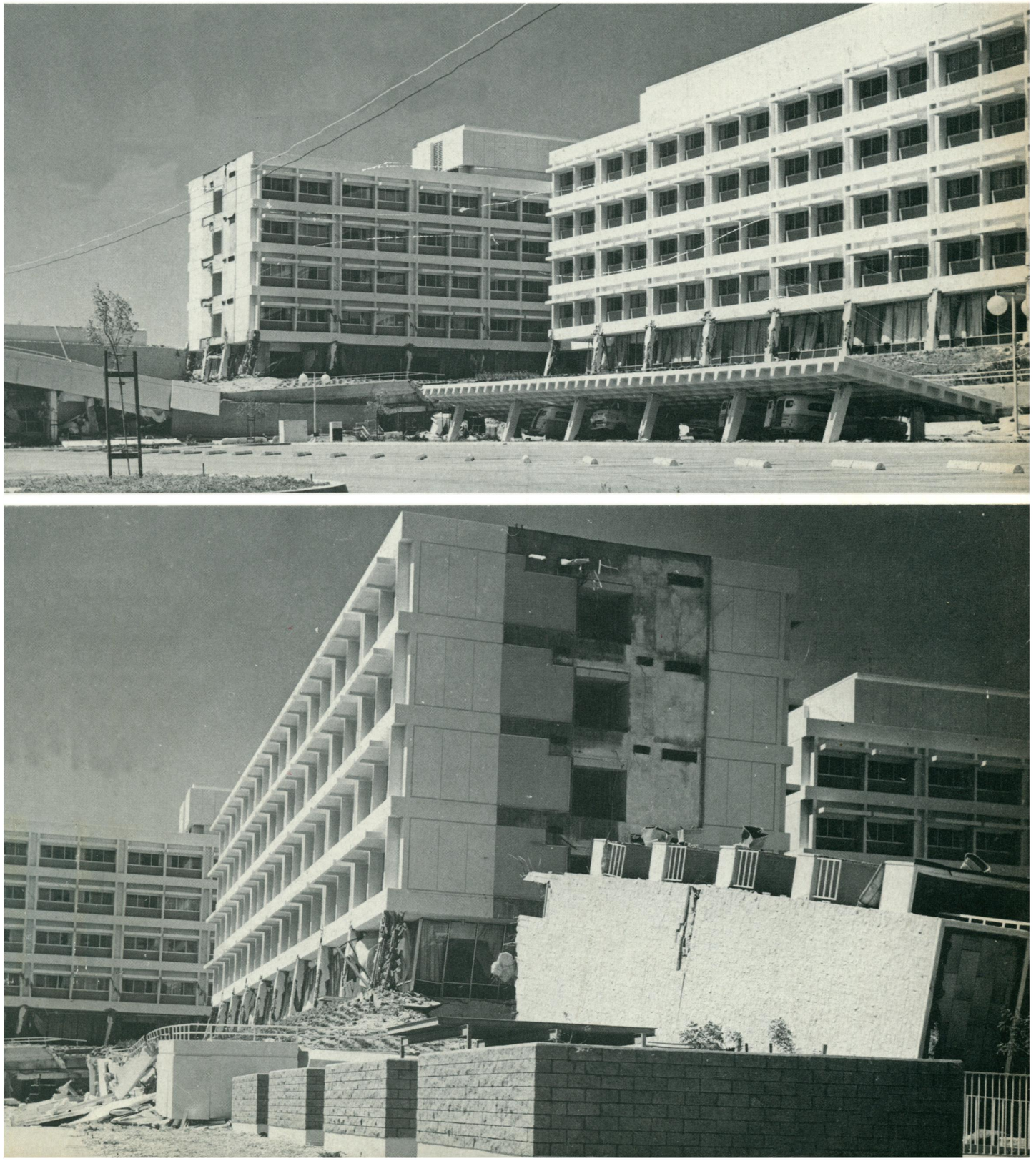
SCIENCE

22 August 1975

Volume 189, No. 4203

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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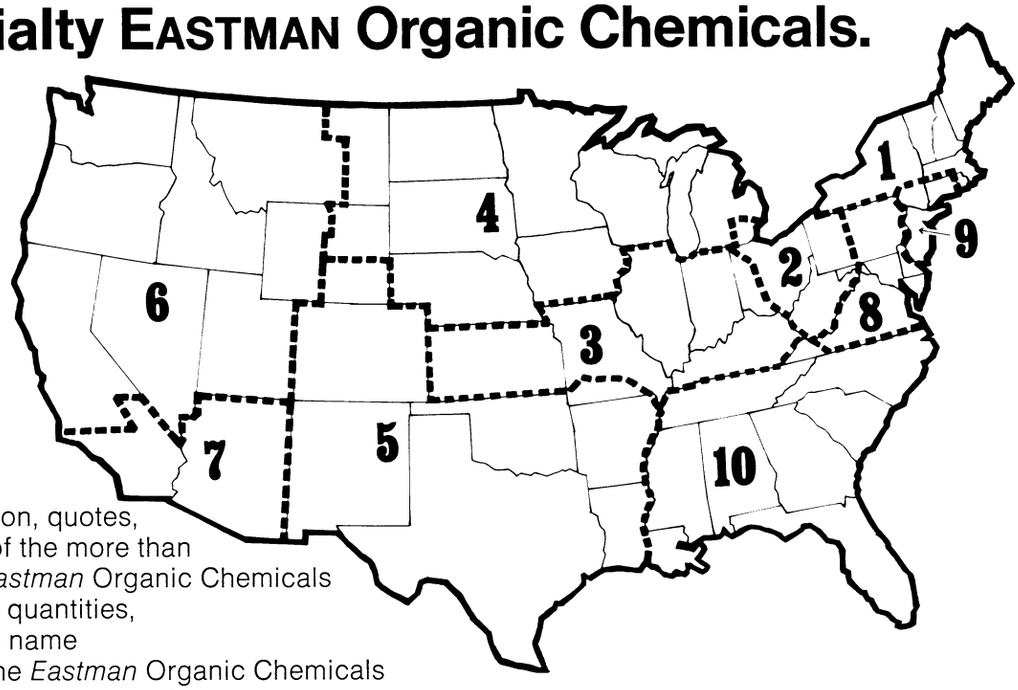

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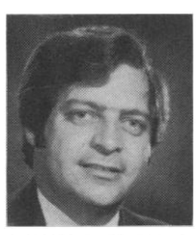

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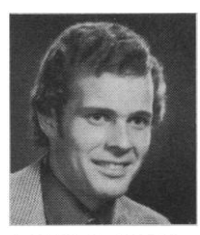

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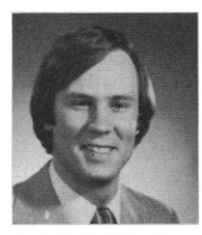

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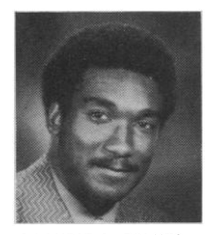

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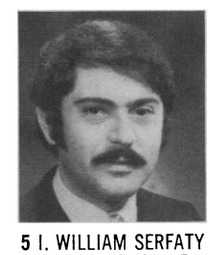

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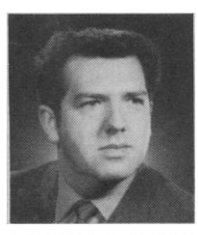

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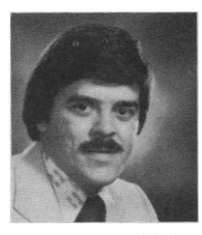

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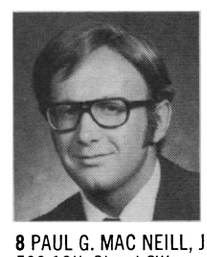

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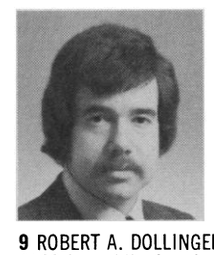

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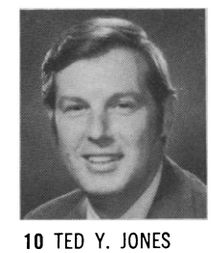

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Volume 189, No. 4203

SCIENCE

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COVER

Main building, Olive View Hospital, northern San Fernando Valley, California, after 6.6-magnitude earthquake of 9 February 1971. Building, which was designed in 1964 and completed in 1970, was damaged beyond repair and subsequently razed. Site was about 3 kilometers from causative fault. Damage included overturned stairwells at ends of building, severely damaged columns in first floor, and collapsed pergola on top of ambulances. See page 601. [Robert E. Wallace, U.S. Geological Survey, Menlo Park, California]

