SCIENCE

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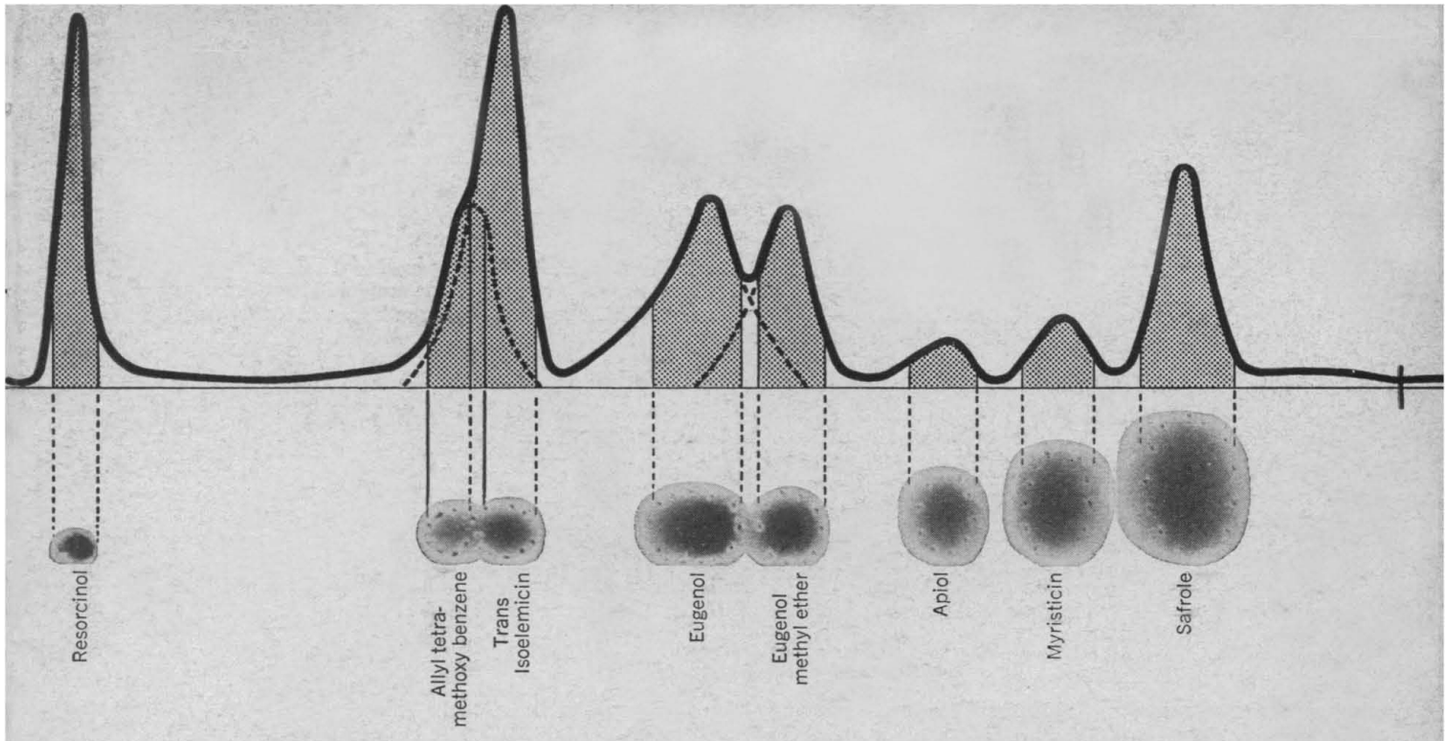

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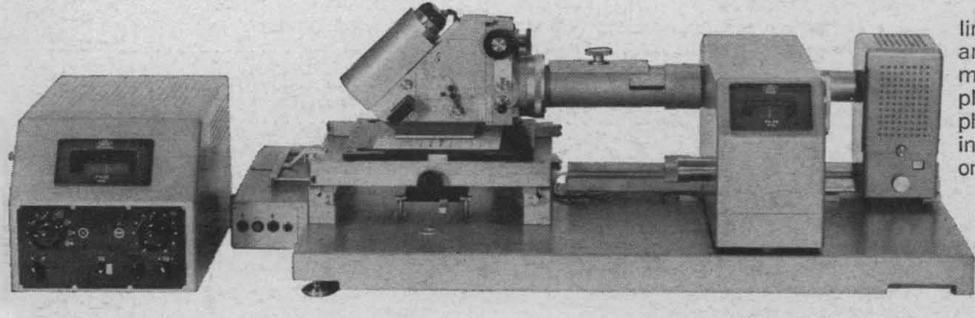

