mutants differs from that of normal animals and to unravel how genes control neuronal structure and function.

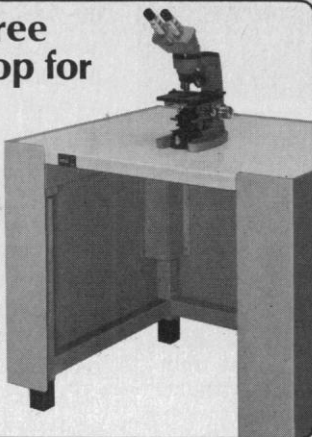
The techniques of computer reconstruction of neuronal structure are not limited to cells from simple invertebrate animals, however. Several investigators are using them to study the nervous systems of a wide variety of vertebrates including the frog, cat, rat, and even the human. One goal is to determine how environment affects the development of cells in various areas of the brain. For example, the visual responses of cats raised in a striped environment differ from those of normal cats. How these behavioral changes are related to neuronal structure is a major question that computer techniques may help answer.

Once a body of information about the structure of nerve cells and their interconnections has been acquired, whether from computer or other studies, it can be fed into an appropriately programmed computer in order to build models of whole areas of the brain. Llinas and A. Pellionisz of Semmelweis University Medical School in Budapest, Hungary, are using this approach to study the function of the frog cerebellum.

A great deal is known about the structure and activities of the different types of neurons that make up this portion of

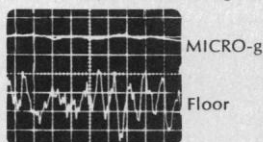
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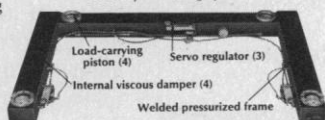
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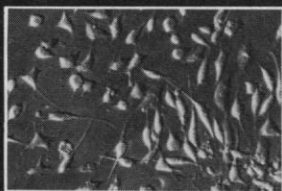
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Photomicrograph of an L 292 Fibroblast taken with the Hoffman Modulation Contrast System; Achromat 10X Objective. Photomicrograph Courtesy: Dr. M. Padnos

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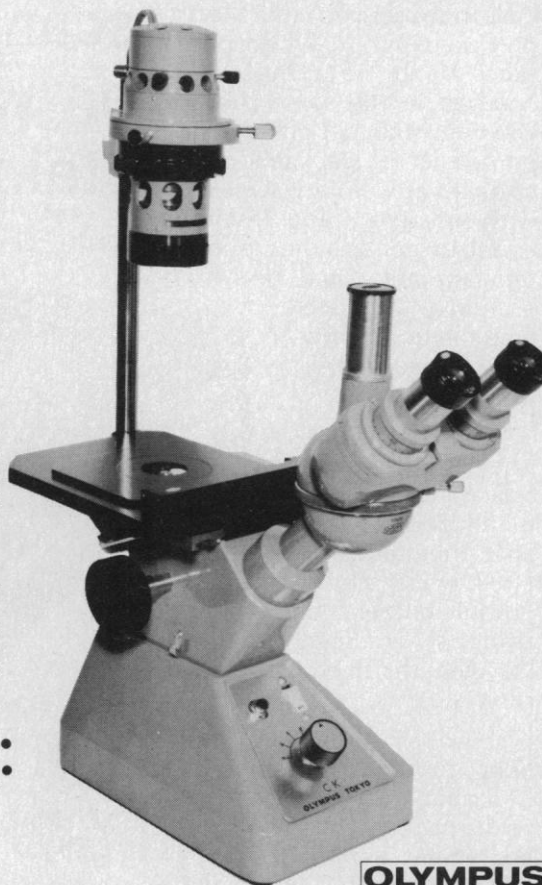
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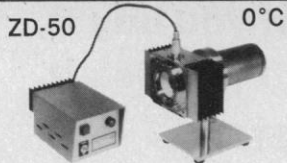
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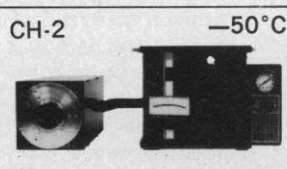