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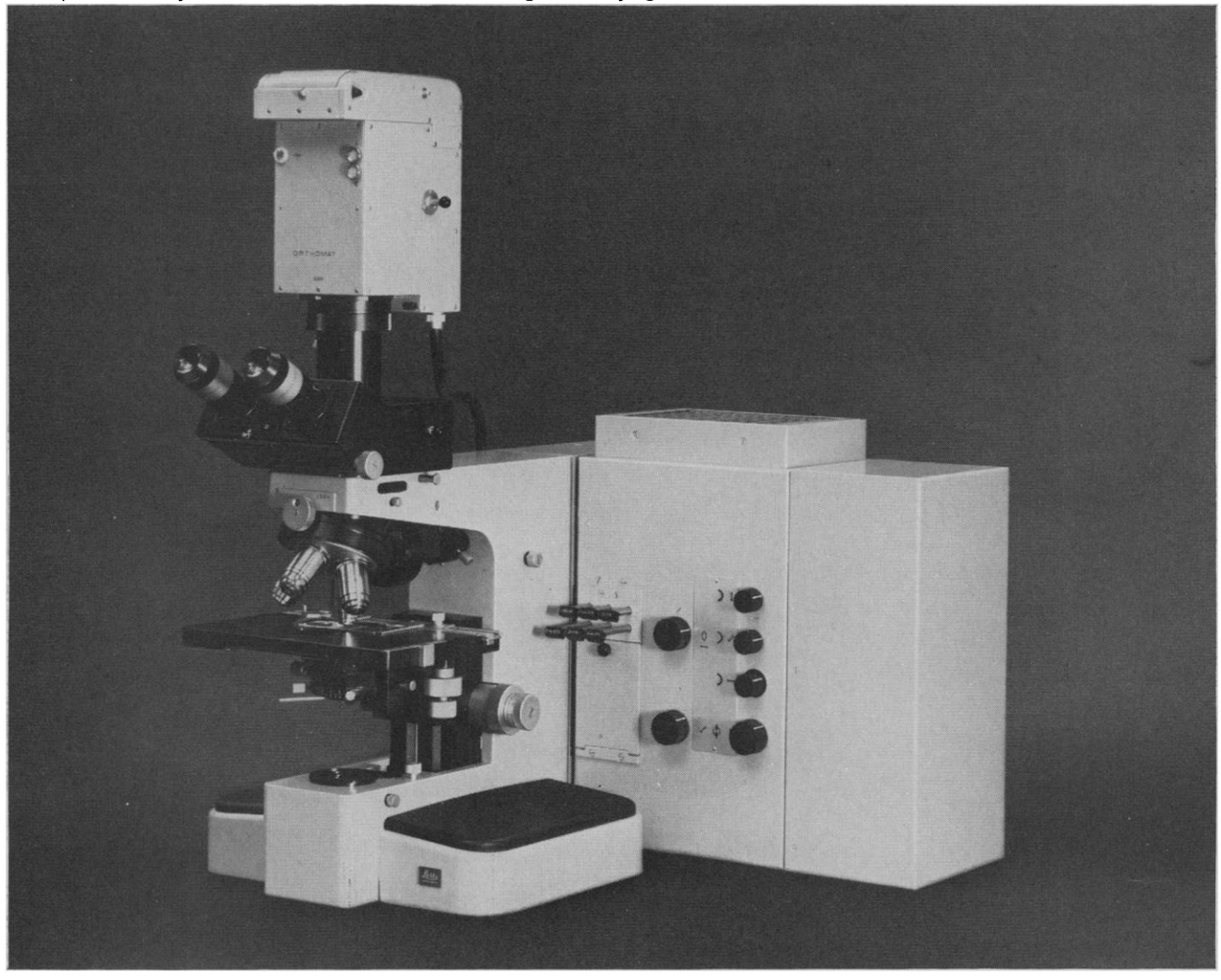

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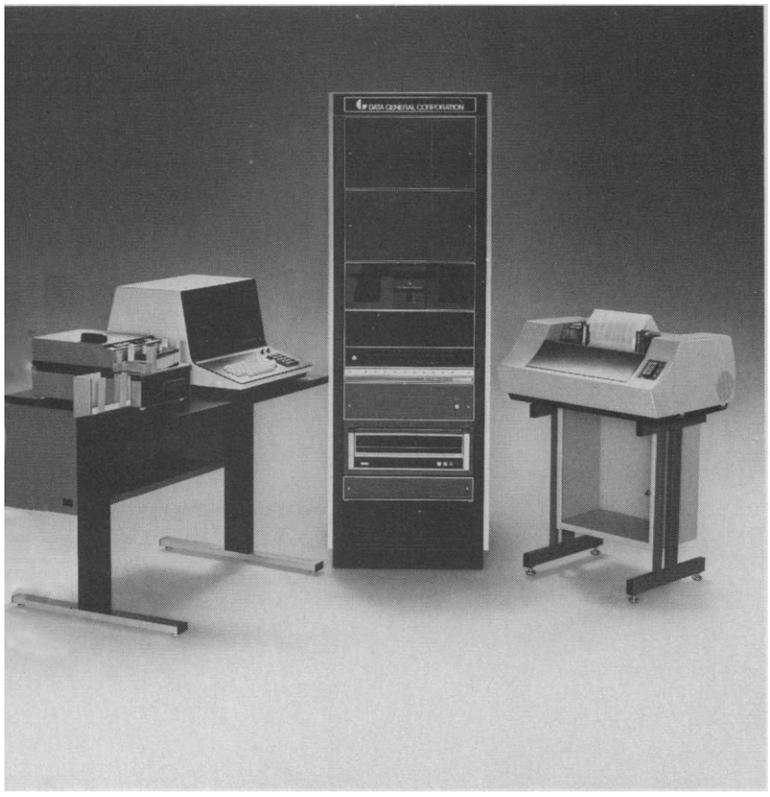

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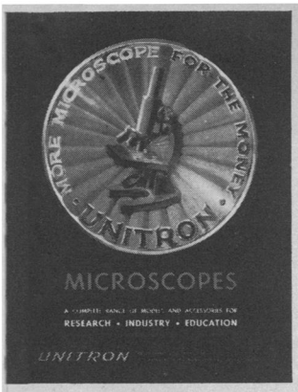