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COVER

Glaucilla (buoyed up by bubbles of air gulped into the stomachs) floating in the usual manner, upside down near the seawater surface. See page 1532. [J. Myers]

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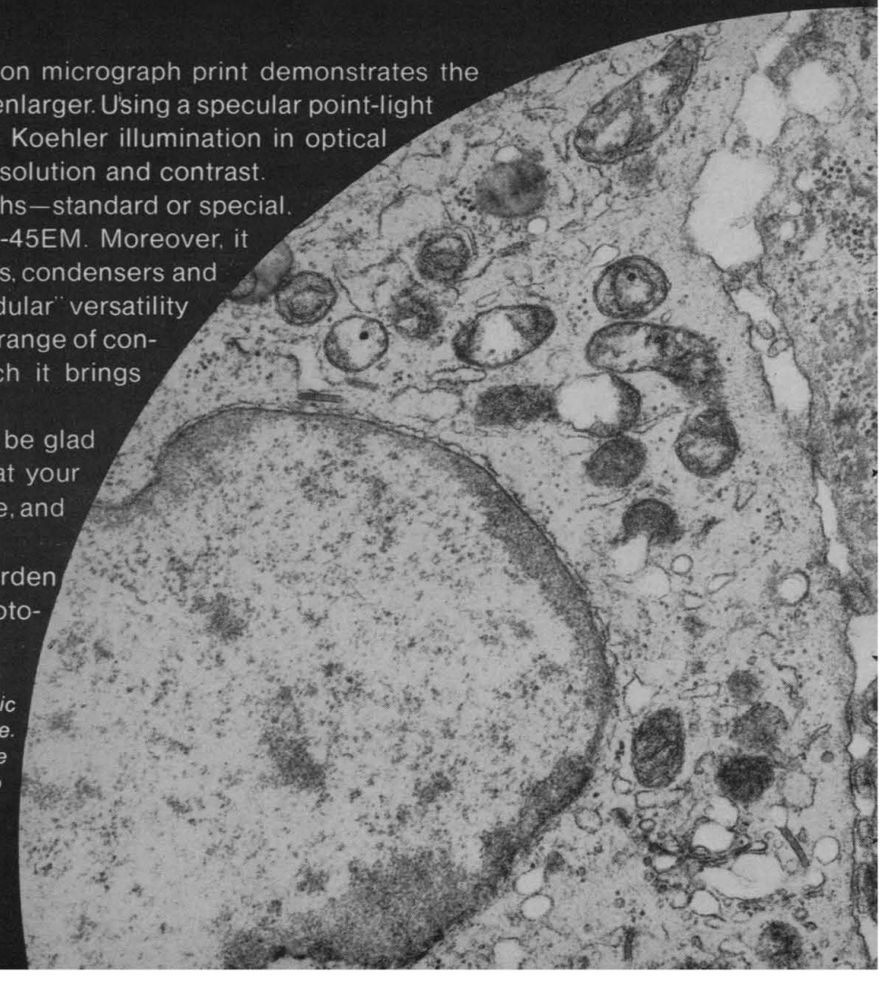

Section of human epidermis taken from a site of allergic eczematous contact dermatitis due to mercuric chloride. Parts of a Langerhans cell and of a keratinocyte are shown. Photographed at 6,000x in a Siemens Elmiskop 1 A electron microscope; enlarged to 16,000x with a Durst S-45EM.

