American Association for the Advancement of Science

SCIENCE

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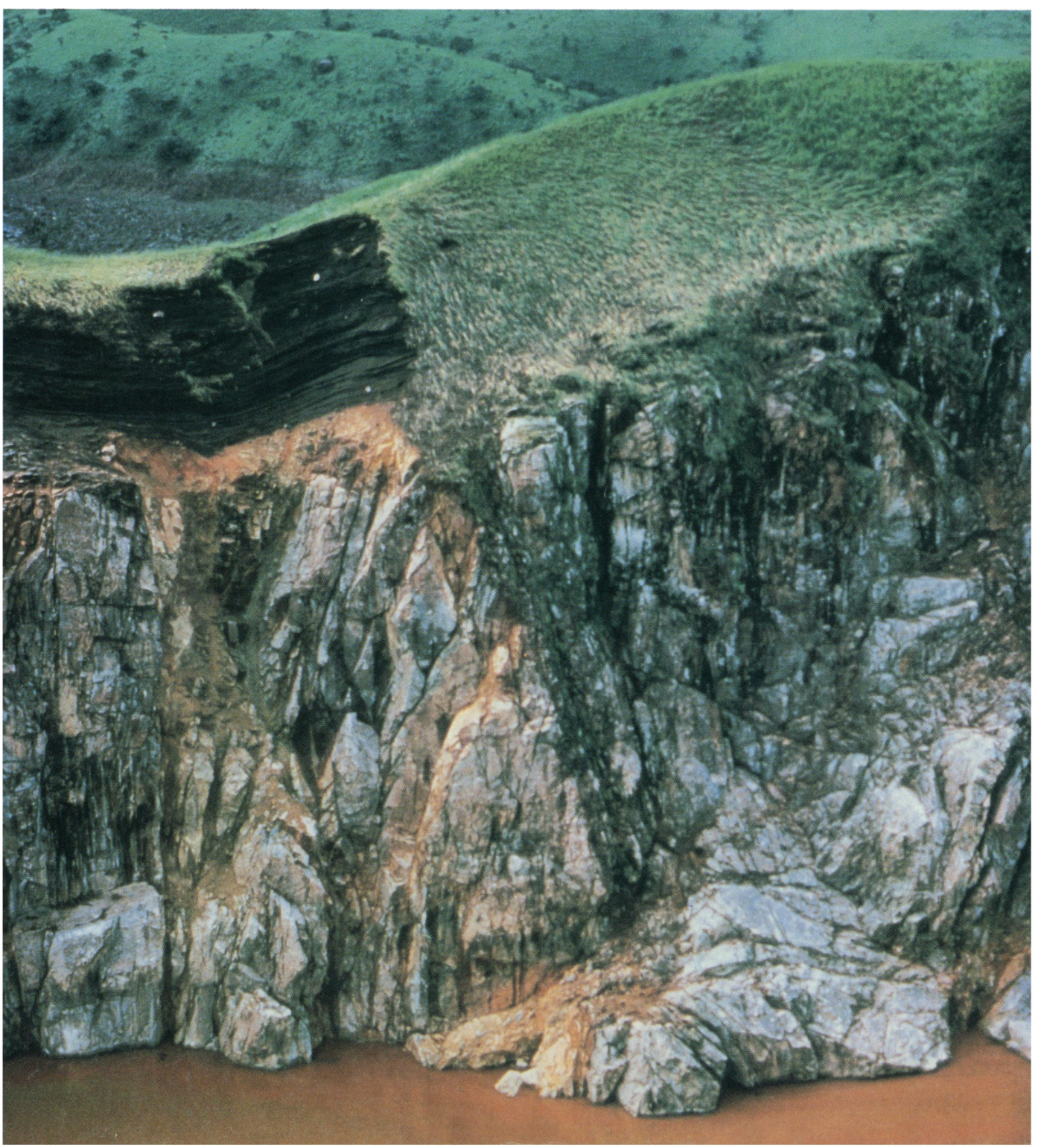

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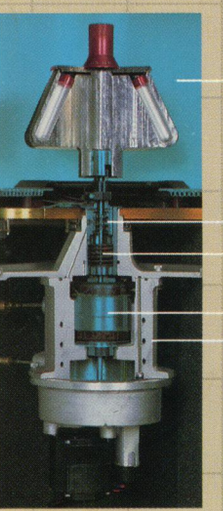