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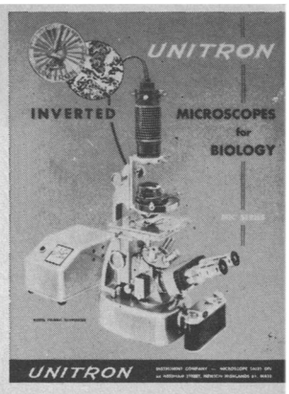

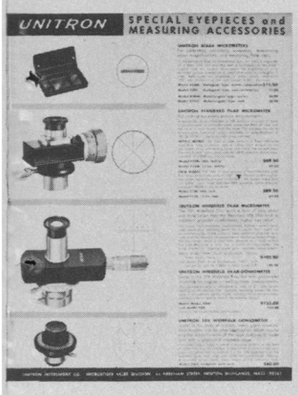

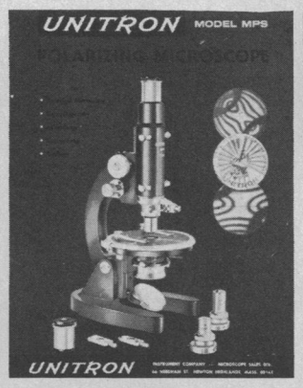

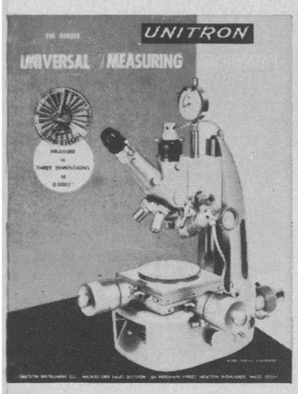

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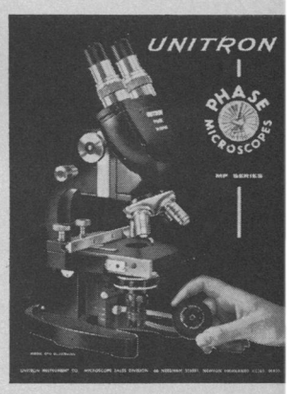

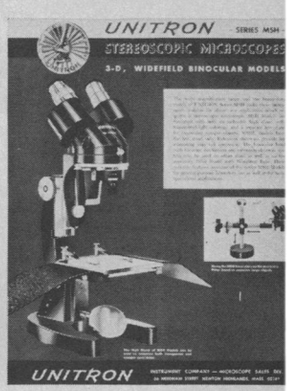

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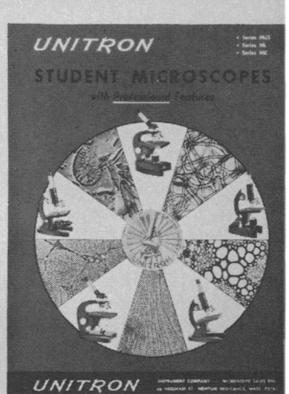

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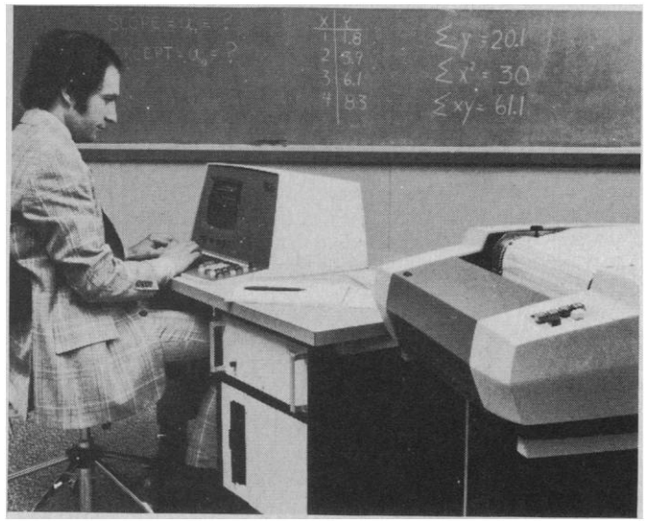

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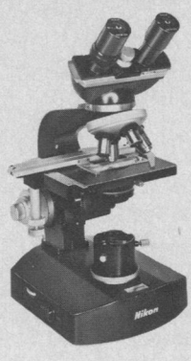

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constraints such as limited resources, disease, and predation serve to limit the growth of populations. Mitigation of constraints, as in the case of man, results in a population explosion, which, if unchecked, is certain to visit global catastrophe on the species.

I agree with Dare that an anthropocentric bias can be explained in scientific terms. However, my claim that man occupies a special place in the biosphere because of his ability to influence his own evolution toward the enhancement of value in the world and that an anthropocentric belief in the value, meaningfulness, and creative potential of the human phenomenon may be a necessary motivation for action to solve our crises is no more verifiable by the present data of science than the claim of others who deny man unique importance and advocate the abnegation of anthropocentrism in order to preserve and enhance "nature's values." I regard both positions presently as items of faith.