(Courtesy of Dr. Inga Silberberg, New York University School of Medicine, Department of Dermatology).

plants. The burning of fossil fuel pollutes the atmosphere; even if the solids are removed from the smoke, gaseous pollutants escape. Nuclear and fossil fuel plants liberate tremendous amounts of heat, either via cooling water discharge or cooling towers. Air pollution control authorities are quite concerned about the long-term effects of heating the atmosphere with cooling towers. Thus all known economical forms of large-scale power generation pollute the environment in one form or another. . . . If the demand for energy exceeds the supply, then the supply must be rationed, either through the existing free enterprise price system, or by regulation if serious inequities arise. I believe that "cheap and plentiful" electrical energy is a luxury our environment can no longer tolerate. This of course implies a slowdown and eventual stoppage of expansion in some industrial and domestic power consumption. . . .

THOMAS C. WESTON
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Angel makes three points, the first two of which are essentially straw men he has set up. Thus, there is no basis for his presumption that I consider the impending catastrophe is worse than continued air pollution. Although he chides me for stating that the public is too concerned about the environmental impact of industrial operations, what I said was "this concern has solid basis, and in the long run can prove to be socially beneficial." Finally, he cites in condemnation of the whole power industry the proposal of his local utility—which represents one-half of 1 percent of the industry—to carry out the raising of a power dam of dubious validity. This discussion of his particular local peeve has little bearing on the broad subject of the editorial.

Although Berkowitz says I give first priority to creating no obstacles in the way of providing adequate energy, he neglects an earlier statement in which I said, "A major effort is called for to make possible continuing and expanding use of energy by man and to assure compatibility of this energy with a healthy environment." In my book this ranks the two in a parallel effort, with neither given precedence. His particular straw man raises the specter of unlimited growth of power generation and energy release desired by man. But why unlimited growth? I suggested a continuing and expanding use, but not necessarily at the present rate. Certainly with time, and this may not be so far off, saturation factors will make themselves felt in the demand for energy.

I thoroughly agree with Frank that "what is needed is reasoned assessment of the options that are open and their consequences, to the extent that they can be foreseen. . . ." As to veiled threats, I believe that if the opposition to expanding electric energy supply continues we are going to bring about a catastrophic situation because it will result in an energy shortage and a disruption of our industrial production and, in general, adverse consequences to an economy that is currently bedeviled by a galloping inflation, one of the cures for which is continued and expanding production. I disagree with his singling out the rate of growth of energy use as the cause for alarm. It seems to me that the issue is a double one. We need to be concerned from the pollution standpoint with the absolute amount of energy we produce and also with the rate of growth. Certainly as long as our population continues to increase, we need to expand our energy use so that the coming generations will at least have the same amount of energy per capita to build as good a living world for themselves as the current generations have. Regardless of what Frank's local utility may think, I do not believe we are headed toward an unlimited expansion of energy at the rate of doubling every 6 years. Such a rate continued for the next 60 years would result in increasing the amount of energy a thousand-fold, and well before it has reached 1 percent of that value there are certainly going to be introduced into the growth factors heavy saturation influences.

Finally, I do not agree that our choice is between different catastrophes. I believe we have a choice, but it is between permitting the development of a catastrophic situation and finding how to bring about full compatibility between man's requirements for expanding use of energy and its production and use in a healthy environment.

I am heartened by the communications of Emerson and Walter and their plea for population control. In a recent report of the Committee for Economic Development on a program of assistance to underdeveloped countries, I stated that "the overwhelmingly most important item is population con-

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trol; without it all the potential effectiveness of an intelligent and generous aid program will be wiped out." I am not certain that population control is as immediately pressing in the United States as it is in the underdeveloped countries, but that we have to embrace population controls to solve the problems of exhausting resources, pollution, transportation, and general ecological balance I am firmly convinced.

I find the final part of Weston's statement very hard to take. Our problem is to expand supply to meet any demand in the interest of enhancing man's and society's welfare. This includes compatibility with a healthy environment. Weston's ex cathedra judgment that "cheap and plentiful" electrical energy is a luxury our environment can no longer tolerate is most certainly not based on facts heretofore disclosed and is far, far premature. I stand on the conclusion given in the final two sentences of my editorial: "Neither is there any need to doubt the feasibility of obtaining both increased energy for man and environmental protection. It may be difficult, but the two are, or can be made, compatible."

