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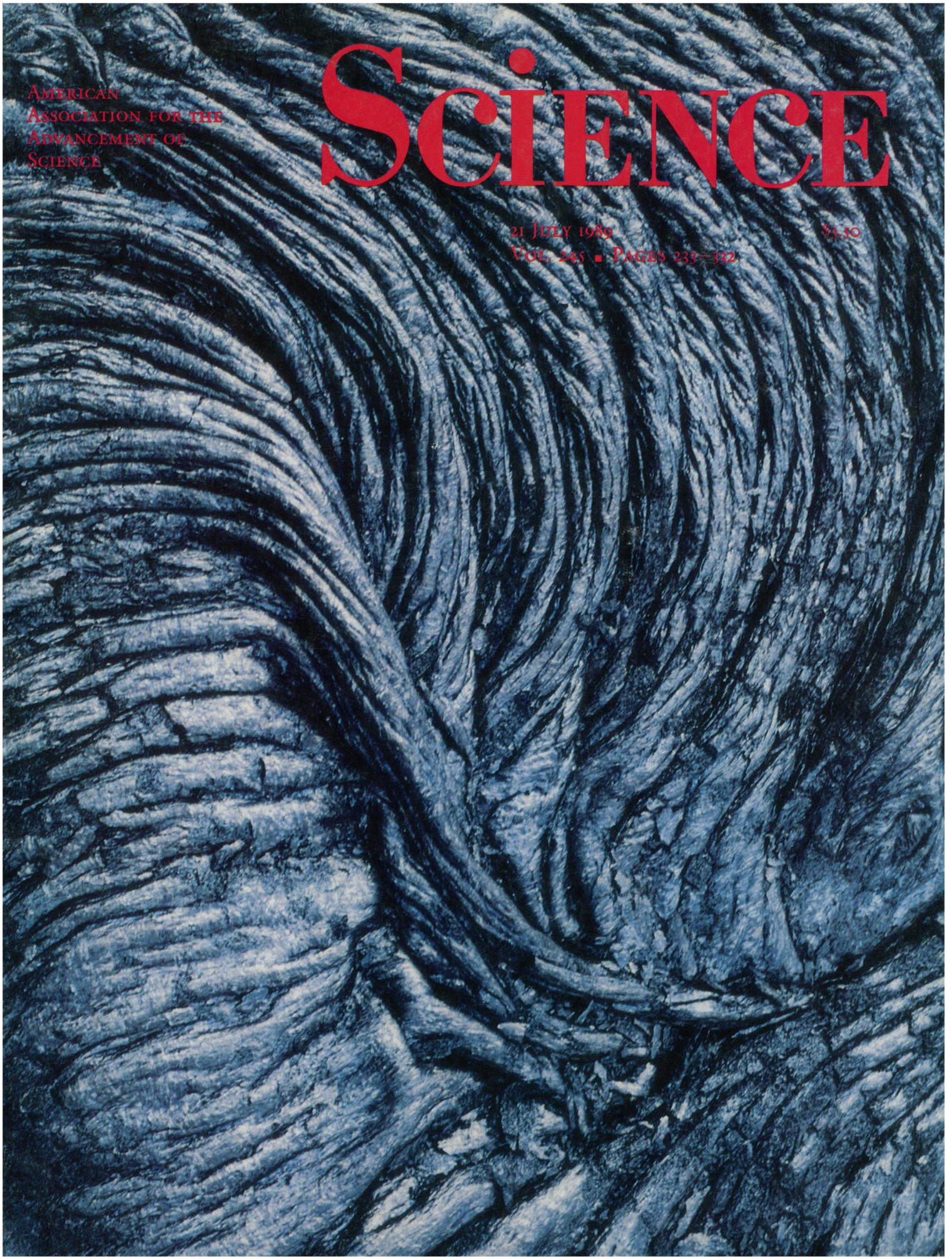