Rowe in his letter asserts: "the purpose of a species is to keep its ecosystem running smoothly." I maintain that in order to survive as a biological species we must preserve our life support system, but in addition, in order to survive as an evolving cultural entity, we must seek to preserve and to enhance values unique to the human species.

W. H. MURDY

Department of Biology, Emory University, Atlanta, Georgia 30322

Radioactive Waste Disposal

Recently we have become aware of the difficulties of storing or disposing of radioactive wastes from the world's nuclear power stations. Possible methods of disposal include elimination by nuclear transformation or disposal in space, salt and other geologic formations, the ocean bed, and the major ice sheets, particularly that of East Antarctica (*1*).

This last suggestion was considered in May 1973, by the Glaciology Panel of the Committee on Polar Research of the National Academy of Sciences, and later by the committee itself, which then conveyed to the Scientific Committee on Antarctic Research (SCAR) of the International Council of Scientific Unions, and to the International Commission on Snow and Ice (ICSI), "the urgent need to investigate thoroughly the geophysical basis for, the implications of, and any scientific basis for such an ice sheet disposal scheme, so that its feasibility can be evaluated. . . ." In September 1974, SCAR agreed on the urgency of investigating the environmental

implications of such schemes, pointing out that, although past research has already generated much valuable scientific information for these investigations, national committees should encourage governments to support further studies.

Concurrently, Battelle Northwest Laboratories has examined many possible disposal schemes (*2*). For disposal in the ice sheet, three main concepts were developed: (i) surface storage; (ii) anchored emplacement at a depth of 200 to 500 meters; and (iii) "melt-down," in which canisters containing radioactive material would melt through the ice sheet. These concepts, and the earlier one (*1*), were based on analyses by Budd, Jensen, and Radok (*3*). With extreme values for some parameters, their models predicted that in part of East Antarctica the ice sheet base was well below melting point and that the "residence time" for snow falling there was greater than 250,000 years—the time the waste must be isolated from the biosphere.

A meeting was held in Cambridge, England, on 25 September 1974, of representatives of ICSI, the SCAR Working Group on Glaciology, and the International Antarctic Glaciological Project, from eight countries (*4*). They determined that the primary requirement in any disposal concept is that the oceans and atmosphere must not be contaminated by the dissemination of radioactive wastes, including that initially contained in canisters if the canisters are not retrievable.

With present technology we cannot recover canisters that have sunk deep into the ice sheet, even if they remain intact; the recovery of "melted-down" material will always be more difficult than with the other concepts. The waste and canisters could be constructed with the same density as ice and, if aged to thermal inertness before emplacement, would follow flow lines, increasing their residence times. "Tethered-canisters" probably are retrievable unless the mooring system fails.

In the last 2 years, radio echo sounding has shown that many lakes underlie the East Antarctic ice sheet, and over extensive areas the base is melting. Water may flow from these areas to the oceans very quickly. The implications for ice sheet disposal are obvious.

The major question with all these concepts, however, is the ice sheet's durability. In the last 250,000 years northern ice sheets have come and gone, although the Antarctic ice sheet may have changed only 10 percent. Our knowledge of the mechanisms for initiation and disappearance of ice sheets and of future natural and man-made changes in climate and in geothermal flux is insufficient for long-range pre-

(Continued on page 658)

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SCIENCE

National Institutes of Health, Alma Mater

Hundreds of us came to the first alumni reunion of the National Institutes of Health because the NIH, more than any college or university, had profoundly shaped our scientific lives and because we were concerned for its future. It is an institution of such unique quality, and of such importance for the training of future generations of scientists and for the health and welfare of our society, that we must do everything possible to preserve its vigor.

The NIH has been recognized for its achievements in two areas: intramural research and guidance of extramural grants and training programs.

In the past 25 years no single institution has so dominated the journals of basic medical science, and some of these contributions have been of stellar magnitude. The extramural grants and training programs have been the single most important foundation for the biological revolution of the postwar period. Guided initially by NIH scientists, the peer review system for awarding grants and fellowships has administered tens of billions of dollars with a scrupulous regard for quality and without a hint of chicanery. I know of no government program of this magnitude with such a magnificent record.

Less recognized, but of equal rank with these two facets of NIH activities, is the training of scientists at the NIH. In the untrammeled setting of well-equipped, well-directed laboratories, several thousand young M.D.'s and Ph.D.'s were introduced to professional science. Some remained at the NIH. Some entered other government laboratories. But the vast majority left to staff research, clinical, and administrative departments throughout the world. Today they staff and, as professors, chairmen, and deans, direct the finest university departments and schools of basic medical science and clinical science. Today they are the clinicians in the leading hospitals, and the research directors of the foremost pharmaceutical companies. They bring a novel outlook from their training in basic biological and chemical sciences to the lecture hall, laboratory, bedside, and industry. The NIH is truly a National University of Health.