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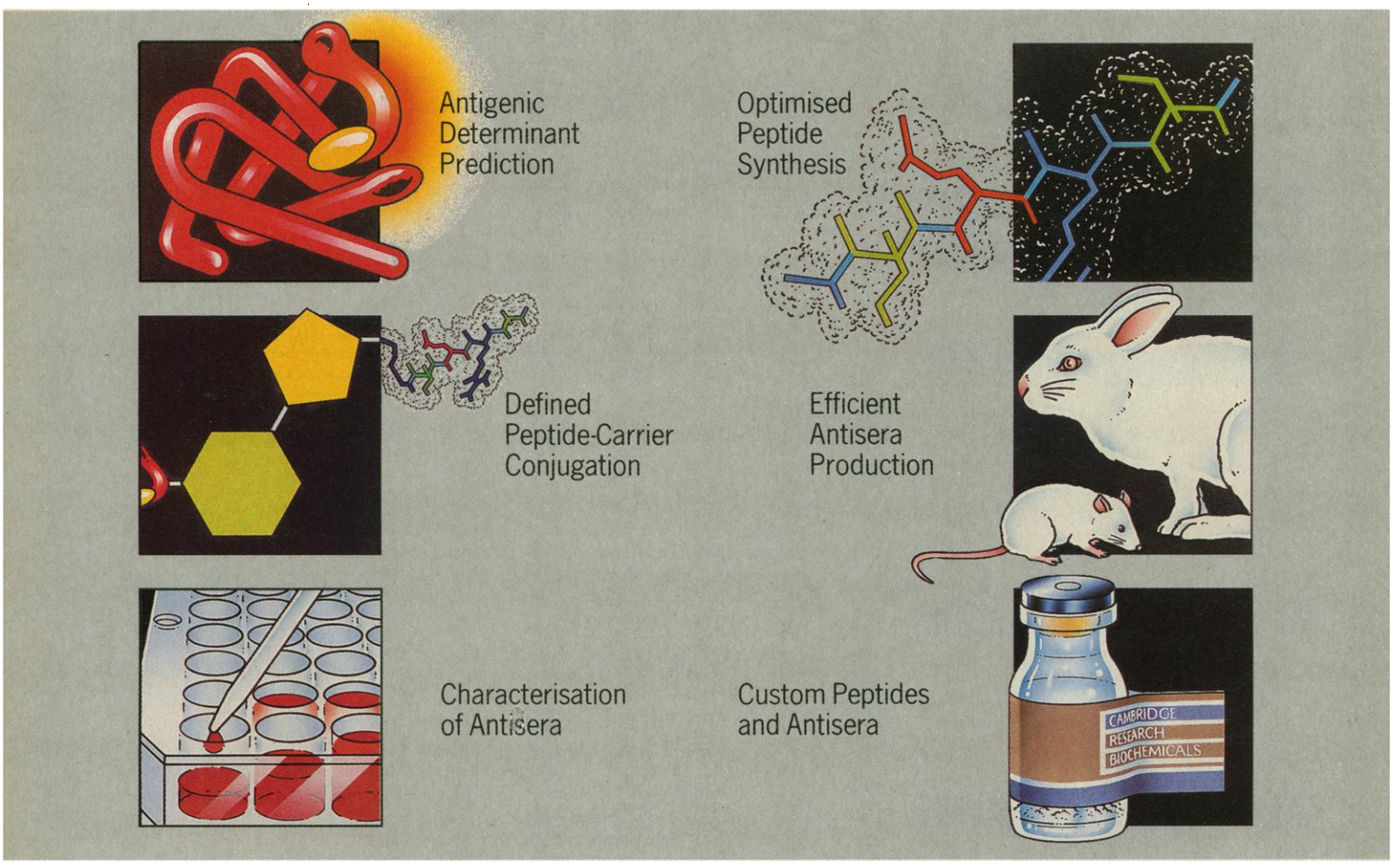

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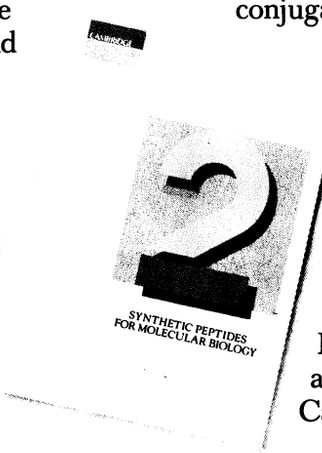

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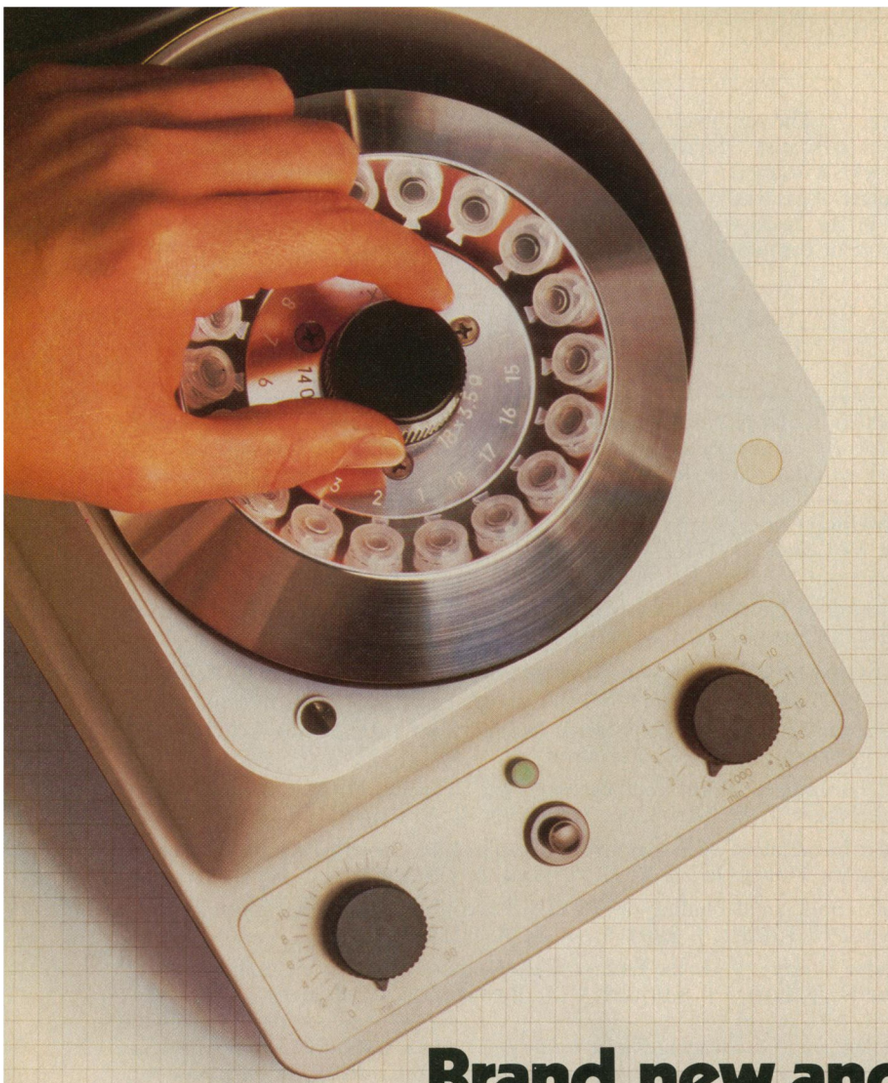
COVER The southwestern shore of Lake Nyos in Cameroon after the toxic gas disaster in August 1986 which killed an estimated 1700 people and several thousand livestock. A fountain of water created by the release of an estimated 1.0 cubic kilometer of gas washed over an 80-meter rock promontory causing a 90-centimeter drop in the lake's water level. See page 169. [Michael A. Clark, Armed Forces Institute of Pathology, Washington, DC 20306]