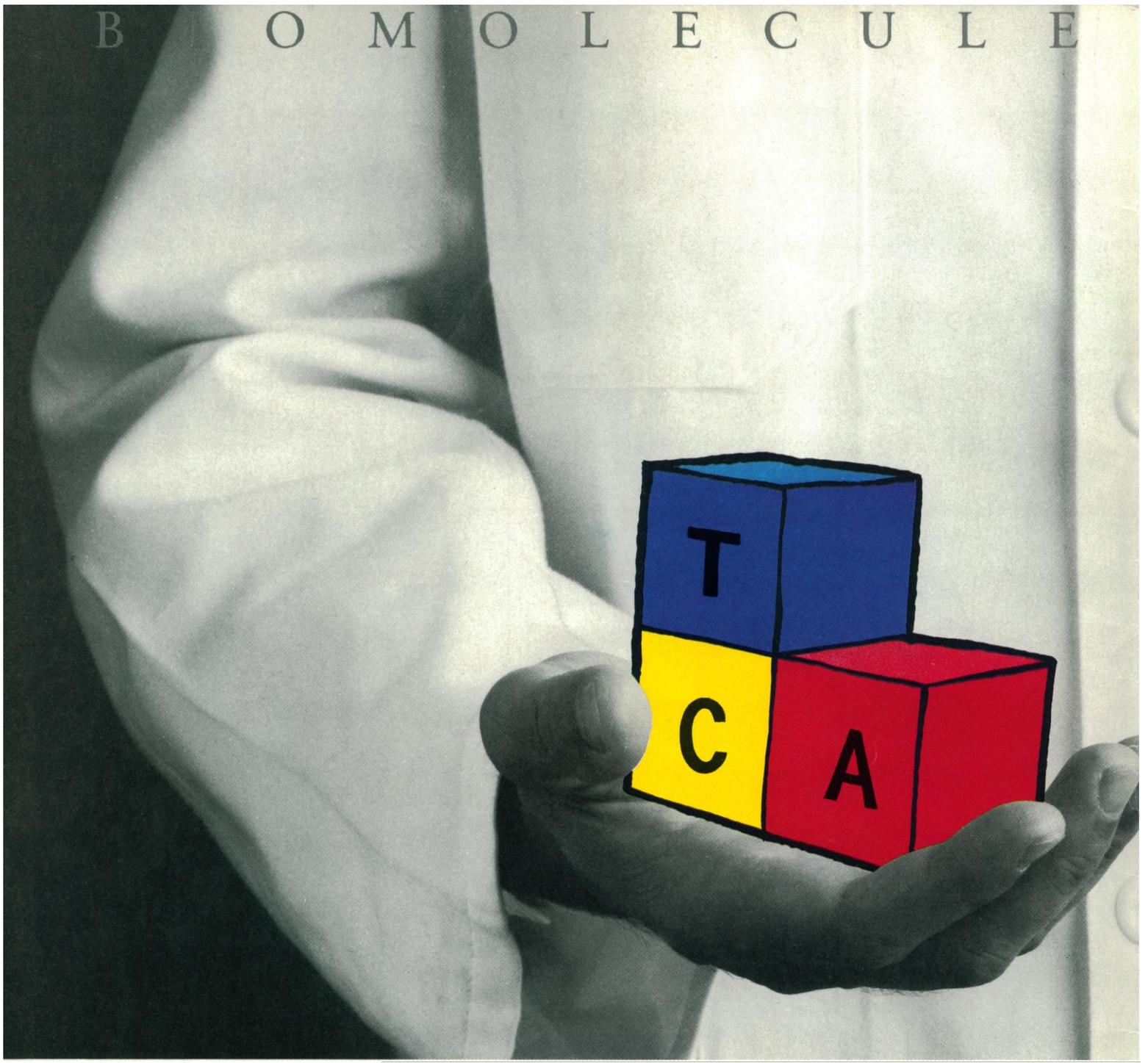

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COVER Fresh pahoehoe lava on Kilauea volcano, Hawaii. The interplay between structure and dynamics in the glassy surface layer of the flow and in its mixed crystal plus liquid interior are reflected in the complex forms developed on cooling. Nuclear magnetic resonance spectroscopy is becoming increasingly useful in elucidating both local atomic structure and motion in geological materials. See page 257. [Photograph by J. F. Stebbins]