PHILIP SPORN
140 Broadway, New York 10005

Environmental Problems

Many believe that scientists concerned about the alarming and accelerating deterioration of our environment can do very little personally about these enormous problems. This viewpoint is dangerous because it leads to inaction and misleading because one cannot predict effectiveness. Biologists are especially qualified by training and knowledge to evaluate dangers to health and well-being. We have the right and responsibility to try to influence the public and government.

To provide effective channels for communication, I propose the establishment of a series of permanent commissions (composed of commissioners with 3- to 5-year appointments), each assigned to deal with one area of human ecology and public health—such as radiation hazards, new methods of contraception, the impact of chemical and biological warfare on public health, pollution, conservation of natural resources, novel sources of food, man-made changes in ecological patterns, toxic additives in food and drugs, and medical ethics. These commissions would publicize problems in their areas and develop positive innovative measures. Unlike the committees of the National Academy of Sciences, they would be autonomous and permanent and would have great independence and influence, even though their functions would be fact-finding and informational in nature. Selection of commissioners, experts in their fields, would be by their peers, perhaps by the various professional societies. Commissioners would be expected to devote considerable time to this activity, including public lecturing, contact with congressmen and other government officials, the press and television, with some research activity within the framework of the commission.

The importance of establishing permanent commissions should be stressed. Continuity would be improved if a permanent secretariat were provided to assist each commissioner. It is hoped that the modest costs could be borne by the participating professional societies, with perhaps an additional direct contribution from individual scientists.

Many of these problems do not stop at national boundaries. A plan for an international center for the environment to include 14 areas of concern is being considered by the International Council of Scientific Unions. It is very important that the United States participate fully in that program. The commissions clearly could provide a well-developed base from which to coordinate activities.

RUTH SAGER
Department of Biological Sciences, Hunter College, 695 Park Avenue, New York 10021

Venus: A Joint U.S.–U.S.S.R. Exploration Program

In their comprehensive article, Hunten and Goody (26 Sept., p. 1317) make a strong case for a more ambitious program of exploring Venus. The study of the earth's "sister" planet holds great promise toward understanding the origin and evolution of the earth's atmosphere, and the two planets are similar in size and distance from the sun, but the question persists—why does the earth not have a hot, dense atmosphere as Venus does?

The exploration of Venus may have another very important tangible benefit to mankind. It could serve as the object of a cooperative planetary ex-

ploration program carried out jointly by the United States and the Soviet Union. The U.S.S.R. has clearly demonstrated their interest in the exploration of Venus through the launching of the Venera series of spacecraft with the highly successful probes of the Venus atmosphere by Veneras 4, 5, and 6. They have used large resources in the development of the technology necessary to penetrate a planetary atmosphere. We have invested our planetary exploration resources toward the development of the Mariner-class spacecraft which will reach its culmination in the 1971 Mars orbiters.

A wise use of the resources of the two countries would be to conduct a coordinated exploration of Venus, each using the technology that they have developed—the U.S.S.R. the atmospheric probe, and the United States the planetary orbiter. An exchange of ideas between the two countries would produce complementary experiments in the two types of vehicles. Some atmospheric properties can only be completely defined by having one probe enter the atmosphere while the other orbits above. As each country conducts its own mission in coordination with the other's mission, a spirit of competitiveness and cooperation will be fostered that could serve as a model for other international activities.

CHARLES A. BARTH
Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder 80302

Where Are the Jobs?

I agree with Bryce Nelson's statement (31 Oct., p. 584) that "it is impossible to ascertain future need for scientists if there is no clear idea of what is happening now to recent graduates." In connection with my new book *Opportunities in Oceanographic Careers* (Vocational Guidance Manuals), I found it impossible to find any reliable figures on manpower needs for the next decade, not to mention present employment. I second Nelson's suggestion that the federal government (perhaps the National Science Foundation) might assume the task of accumulating data on the supply-demand situation for scientific manpower.