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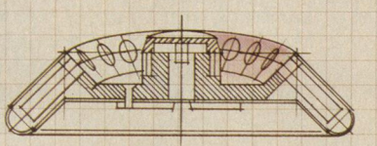

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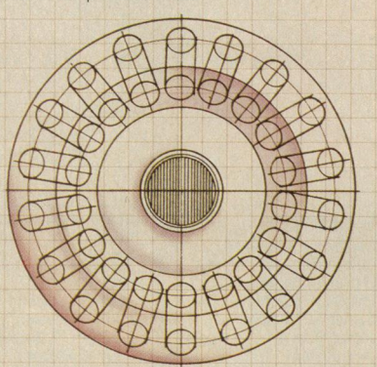

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This Week in SCIENCE

Lake Nyos

ROUGHLY 1700 people and 3000 cattle "died in their tracks" at Lake Nyos in Cameroon in August 1986 (page 169). Investigators from several countries have since studied Lake Nyos to determine what happened, how it happened, and why. Kling *et al.* from the U.S. team conclude that a huge cloud of carbon dioxide gas was released from Lake Nyos and that this gas asphyxiated the victims. The gas, originating in a deep-seated source (not a volcanic or organic one), entered the lake dissolved in ground water and eventually saturated the waters. Some disturbance to the stratified lake initiated the gas release; the usually clear blue lake turned rusty-red and floating vegetation was strewn across the surface. Since many of the lakes in Cameroon have geologic and limnologic features like those of Lake Nyos, they too have the potential to release harmful gas: just 2 years before the Lake Nyos disaster, something similar happened at nearby Lake Monoun, killing 37 people. Possibly, these and similar lakes could be monitored, and, when dangerous levels of gases were found to accumulate, gas-rich waters could be pumped safely to the surface.

Suppression of Wilms' tumors

HUMAN chromosome 11 carries information that prevents malignant Wilms' tumors from growing; in the absence of the suppressor segment of the chromosome (a common finding in Wilms' tumors), kidney tumors develop in young children (page 175). Weissman *et al.* used microcell hybridization to insert normal copies of human chromosome 11 into cells of a Wilms' tumor line. Many of the cells' growth characteristics in vitro were unchanged by the insertion. But, when the cells were injected into mice, no tumors formed during 6 months of observation, whereas unmodified Wilms' tumor cells typically produce large tumors in 100% of animals within 2 to 4 weeks. This is direct evidence that chromosome 11 carries genetic information that has an antitumor effect, probably suppressing tumor genes when present but permitting their expression when absent. Suppressor genes that prevent development of other kinds of tumors are associated with other chromosome deletions; these can be similarly evaluated with microcell fusions.

Ironing out the earth's thermal characteristics

IRON is the major constituent of both the earth's solid inner core and its liquid outer core (page 181). Williams *et al.* studied temperatures at which iron melts under high-pressure conditions using a static technique (a laser-heated diamond cell) and a dynamic one (subjecting iron to high-pressure shock waves). Resulting temperatures were adjusted to account for the melting not of pure iron but of an iron-rich alloy. The temperature at the core-mantle boundary (with pressure of 136 gigapascals) would be about 3800 kelvin in order for the outer core to remain liquid. At the boundary between the inner and outer cores (with a pressure of 330 gigapascals), the temperature should be about 6600 K. The temperature gradient across the inner core is not great, so the melting temperature of iron at pressures near those of the inner–outer core boundary can be considered close to the temperature at the center of the earth. The measurements place an upper limit of 6900 ± 1000 K on the temperature at the center of the earth.

North American digs for ancient anteaters

SOUTH America was isolated until about 3 million years ago when the Panamanian land bridge joined it with landmasses to the north (page 186). Thereafter came the Great American Interchange of species, with migration of terrestrial animals in both directions across the bridge. Species established themselves in new habitats where rainfall, climate, and vegetation were conducive to their growth. Nine families had been identified as northward migrators; now a tenth, represented by the giant anteater *Myrmecophaga tridactyla*, can be added to the list. Shaw and McDonald discovered a fossil metacarpal III (a bone crucial to the activity of the digging claw used by contemporary anteaters to open termite mounds) in Sonora in northern Mexico. The fossil dates to early Pleistocene time (about 1 million years ago). Today subtropical conditions make life in Sonora untenable for anteaters, which need a steady supply of ants or termites and stable warm temperatures year-round; modern anteaters live 3000 kilometers or more to the south in tropical Central and South American habitats. During the early Pleistocene, tropical conditions probably prevailed not only in Sonora but also along the corridor through which the anteaters traveled.

Local synthesis of insulin-like growth factors

IN connective tissues throughout the bodies of human fetuses, fibroblasts and other cells of mesenchymal origin produce messenger RNA molecules for insulin-like growth factors (IGFs) (page 193). IGFs are peptides that may play a part in promoting growth of fetal tissues (bone, brain, and others); both their activation and their actions are associated with the activities of growth hormones. IGFs or somatomedins were previously thought to be made in the liver and, from there, to travel to other parts of the body. However, in situ hybridization experiments—with synthetic oligonucleotides that correspond to portions of the IGF molecules—performed by Han *et al.* show that messenger RNA molecules for the IGFs are found in all human fetal tissues rich in fibroblasts and other mesenchymal cells. IGF messenger molecules appear not to be made by parenchymal cells. The localization of these messenger molecules to specific cells that are integral to most tissues and organs suggests that IGFs are made and then function locally.