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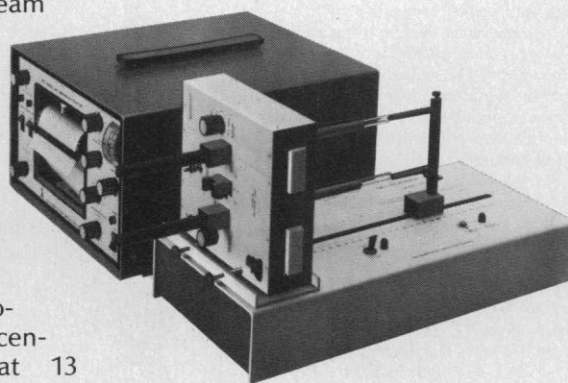
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the frog brain, but much less is known about how their interactions affect the properties of the whole cerebellum. With a reconstruction of the anatomy and interconnections of the cerebellar neurons stored in the computer memory, it is possible to simulate the stimulation of a particular group of neurons and determine the response pattern of the neurons with which they connect. The results of the computer experiments can then be compared with the results of physiological experiments to determine how accurate the model is. The model can also serve as a guide for designing the physiological experiments.

In addition to helping neurobiologists gather quantitative information about the three-dimensional structure of nerve cells, computers are assisting in the tracing of nerve fibers and their connections in the brain and spinal cord. One way to trace fibers involves injecting radioactively labeled amino acids into the vicinity of the nerve cell bodies. After being taken up by the cell bodies, the amino acids are incorporated into proteins which are transported along the axons.

Location and quantitation of the label in serial slices of brain and spinal cord can be done by autoradiography. The sliced tissue is placed on slides and coated with a photographic emulsion. Wherever there is radioactivity, the emulsion is exposed and silver grains are formed. Locating and counting the grains on a slide is extremely tedious when done visually, but now David Whitlock of the University of Colorado Medical Center and Cowan and Wann have developed completely automatic computer systems for counting them. This process can be completely automatic because recognizing silver grains is a much simpler task than recognizing the more complex structure of neurons.

Both groups of investigators use television cameras to convert the gray tones of the autoradiographic image into a signal in which the grains appear totally black on a white background or conversely. The computer then counts and records the number of grains along with the spatial coordinates of the grain locations. Scanning the fields and focusing are completely automatic, although the operator can monitor the process. Whitlock says, however, that the system is accurate enough that counting can be done overnight without monitoring. This is important because scanning large fields may require several hours. The systems are adaptable to any kind of autoradiograph, not just those from nerve tissue.

—JEAN L. MARX

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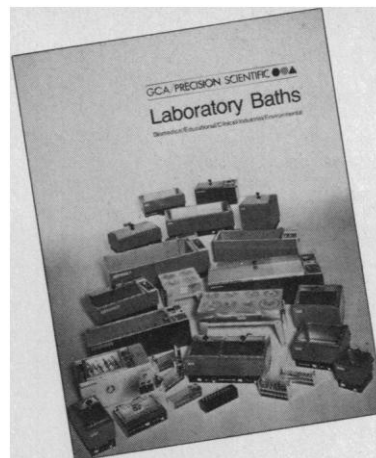
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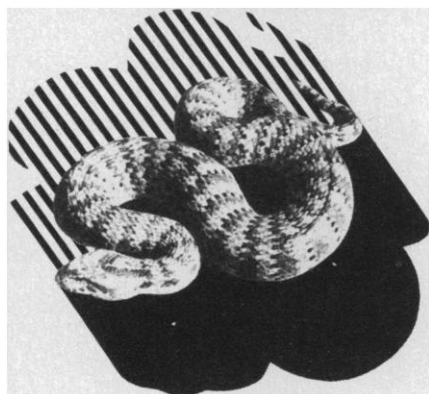


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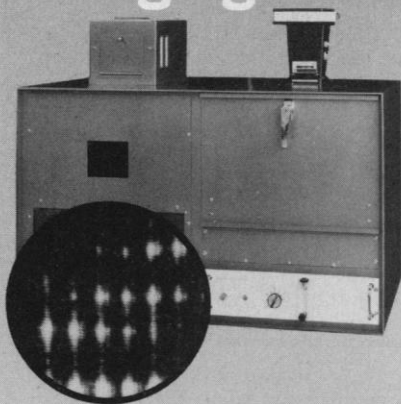
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