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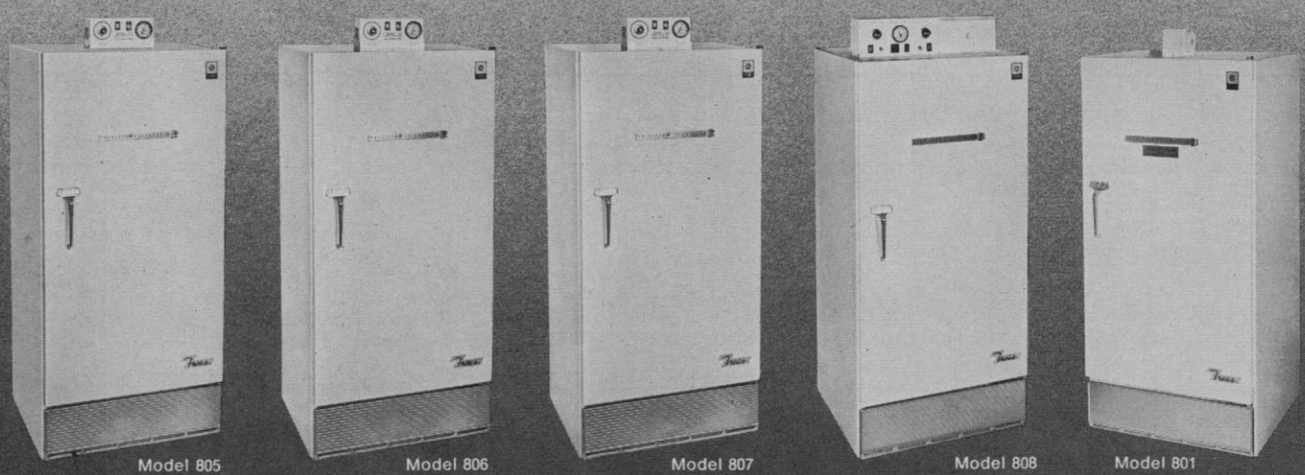

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19 December 1969, Volume 166, Number 3912 **SCIENCE**

Confrontation or Cooperation in the Cornfield

Two different projections are being made concerning the prospect of global hunger. The more gloomy views suggest that massive starvation is probably unavoidable before the end of this century. The more optimistic views, derived from several recent agricultural successes, imply that massive increases in starvation might be neither necessary nor probable. My knowledge in this area is very imperfect, but the data I've seen inspire little optimism. However, if the recommended agricultural strategies continue to focus on ever larger areas of the earth's surface converted to narrow, intensive approaches for maximizing food production and continue to ignore broader ecosystem relationships, we are bound to seriously aggravate the later stages of the "people-food crunch," whatever its magnitude.

The past few decades of agricultural development have made possible increased yields, greater uniformity in the marketed products, and lower unit costs. However, it now becomes clear that the bookkeeping on agricultural production is artificial. Sizable sums have been palmed off on the world at large and do not enter the ledger as part of production costs: these include pollution and other degradative processes which re-emerge as medical bills, more rapid deterioration of property, increased costs for recreation and other goods and services, as well as general lowering of some aspects of environmental quality. Calling attention to this bogus bookkeeping has triggered a loud response from the more blatant polluters. They insist that their critics want a totally unattainable return to pristine presettlement conditions; i.e., some polluters apparently recognize no alternative to the accelerating degradation currently being perpetrated.

In no small measure the restlessness among thoughtful people—including many college students—is aggravated by a growing awareness of this ultimately lethal flaw in our technology. The cynicism displayed by many polluters, including some in agriculture, who have fought governmental regulation while abdicating self-regulation, warns of the increasing role these issues could play when the Vietnam war no longer mesmerizes the nation's activists.