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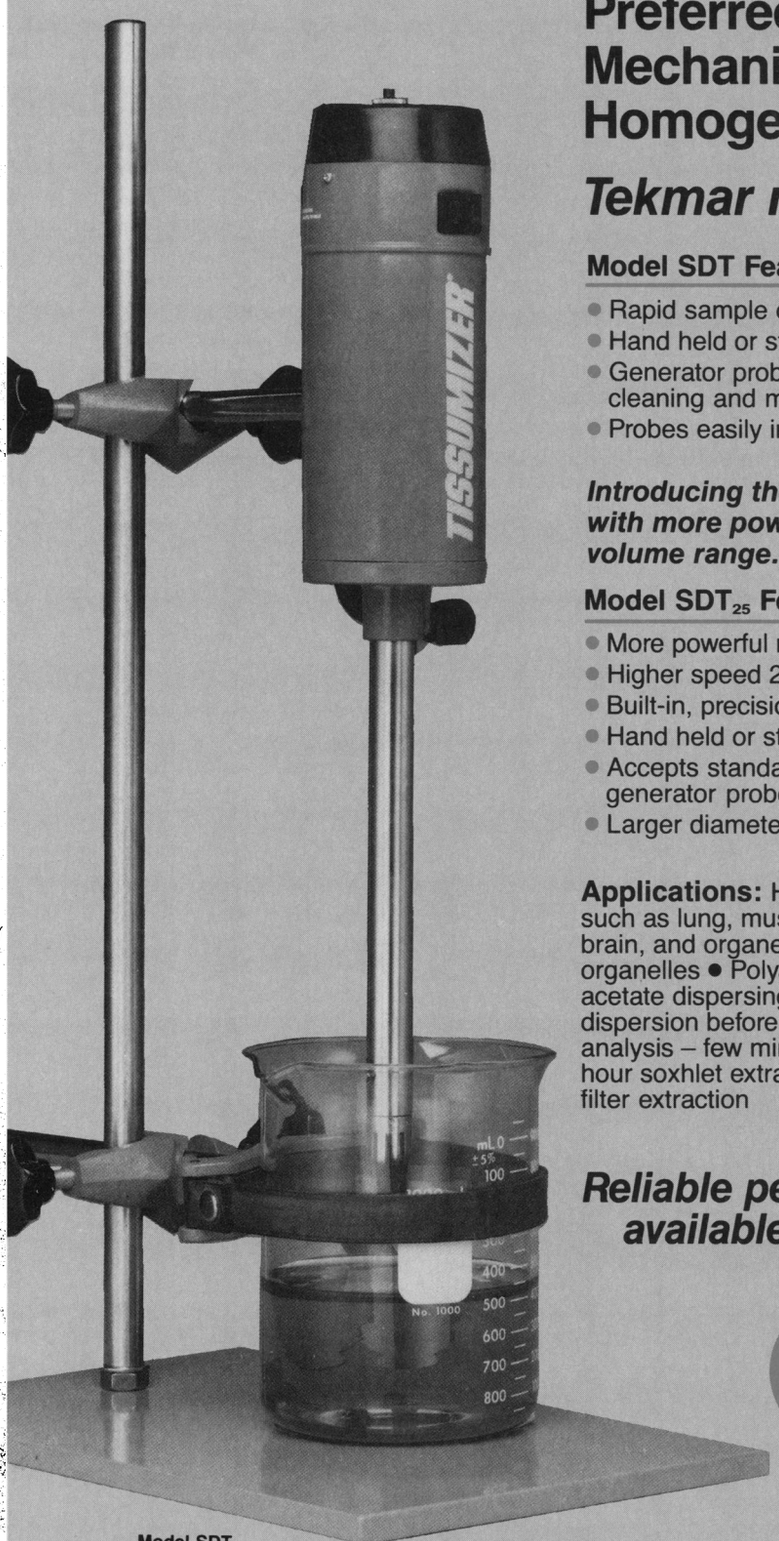

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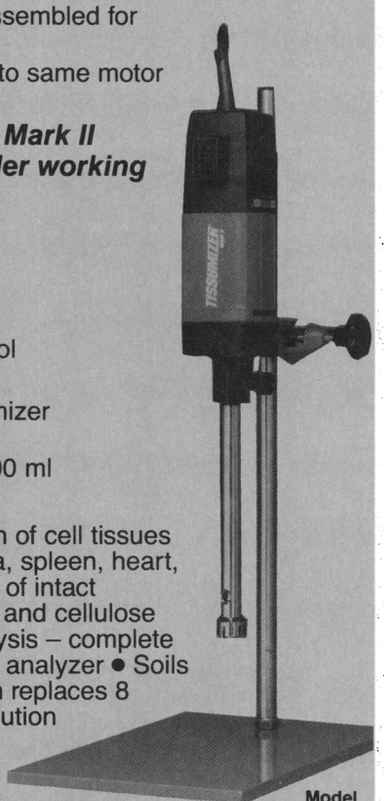

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SCIENCE

10 APRIL 1987
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The Case for Qualifying "Case by Case"

A recurring theme in discussions of governmental oversight of "deliberate releases" of genetically engineered organisms concerns precisely what classes of organisms should be regulated. The experiments "captured" by governmental regulation should be only those that are necessary and sufficient to protect human health and the environment. Related to this theme is the phrase "case by case," as in "ensure that recombinant DNA organisms are evaluated for potential risk, prior to applications in agriculture and the environment by means of an independent review of potential risks on a case-by-case basis."* The concept of case-by-case evaluation of proposed field trials by national authorities is widely touted and has become something of a totem, inspiring much reverence but little reflection. Evaluation of each and every proposed field trial would be contrary to accepted practice, debilitating to academia and to industry, and an unnecessary burden to government.

In the quotation above, from a recently published Organization for Economic Cooperation and Development document, case by case was carefully qualified to mean specifically "an individual review of a proposal against assessment criteria which are relevant to the particular proposal; this is not intended to imply that every case will require review by a national or other authority since various classes of proposals may be excluded." Thus, in current practice, an investigator contemplating a field trial reviews, or compares, the various aspects of his experiment with relevant assessment criteria to determine whether prior governmental approval is required. For example, if the experiment were a field test of ore extraction by an indigenous *Thiobacillus* manipulated with recombinant DNA techniques in order to delete a gene, the review performed by the investigator would reveal that both the National Institutes of Health Guidelines and the relevant Environmental Protection Agency regulations (under the Toxic Substances Control Act) exempt the experiment from prior approval.