The reunion was convened not only to recall the past and present achievements of the NIH, but to express our concern for its future. Despite its superb record, and its dedication to science and the conquest of human disease, the NIH is being subjected to severe criticism. Unfortunately, the NIH has grown to a size that makes it vulnerable, although much of this growth was due to public health programs imposed upon it. The enlarged budget is an obvious target for budget cutting and for antiscience forces. As with all worthwhile things the struggle for survival is never won. This is even more true for support of science than for other institutions in society.

Funds for basic research by excellent scientists at the NIH and elsewhere have been cut at a time when inflation and advanced technology call for increases. It cannot be for reasons of sound economy. We invest in medical research only about 3 percent of the gross product of a $100 billion health industry. There is no industry based on technology today that spends less than 5 percent of its product on research and development.

The lifeline of medicine has been and will remain science and technology. When medicine grapples with the unknown, the art of witchcraft eventually supervenes. In the future, medicine must become more reliant on science and technology, not less so.

No one person or committee planned the extraordinary development of the NIH today. It is a serendipitous discovery. By chance and sagacity we have an institution of the greatest value for the health of our society. Had we had the good sense to develop national institutes of comparable stature in agriculture and energy resources, many of our present problems would be less serious. In the Bicentennial Year spirit let us celebrate and preserve the NIH as a great national institution.—ARTHUR KORNBERG, *Department of Biochemistry, Stanford University, Stanford, California 94305.*

Adapted from an address delivered at the first NIH alumni reunion, Bethesda, Maryland, 19 April 1975; the address was published in *Pharos* (July 1975).

PRODUCTS and MATERIALS

Liothyronine Assay Kits

This T-3 radioimmunoassay kit detects liothyronine in the range of 0 to 5 nanograms per milliliter. It requires as little as 50 microliters of serum per test. It is designed for minimum cross reactivity with T-4 (less than 0.2 percent). Four freeze-dried human serum standards are provided with each kit. Kits also include all reagents, racks, disposable tubes, and caps. Amersham/Searle. Circle 864.

Electrocardiograph

The HP 1517A is mobile and it records on perforated scratch-resistant matte paper. The paper separates into $8\frac{1}{2}$ by 11 inch pages for easy filing and reference. The unit records from 12 leads on either 40- or 50-millimeter channels. All lead sets are identified as they are recorded. The unit is protected from defibrillation impulses and has isolated inputs to further protect the patient. Hewlett-Packard Medical Products Group. Circle 858.

Blood Analyzer

The Colysagraph (Fig. 1) can be used for any test in which fibrogen is converted to fibrin or in which another indicator substance alters its optical density. It uses a program recorder and circular charting system in which the chart is divided into three time-base sectors that are aligned with the chart-speed program. Other features include no reagent restrictions, automatic base-line zero, coagulation and aggregation modes, magnetic stirring for aggregation tests, and a procedures manual. Damon/IEC. Circle 860.

Transferrin Quantitation

The Trans-QUIPlate is designed for radial immunodiffusion analysis in the detection of atransferrinemia, nephrotic disease, protein-losing conditions, hypoproteinemia, and chronic iron-deficiency anemia. The kits detect in the normal range of 200 to 300 milligrams of serum transferrin per deciliter and a total range of 110 to 440 milligrams per deciliter for abnormal conditions. Each system consists of five ten-well plates, reference standards, instructions, graph paper, and a quality control data sheet. Helena Laboratories. Circle 869.

Interactive Student Terminals

A new hybrid computer terminal system permits students with no computing experience to learn to solve simulation problems. An existing computer can be programmed with specific problems. Input-output is controlled by the student from an alphanumeric-graphic terminal. Speed is such that response time for 16 terminals is no more than 0.3 or 0.4 second with five or six times as many students per terminal as can be accommodated with a digital-only system. Electronic Associates. Circle 861.

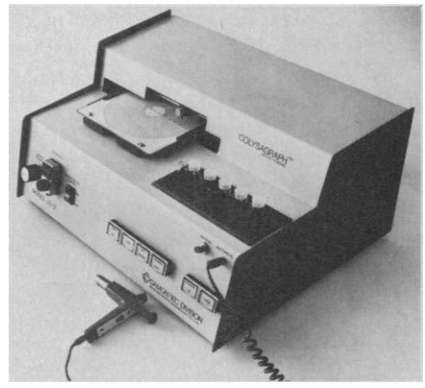

Fig. 1. The Colysagraph from Damon/IEC combines the functions of coagulation timer and aggregometers to perform fibrinolysis, coagulation, and platelet aggregation analyses.

Single Cell Culture Dish

Tissue culture dishes are available for single cell isolation. The dish is well suited for cloning procedures. It is made from injection-molded polystyrene for optical clarity, distortion-free surface, and accurate dimensions. Surfaces are treated for optimum cell attachment and growth. Cosar. Circle 868.

Nephelometer

The model 400 nephelometer and test procedures will perform lipase determinations in 5 minutes and amylase determinations in 10 minutes. These tests have a high degree of correlation with standard methods with a smaller coefficient of variation than manual testing. Other tests that may be performed are triglycerides, fibrinogen, and protein determinations. Volu-Sol. Circle 865.