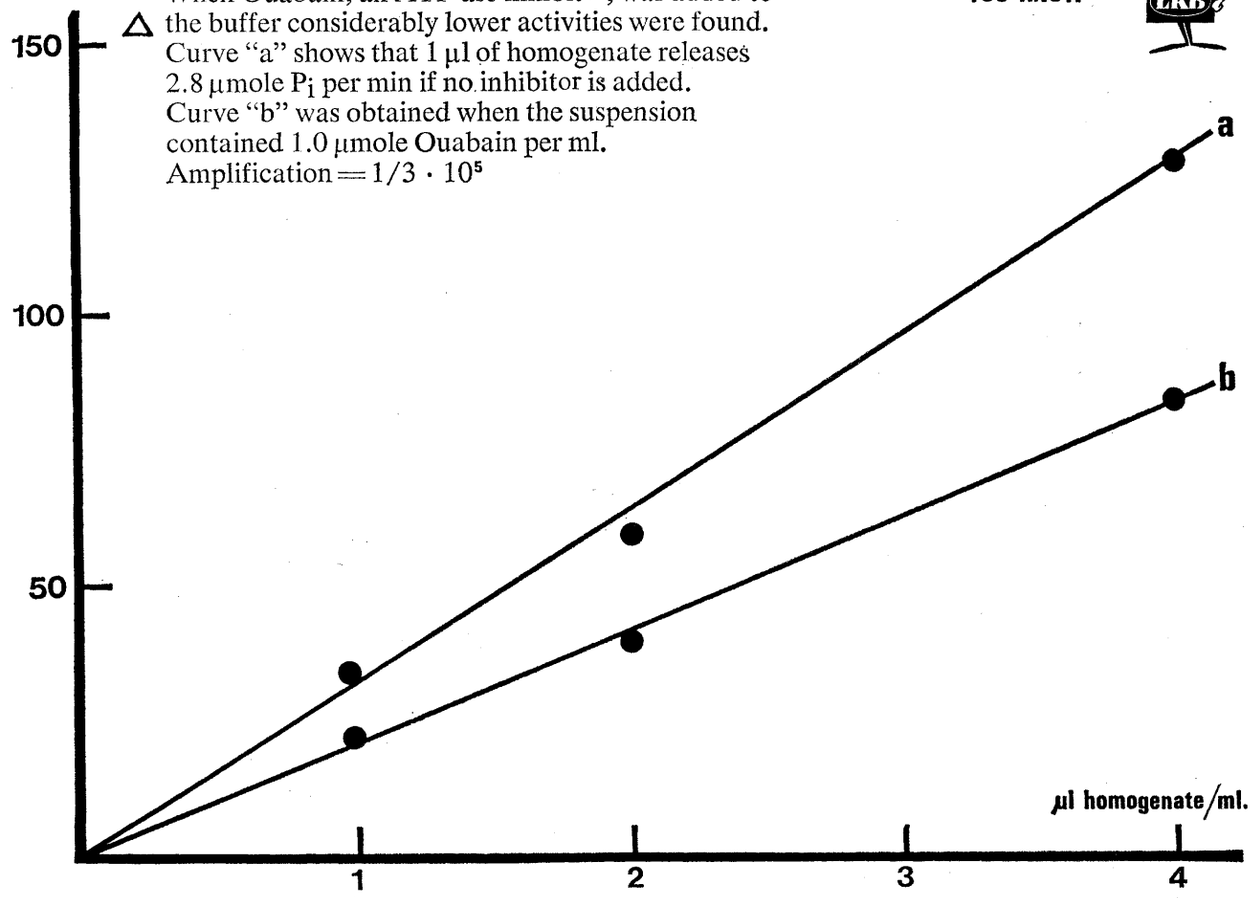
The foreseeable demand for improved food production should result in increased prestige for the profession. But turning agricultural graduates loose on the world without sensitizing them to the larger environmental problems or to the serious flaws in many narrowly specialized strategies for maximizing food yields and profits must end. There are encouraging signs that required curricula are indeed being altered to include a broad environmental viewpoint. For their part, more ecologists might assume the responsibility of illuminating ecological principles as they apply to agriculture.