The OECD qualification of case by case underscores the important principle that categories of products entailing negligible or trivial risk may be defined so as not to require special governmental scrutiny or restriction; these could range from narrow products (for example, an inclusive list of such organisms as *Pseudomonas syringae, Bacillus thuringiensis*, and *Thiobacillus ferrooxidans*, manipulated by self-cloning) to broad ones (for example, all well-characterized nonpathogens). This principle of exemption of low-risk categories is, after all, nothing new: more than 90 percent of recombinant DNA laboratory experiments potentially under the jurisdiction of the NIH guidelines have been exempted completely, and the NIH Recombinant DNA Advisory Committee has begun to create categorical exemptions from the definition of "deliberate release."

Perhaps the most compelling argument for a qualified definition of case by case is the extraordinary safety record of field testing of live microbial pesticides that, until recently, could occur unencumbered by federal regulation. At least 13 organisms, approved and registered with EPA, are marketed in dozens of different products.† All of these (as well as numerous other unsuccessful candidates, undoubtedly) were developed and field tested safely without regulatory oversight, because field trials on less than 10 acres were then exempt from the Federal Insecticide, Fungicide, and Rodenticide Act, the pesticide statute.

Consider, in addition, the monumental successes of pre–recombinant DNA genetic engineering of "deliberately released" products such as high-lysine corn, disease-resistant wheat, and genetic hybrids such as tangelos, beefaloes, and a vast array of flowers. Should every field trial of a new variety of these require the imprimatur of the federal government? Should the use of recombinant DNA techniques per se to effect a genetic change determine the need for federal oversight? Obviously not, but one might well wonder, hearing the uncritical clamor for "case-by-case" approvals of all "deliberate releases."—HENRY I. MILLER, *Special Assistant to the Commissioner, Food and Drug Administration, Rockville, MD 20857*

*Organization for Economic Cooperation and Development, *Recombinant DNA Safety Considerations* (Paris, France, 1986). †F. Betz, M. Levin, M. Rogul, *Recomb. DNA Tech. Bull.* **6**, 135 (1983).

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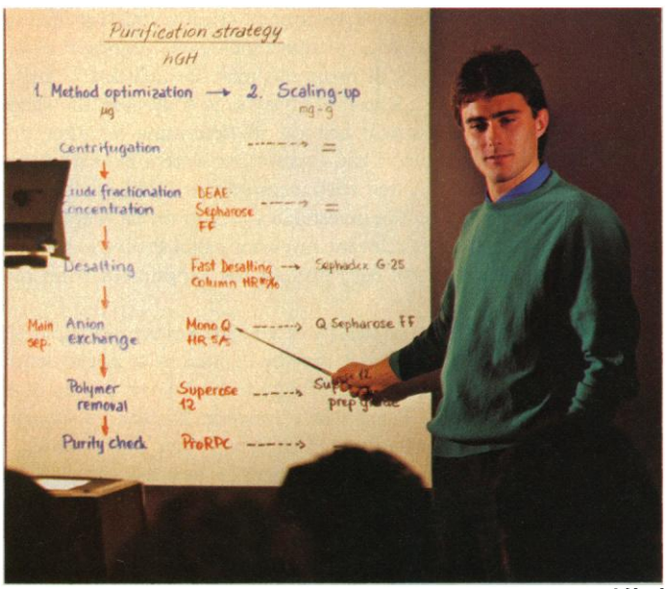

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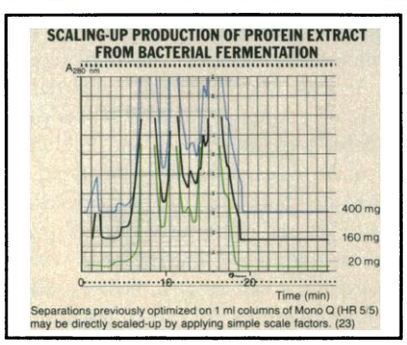

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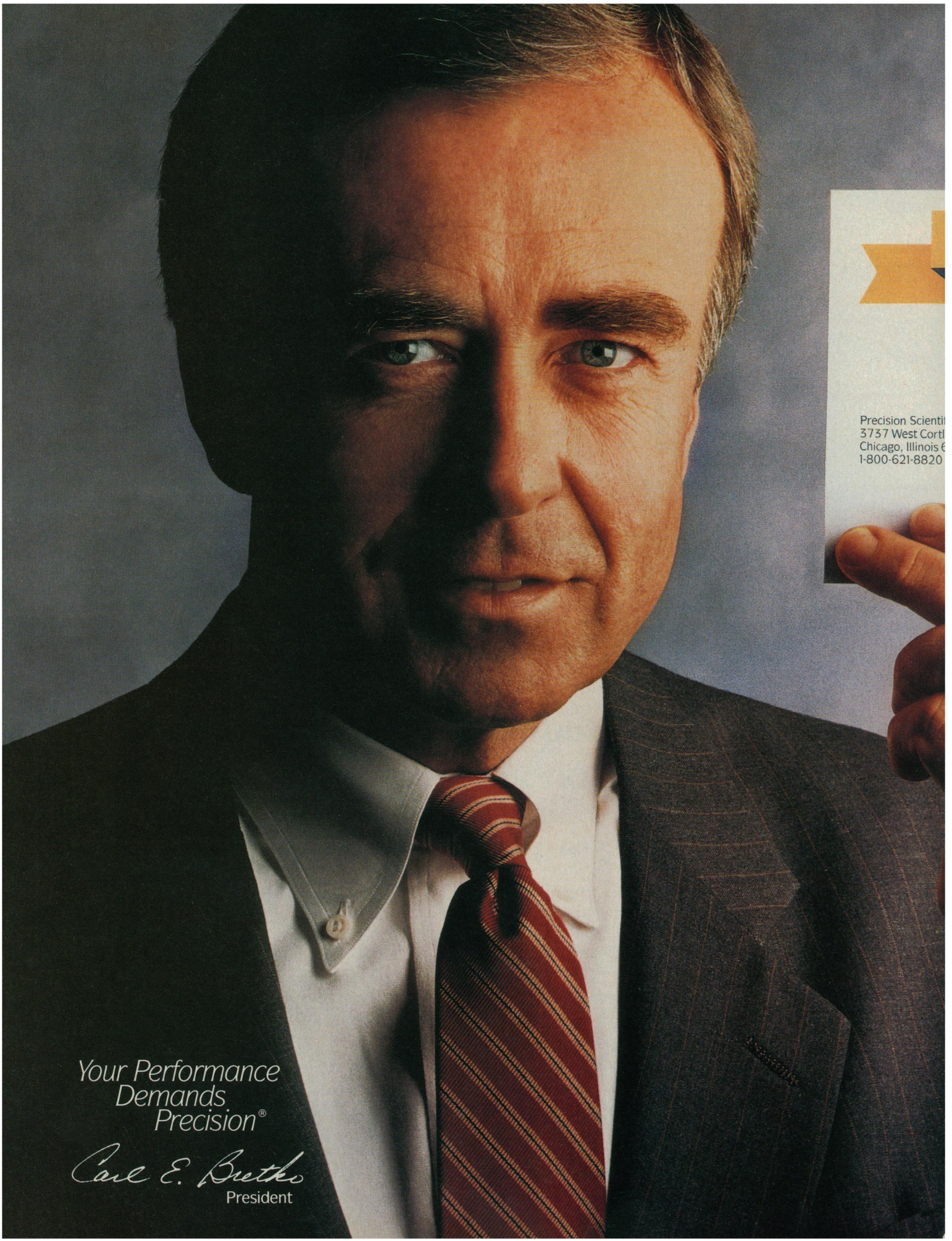
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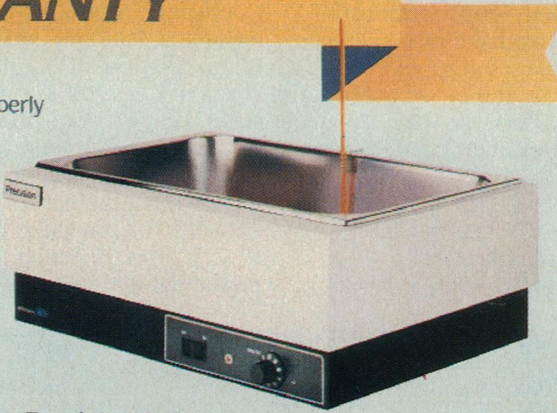