Blood Gas Analyzer

Model 175 is fully automated and includes a self-diagnostic feature to indicate malfunctions to the operator. It measures *p*H and partial pressure of oxygen and carbon dioxide. Those values are then used to calculate base excess, bicarbonate, oxygen content, and saturation. It conducts a one-point calibration every 30 seconds and a two-point procedure every 2 hours. Routine throughput is 18 to 22 samples per hour. Corning Instruments. Circle 859.

Radiation Dose Calibrator

Model 888 features a plastic scintillator detector to measure the activity of gamma- and/or beta-emitting isotopes. It is adaptable to use with small samples. It reads from 0.1 to 999 microcuries. Six isotope modules are supplied with each calibrator and other modules are available. The detector may be operated away from the instrument to protect the operator. The detector is unaffected by temperature, humidity, or air pressure. Victoreen Instrument. Circle 867.

Patient Monitoring

The HP 5600A system will monitor up to 32 patients simultaneously, keep records of up to 99 patients on file, and display stored information on up to 16 local or remote terminals. Vital signs and results of laboratory tests as well as staff notes, fluid balance results, medication records, and

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Newly offered instrumentation, apparatus, and laboratory materials of interest to researchers in all disciplines in academic, industrial, and government organizations are featured in this space. Emphasis is given to purpose, chief characteristics, and availability of products and materials. Endorsement by *Science* or AAAS is not implied. Additional information may be obtained from the manufacturers or suppliers named by circling the appropriate number on the Readers' Service Card (on pages 598A and 654A) and placing it in the mailbox. Postage is free.—RICHARD G. SOMMER

other data may be treated. Up to 256 vital sign signals may be recorded with bedside apparatus and logged at precise intervals by the system. Hewlett-Packard Medical Electronics Group. Circle 870.

Blood Analysis Photometer

Model 370 (Fig 2). is a filter photometer that includes a 37° and a 100°C incubator. Seventeen blood chemistry tests are available for use with the device. Each test requires a single pipetting. Sample is placed in a cuvette and a reagent module is added to the cuvette. After color develops the cuvette is read in the serometer and the readout is compared to a reference chart. Mallinckrodt. Circle 872.

Urinary Sediment Stain

Cyto-Diachrome is a supravital diagnostic stain for urinary sediments. It consists of copper-phthalocyanine, a blue dye, and pyronin-B, a red dye. Benign and malignant cells, casts, and inclusions are stained differentially. Cyto-Diachrome facilitates identification of leukocytes, erythrocytes, and epithelial cells. Staining is rapid enough for use in routine screening applications. Sufficient stain for 325 determinations is provided in each 12.5-milliliter bottle. Regis Chemical. Circle 871.

Urinalysis System

Uricult simplifies urinary tract infection screening procedures. Test paddles are integral with caps on sterile capsules. The user opens the capsule, dips the paddle in a sample, allows the excess to run off, and returns the paddle to the capsule. The capsule incubates for 24 hours and bacterial colony density is estimated from a reference chart. Each paddle has two media, one on each side, and six media combinations are available. Corning Diagnostics. Circle 866.

Electrophoresis Cell

The 82-100 is suitable for gel electrophoresis with polyacrylamide, agarose, Sephadex, starch gel, and others. It features simultaneous rapid scanning of separations in six gels of different composition. The cell accommodates slabs 120 by 200 millimeters with thicknesses from 1.5 to 5 millimeters. It is suitable for preparative applications. The cell is tap-water cooled and is constructed mainly of acrylic plastics. Camag. Circle 863.

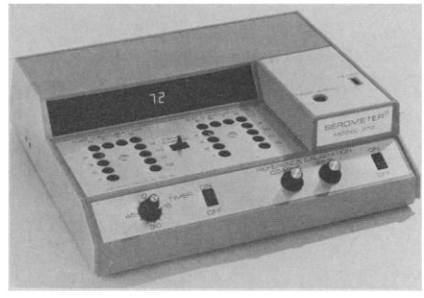

Fig. 2. Mallinckrodt's serometer model 370 features two integral incubators and provides temperature data along with blood chemistry results.

Hand-Held Programmable Calculator

The FX-20 is an eight-digit device that will operate up to 20 hours on two penlight batteries; it will also operate on line current. It features an independent memory (MR, MC, and M+). It performs trigonometric functions, inverse trig functions, common and neutral logarithms, raising to powers, square roots, exponentiation, and sign change. It also has a sexagesimal-decimal conversion key, a full floating point decimal system, and zero suppression. Casio. Circle 862.

Literature

Subsurface Monitors are sensitive listening devices with a variety of applications in fields as diverse as marine biology and earth science. Geophysical Instrument and Supply. Circle 857.

Petri-Scan is a bacterial counter featured in a four-page brochure. American Instrument. Circle 873.

Thin-layer Plates and Supplies are treated in a catalog. Kontes. Circle 874.