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Voyager at Triton

THERE is exciting news for the Voyager mission: the Voyager cameras should be able to "see" to the surface of Neptune's largest satellite Triton during the flyby in August (page 283). Voyager is in its 12th year of deep-space exploration and in that time has flown almost 4 billion miles. Its flyby of the Neptune system will reveal new information about the planet and its satellites (a third moon has already been detected) and about the distribution patterns and types of liquids and ices on the surface of Triton. Cruikshank *et al.* have based their prediction on a combination of Earth-based near-infrared telescopic data of Triton and laboratory studies of the spectral signatures of methane and nitrogen at Triton-like temperatures (58 kelvin). The spectral patterns from Triton best match spectra of methane in gaseous and ice forms and of nitrogen in gaseous and either ice or liquid forms; thus, the atmosphere of Triton is sufficiently transparent for sunlight to penetrate to the surface where it is absorbed by ices and liquids.

Methane cycling

METHANE, one of the greenhouse gases, is increasing in the atmosphere by about 1% each year (page 286). Methane sources are diverse—bacteria produce methane in peat bogs, wetlands, rice fields, and tundra; cows and other ruminants give off methane-rich rumen gases; and methane is released during the collection and distribution of fossil fuels and during the burning of forests and grasslands. The relative contribution of each source to the global methane supply has been determined by Wahlen *et al.* who measured carbon (^{14}C and ^{13}C) isotopic abundances in the atmosphere and in the sources. Carbon-14 in methane differs in the two hemispheres: pressurized light-water (nuclear) reactors are prevalent in the Northern Hemisphere and have emitted ^{14}C-methane since about 1960. Some sources (ruminants) use contemporary carbon, and their ^{14}C resembles that in the atmosphere; others (peat bogs) release methane after long periods of storage and have lower than contemporary levels of ^{14}C. An understanding of methane sources and cycling is important because methane gas influences atmospheric ozone concentrations, is a major source of stratospheric water, and absorbs the sun's infrared rays and thereby affects global temperature. These studies are essential for determining how best methane emissions might be controlled.

Pancreatic glucose sensor

THE β cells, which secrete insulin in the islets of Langerhans of the pancreas, are sensitive to glucose concentrations in the bloodstream; when glucose increases, the β cells respond by secreting more insulin. A protein that participates in uptake of glucose by cells in the liver, intestine, and kidney has now been found in the plasma membranes of β cells; Orci *et al.* show that β cells have the facilitated glucose transporter (GT) but three other types of islet cells do not (page 295). GT molecules were clustered on microvilli of β cell plasma membranes, facing adjacent endocrine cells; they were sparsely represented on flat surfaces of plasma membranes that front on capillaries and intercellular spaces. Their distribution pattern probably is optimal for facilitating glucose uptake. GT, glucokinase (an enzyme that is instrumental in glucose metabolism inside these cells), and perhaps other enzymes may comprise a "glucose sensor" system for the pancreas.

Programmed cell death

THERE is a phenomenon called programmed cell death: under appropriate conditions, the cytoplasm of the cell condenses, there is blebbing of the cell's membrane, the DNA inside the cell fragments, and the cell dies. This process differs from necrotic cell death in which the cell swells and the membrane bursts and from antibody- and complement-induced cell lysis. Programmed cell death is known to occur during the development of embryos and in conjunction with metamorphosis, tissue atrophy, and tumor regression. Trauth *et al.* show that, in both activated normal and malignant human lymphoid cells, programmed cell death can be induced in vitro with monoclonal antibodies that react with a marker on the surface of the cells called APO-1 (page 301). This marker has also been found on the surfaces of lymphoid tumor cells of some cancer patients. In in vivo trials in mice, large tumors of human cells bearing APO-1 surface markers were eliminated rapidly (in a matter of days) by a single injection of the antibodies. Such antibodies hold promise for therapeutic use in humans if they can similarly induce the pre-programmed suicide of tumor cells.