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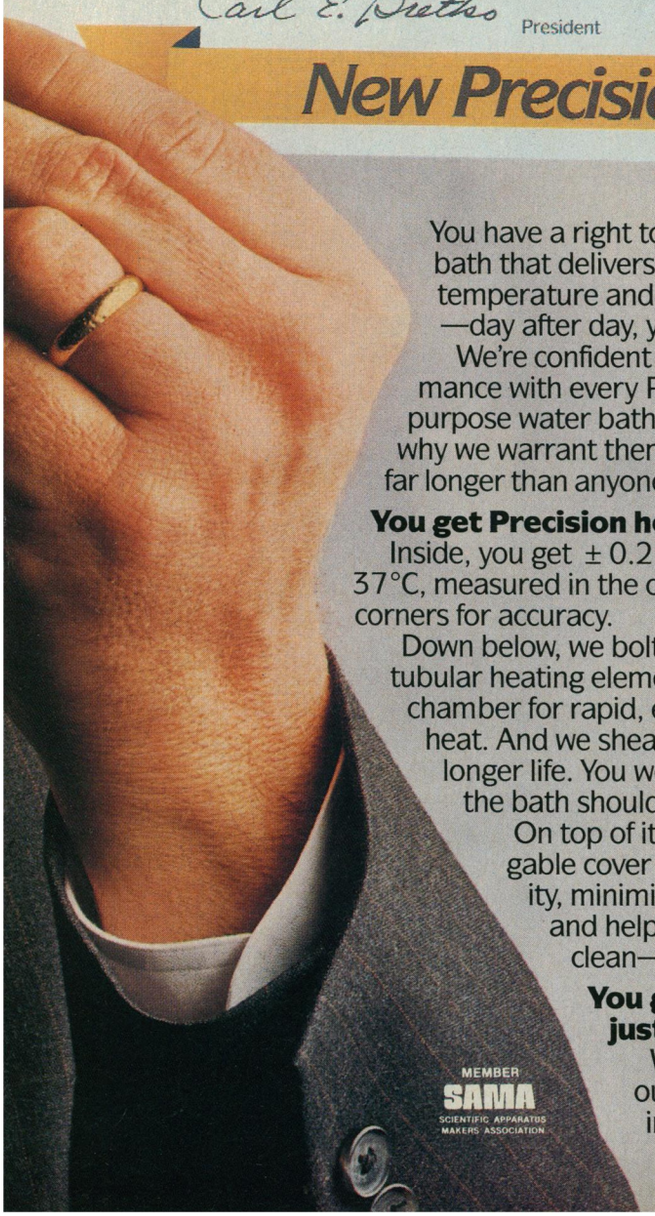