Newscan is a periodic newsletter about scientific instrumentation. DuPont Instrument Products. Circle 875.

New-Tron is a nuclear products application bulletin. Reactor Experiments. Circle 876.

Biochemical Catalog Summer '75 lists products for research and chemical uses. Calbiochem. Circle 877.

Liquid Chromatography includes packing materials and packed columns. Waters Associates. Circle 878.

Insight describes techniques and instrumentation for electron microscopy and microanalysis. McCrone. Circle 879.

Biochemicals Reference Guide catalogs more than 1300 compounds including chromatography media and many others. P-L Biochemicals. Circle 880.

Optical Products includes devices for activities involving light from ultraviolet to infrared. Oriel of America. Circle 881.

LETTERS

(Continued from page 597)

dictions. For East Antarctica, the most stable ice sheet, it may be feasible to predict for 10^4 years, but not for 10^5 years, which is comparable to the longest residence times. For the Greenland and West Antarctic ice sheets, with shorter residence times, our ability to predict is correspondingly reduced. Furthermore, these statements relate to steady-state conditions and neglect the possibilities that the ice sheets could surge.

The Cambridge meeting thus reached three conclusions:

1) The Antarctic ice sheet is not a suitable site for the disposal of radioactive wastes that need to be isolated from the biosphere for periods of several hundred thousand years.

2) Over the last 20 years or so, theoretical and observational studies of the Antarctic and Greenland ice sheets have allowed us to build up an understanding of the basic physics of ice sheets sufficient to go some way toward answering the glaciological questions posed by the proposal to use the ice sheets as disposal sites.

At this stage, the efforts of the glaciological community should continue to be directed toward a better understanding of the basic physics and thermodynamics of ice sheets. Such an understanding is essential before any profitable consideration can be made of applied problems such as those that would be associated with nuclear waste disposal.

3) Even a complete understanding of the behavior of the ice sheet with respect to the present boundary conditions, including climate, geothermal flux, and sea level, is insufficient to allow the precise determination of the ice sheet's future. For that we need a corresponding knowledge of the future changes in boundary conditions.

COLIN BULL

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2. *High-level Radioactive Waste Management Alternatives* (Report No. WASH-1297, National Technical Information Service, Springfield, Va., 1974); *Ice Sheet Disposal* (Report No. BNWL-1900, National Technical Information Service, Springfield, Va., 1974), sect. 5.
3. W. F. Budd, D. Jenssen, U. Radok, *Derived Physical Characteristics of the Antarctic Ice Sheet* (Publ. No. 18, Meteorology Department, University of Melbourne, Melbourne, Australia, 1971).
4. The participants in the meeting were Charles R. Bentley, United States; William Budd, Australia; Colin Bull, United States (secretary); Rene E. Dalinger and advisers, Argentina; Vladimir Kotlyakov, U.S.S.R.; Kou Kusunoki, Japan; Claude Lorius, France; John Nye, United Kingdom; Olav Orheim, Norway; Gordon de Q. Robin, United Kingdom (chairman); Charles Swithinbank, United Kingdom; Jean Vaugelade, France; and Edward J. Zeller, United States (invited guest).

RESEARCH NEWS

(Continued from page 626)

tween real and randomly generated systems. He discovered that real clades of shallow water marine invertebrates that originated in the Cambrian and Ordovician periods differ from randomly generated clades. These clades fill up more quickly with species and die out more slowly than the random clades. However, during these periods, which occurred early in geological history, the earth was filling up with species. After the Ordovician, during the Silurian period, all major taxonomic groups were established and no new phyla originated. At this time, presumably, species diversity could have reached equilibrium. Gould found that the clade shapes for shallow water marine invertebrates during and after the Silurian resembled those of the randomly generated clades.

Not all investigators accept the models and conclusions drawn by Raup, Gould, Schopf, and Simberloff. Arthur Boucot of Oregon State University, for example, thinks the models are too simple. They are "clever, polished, but of limited use," he says. Randomness in evolution is not unexpected, Boucot points out. And major geological events, such as climactic changes, are correlated with major evolutionary events, such as massive species diversifications and extinctions. However, such correlations are not considered in the models that treat all species and all geological times alike.

Another criticism of the stochastic models of evolution is voiced by Karl Flessa and Jeffrey Levinton of the State University of New York at Stony Brook. These investigators used the independent statistical techniques of factor analysis and the runs test to argue that the originations of various taxa in the real world did not occur at random and that there are nonrandom patterns of taxonomic diversity in the fossil record. In other words, they believe that many of the patterns in the fossil record could not have been randomly generated. Gould and Schopf, however, are not convinced that Flessa and Levinton have demonstrated patterns above and beyond those that could be derived from random processes.

Although equilibrium models in paleobiology are still a new concept, Schopf believes that they are leading to a revitalization of that field. Investigators devoted the past century to studying the histories of individual species, but were unable to solve some major problems. Now that a new conceptual framework has been introduced, says Schopf, "it will be fun to see where things go."—GINA BARI KOLATA

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(Continued from page 630)

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