Reservoir for AIDS virus

THE human immunodeficiency virus type 1 (HIV-1) can remain latent in the body for years before becoming active and causing AIDS and AIDS-related diseases. A population of cells in the bloodstream, the $CD4^+$ T cells, has been found to serve as a reservoir for latent HIV-1 viruses (page 305). Schnittman *et al.* report that, in all individuals infected with HIV-1, there are $CD4^+$ T cells containing DNA sequences (called proviral DNA) characteristic of HIV-1; in patients with full-blown AIDS, the proviral DNA is present in 1/100 $CD4^+$ T cells. This frequency is much higher than expected and would not have been anticipated in light of earlier in vitro observations. That $CD4^+$ T cells, which are helper and inducer cells in the immune response, serve as reservoirs of HIV-1 is consistent with observations that individuals who have AIDS lose $CD4^+$ T cells progressively as disease advances and eventually become profoundly suppressed immunologically. Identification of this reservoir adds a piece to the puzzle of AIDS pathogenesis and provides a system in which to study what keeps the viruses latent and what activates them in these cells.

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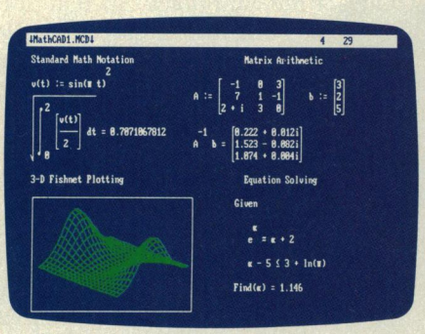

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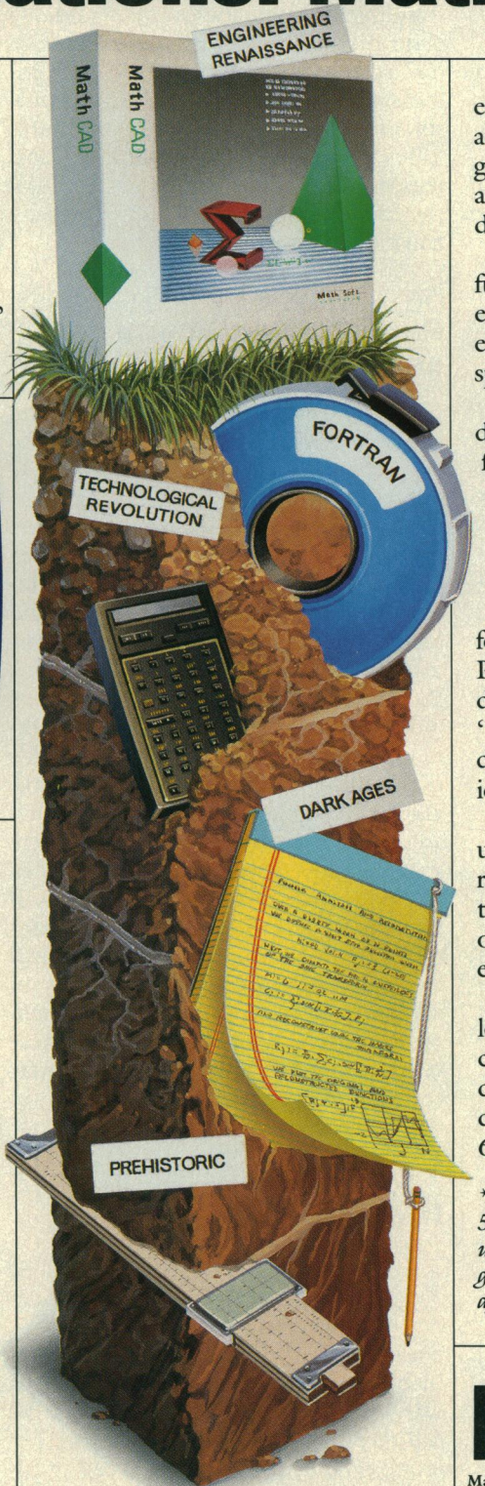

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Effects of Electric and Magnetic Fields

Since the late 1960s there have been controversy and litigation about health effects of electric and magnetic fields produced by power transmission lines. Recent studies have heightened this concern and have led to a request by a subcommittee of Congress that the Office of Technology Assessment (OTA) review the problem. In turn, OTA contracted for a study by a group at Carnegie-Mellon University. Their recently published report* provides a comprehensive review and analysis of the pertinent literature together with policy recommendations. A key finding is that if there are effects on human health from exposure to fields created by electricity, they arise mainly from use in the home. Household appliances and wiring produce electric and magnetic fields that in magnitude are comparable to those near the right of way of a transmission line.