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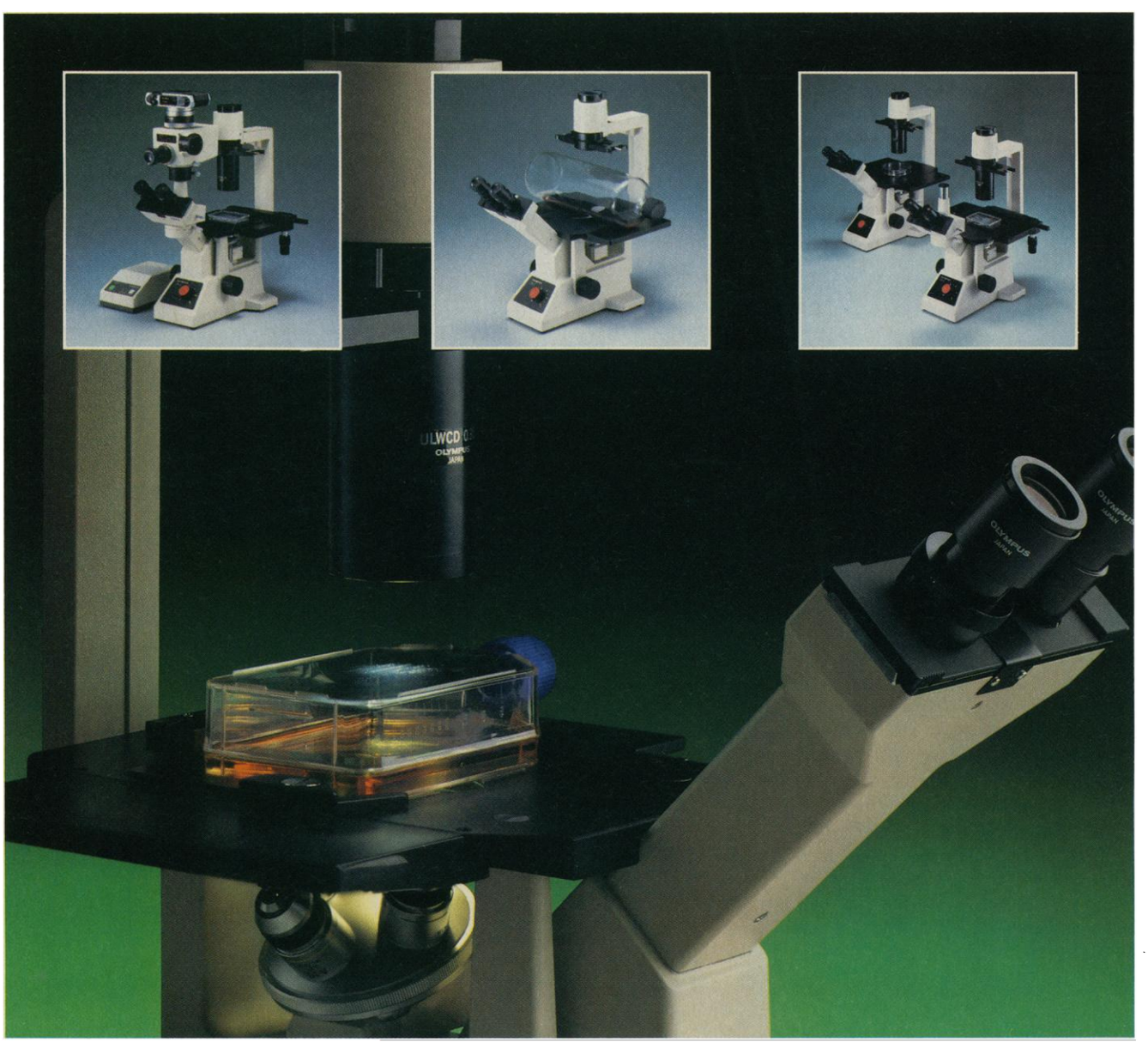

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For a demonstration circle reader service number 5

Vocational Potential

Advantage and Disadvantage. A Profile of American Youth. R. DARRELL BOCK and ELSIE G. J. MOORE. Erlbaum, Hillsdale, NJ, 1986. x, 230 pp., illus. $29.95.

The Profile of American Youth Survey, conducted for the United States Departments of Labor and Defense by the National Opinion Research Center, is the most extensive and detailed attempt on record to assess the cognitive development and vocational aptitudes of young Americans. Several qualities of the project and of the analyses reported in this monograph set the work apart from its predecessors and will attract readers not only from the ranks of educators but also among sociologists, economists, demographers, psychologists, and psychometricians, as well as policy makers and concerned citizens.

To begin, the survey captured a complete cross-section of 15- to 23-year-olds by sampling households rather than schools. Individual-level background data were obtained from the Department of Labor's 1979 National Longitudinal Study (NLS) of labor force participation, and test data were obtained from nearly all of the study's 12,000 participants in 1980. Most large-scale attempts to assess the attributes or achievements of the nation's youth, such as the National Assessment of Educational Progress (NAEP), rely on the lone institution where youngsters are known to congregate for a few hours each day. But we know from reported school attendance patterns and 50% dropout rates in some urban centers that a sizable share of youth are chronically unavailable to researchers. Further, since premature school leaving is known to be more common for certain groups, such as Hispanics and blacks, school-based measures of developmental disparities probably understate true group differences, at least for domains enhanced by secondary school participation.

Despite a seemingly narrow initial purpose for the testing phase of the project—updating norms for the Armed Services Vocational Aptitude Battery—it is satisfyingly broad in scope, for the battery includes numerous established scales of cognitive attainment as well as vocational skills. The subtests (ten in all) assess various reading, quantitative, science, and mechanical skills and possess documented validity as predictors of such outcomes as success in school, positive supervisor ratings in civilian employment, and successful completion of military training sequences. So patterns of performance across the tests are credible indicators of promise for success in adult life. And thus the title and purpose of the book: to consider what is the nature of advantages and disadvantages across groups as American youth make transitions to adulthood.

Rather than modeling comprehensively for average attainment through the labyrinthine path schemes of the status-attainment tradition (as represented for example by the work of Jencks *et al.* and Sewell and Hauser), the authors employ multivariate analyses of variance to examine levels of performance on individual tests in fine-grained subclasses of respondents—by highest grade completed, rich versus poor, mother's educational attainment, male versus female, white, black, Hispanic, and region of residence. What results is a profuse set of displays that can inform current educational and social issues too numerous even to list here. And the authors give considerable attention to the arguments fueled by their data and amply consider the literature that speaks to the issues they identify.

The value of the monograph lies at least as much in these last features as in its chosen and assiduously defended manipulations of test data. To mention a central example, one discussion that may attract attention both in academic circles and in the educational policy community is the book's extensive grappling with a persistent puzzle: the tests point to continued and striking performance differences (with years of school controlled for) among the three dominant sociocultural groups in the United States. Hispanics typically score 1/4 to 1/3 standard deviation below whites, and blacks typically score an additional 1/2 standard deviation below Hispanics. (Of course numerous departures from this rough characterization inspire stories of their own.) The gaps prompt the authors to examine extant explanatory theories, which they find substantively wanting. They proceed to pose a comprehensive theory of their own.