Until recently, conventional wisdom held that fields associated with power systems posed no threat to human health. There is no substantial transfer of energy from power fields to biological systems. Moreover, naturally occurring fields in vivo are at least 100 times as intense as those induced by 60-hertz power fields. In addition, there has been an absence of any large-scale obvious public health effects associated with electrification.

However, a growing number of positive findings have demonstrated that under special circumstances weak low-frequency electromagnetic fields can produce changes at the cellular level. Among the responses found in laboratory studies of animal cells and tissues are modulation of ion flows, interference with DNA synthesis and RNA transcription, and interaction with the biomedical kinetics of cancer cells. In a few instances effects have been demonstrated at the level of the whole animal. Experiments involving calcium-ion efflux from chick brain tissue in vitro produced interesting but puzzling effects. At 60 hertz, enhanced efflux occurred at three intermediate values of field strength, but not at higher or lower values. In addition, when field strength was held constant, enhanced efflux occurred at a series of specific frequencies but not in between them. The values of these frequencies were influenced by the strength and orientation of static magnetic fields.

To evaluate electromagnetic effects on humans, one must rely on epidemiological studies. These are notoriously difficult to conduct with certainty due to confounding factors. For example, in cancer studies one must control for smoking, diet, food preparation, and other variables. Perhaps the two most quoted epidemiological studies were conducted in and around Denver. Both reported a doubling of the frequency of childhood leukemia in homes where fields were higher than average. One of the two studies showed that high appliance use leading to magnetic fields greater than 2.5 milligauss was associated with increased risk in the offspring for all cancers. Also childhood electric blanket and isolette exposures were associated with increased cancer risks.

Studies other than those at mile-high Denver have yielded mixed results regarding the question of association between cancer and low-frequency electromagnetic fields. The OTA report states, "Overall the evidence now available is too weak to allow firm conclusions either way."

If there are human health effects, what are the cogent variables? For example, it is not certain whether the changing electric fields or magnetic fields are the causative agents. Are effects related to the integral of field strength over time, or are infrequent exposures to very high fields crucial? If regulators wished to set standards now, they would not have a solid knowledge base to guide them. They could mandate the expenditure of tens of billions of dollars to little effect.

The situation calls for much more effort in research than has hitherto taken place. The previous level of support in the United States has been of the order of a few million dollars a year. The new work should include more animal studies and substantial epidemiological studies, coupled with accurate measures of fields. In the meantime, one option suggested by the OTA study is to "adopt a 'prudent avoidance' strategy. That is, systematically look for strategies which can keep people out of 60 Hz fields . . . but only adopt those which look to be 'prudent' investments given their cost and our current level of scientific understanding about possible risks."—PHILIP H. ABELSON

*I. Nair, M. G. Morgan, H. K. Florig, "Biological effects of power frequency electric and magnetic fields" (Office of Technology Assessment, Washington, DC, May 1989).

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ing parties to litigation may grow increasingly attractive. One frequently suggested option is a panel of experts, who meet and reach conclusions about the research outside the adversary environment of the courtroom. Chesler, Sanders, and Kalmuss discovered that their respondents had mixed reactions to the expert panel alternative. Interestingly, lawyers were opposed to expert panels for hearings on whether civil rights laws had been violated, but were more willing to support them for hearings about remedies for legal violations. At the remedy stage, expert panels may be ideally suited to construct a compromise plan that is satisfactory to all the major players who, following adversary litigation, must develop new ways to work together. This dichotomy in the perceived usefulness of expert panels suggests the circumstances in which they may be most valuable and deserves greater attention.

The book raises important questions about the phenomenon of expert witnessing within the context of a controversial social movement. Do comparable attorney recruitment and preparation strategies, and similar tensions between scientific norms and adversary roles, characterize the experiences of scientific experts appearing in less politicized cases? The generalizability of the experiences of the desegregation experts must be tested by future researchers, but the meticulous and insightful exploration of the phenomenon in *Social Science in Court* provides an excellent foundation.