Genetic endowment theories are discredited with a careful examination of recent studies. Linguistic theories (postulating middle-class English as prerequisite to test performance) have trouble surviving the findings of this study, where differences in group means are roughly comparable across tests differentiated in their demands on the

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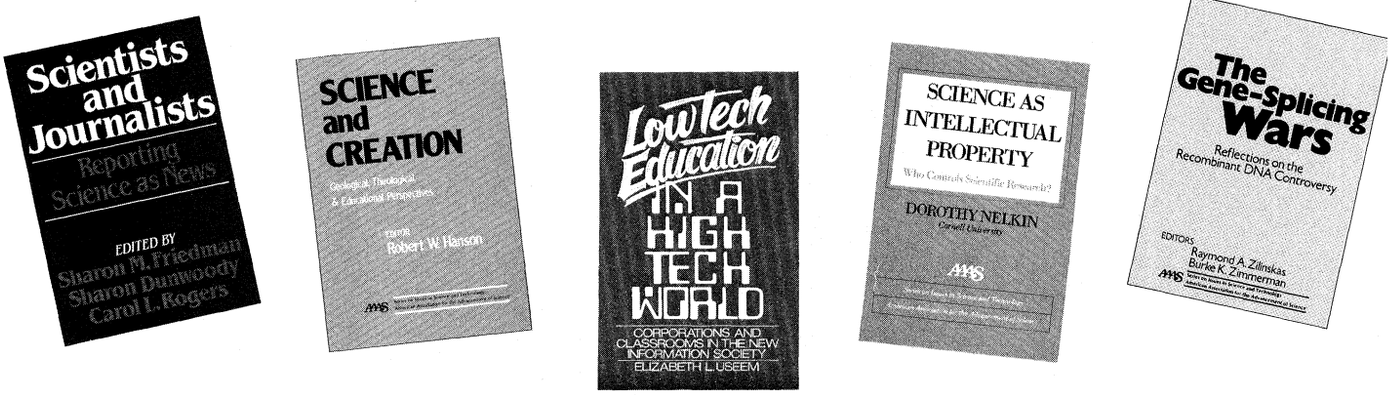

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Edited by Raymond A. Zilinskas and Burke K. Zimmerman

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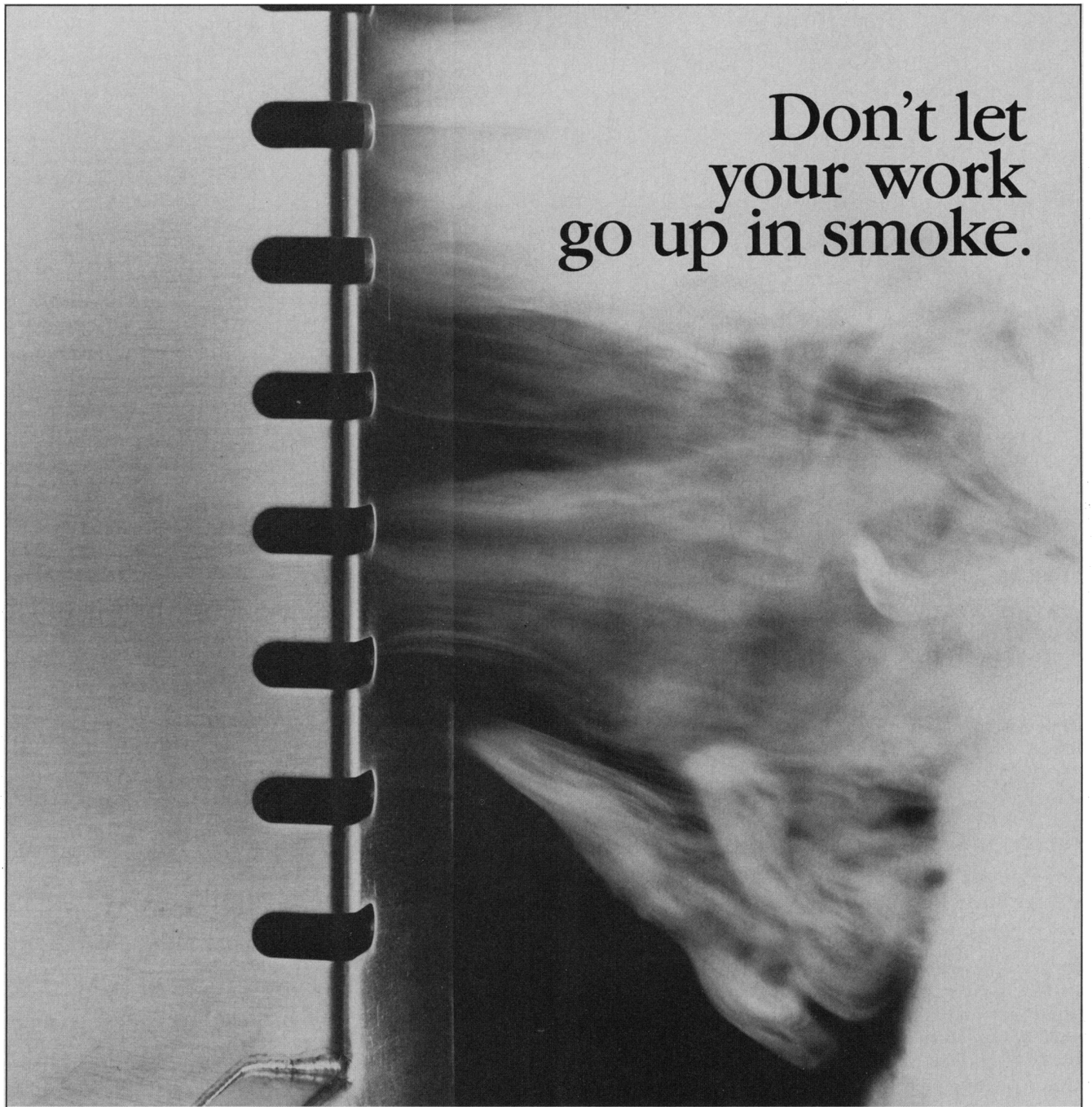

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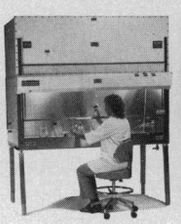

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