VALERIE P. HANS
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Insect Sociobiology

The Genetics of Social Evolution. MICHAEL D. BREED and ROBERT E. PAGE, JR., Eds. Westview, Boulder, CO, 1989. viii, 213 pp., illus. Paper, $36.50. Westview Studies in Insect Biology. Based on a conference, Dec. 1987.

Time was that worker honeybees were thought of as interchangeable little automata, identical within a colony except for a change with age of the set of tasks responded to. No more. Time was that social insect colonies were regarded as "superorganisms," analogous to the bodies of single animals in the devotion of their constituent members to the common good. No more. Both views have fallen decisively under the weight of both empirical and theoretical studies. As the number of bee and ant pictures on the recent covers of international journals attests, the evolutionary study of social insects is coming to grips more and more with the unraveling of the predictions of hypotheses now decades old and the pleasant discovery of unanticipated phenomena such as genetical bases for behavioral specialization in honeybees.

This book, accordingly, based loosely on a symposium but molded into a unitary form, is about the interaction of genetics and evolution with sociality. The focus is narrower than the title: it is restricted not only to eusocial insects (those with a reproductive division of labor) but to the Hymenoptera (bees, ants, and wasps). Nevertheless, this group is in many ways the core group for sociobiological studies, and the focus actually achieved makes for an effective and exciting book.

After an introduction by Breed to the concepts and questions of the field, the book turns quickly to the recent finding that

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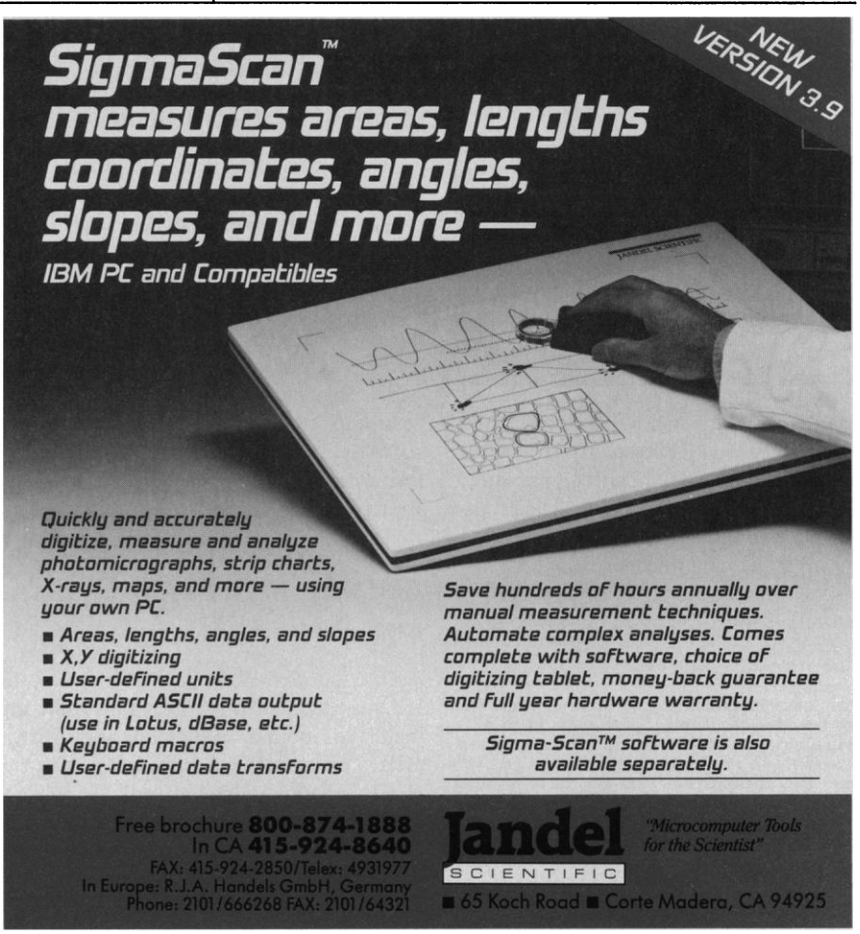

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