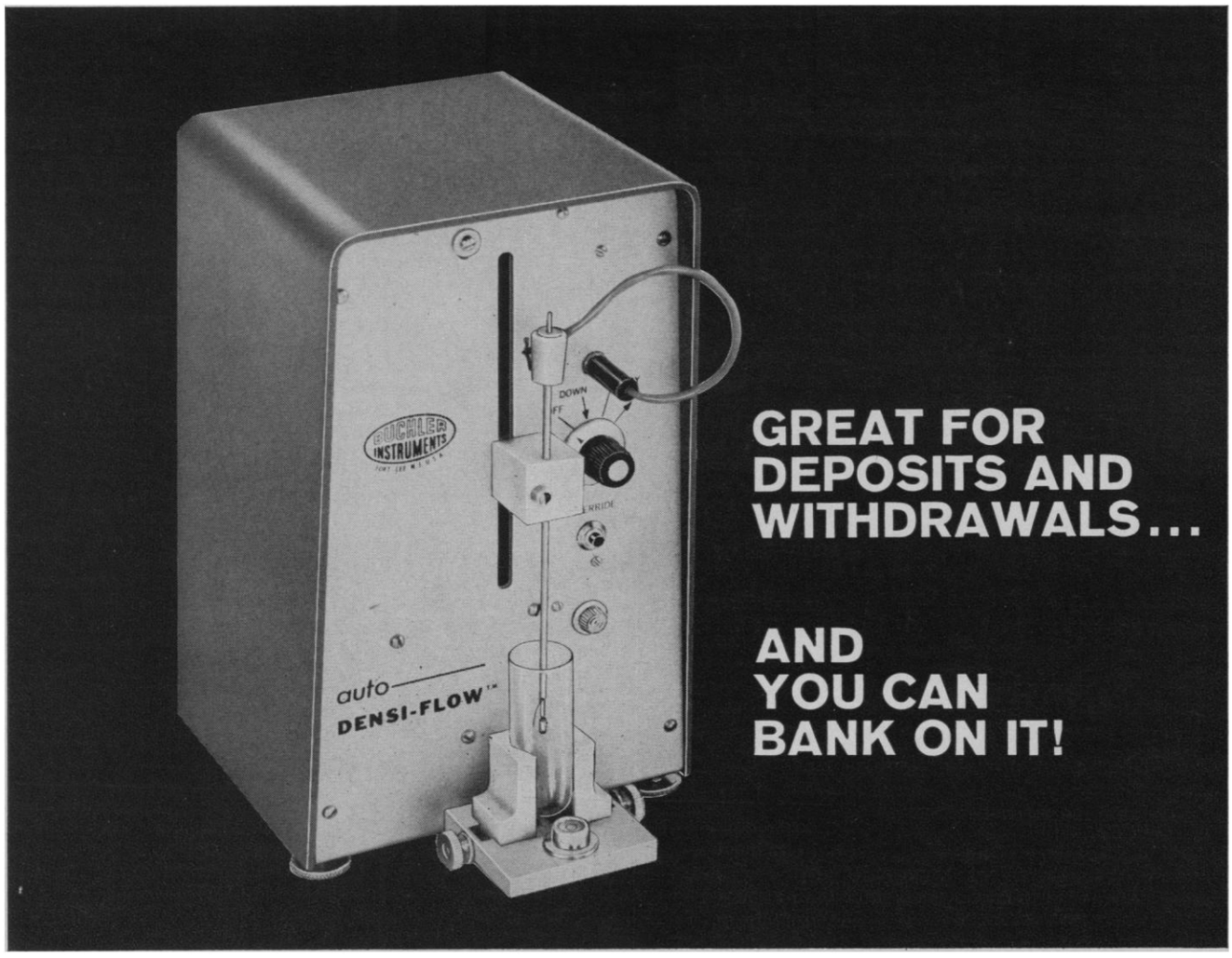
But change is difficult, slow, dependent on strong motivation and on financial support. As the hidden costs of narrow management strategies, largely spawned on our campuses, become more apparent, will agricultural programs become subject to the kind of ridicule and protest currently being heaped on academics conducting research for narrow military ends? Three-way communication seems required among (i) those concerned with designing tomorrow's food production technologies, (ii) those concerned with studying the earth's ecosystems and the presently unutilized species in natural communities, and (iii) those concerned with the value systems in our many different cultures. The sooner sound cooperation begins, the better our chances for escaping a wasteful confrontation.—JOHN E. CANTLON, *Provost, Michigan State University.*

This editorial is reprinted from *Ecology* **50**, No. 4 (1969).

Microcalorimetry for the Biochemist

An Application that shows the unique possibilities that exist for physicists, biologists, physical chemists and biochemists to use biochemical calorimetry. Determination of ATP-ase activity in a tissue homogenate. Prepared from rat Kidney cortex, the homogenate, in suspension in an imidazole buffer containing excess ATP, was circulated through the calorimeter. Steady state values were obtained and the plot of calorimetric response values, Δ, versus amount of homogenate formed a linear relationship. When Ouabain, an ATP-ase inhibitor, was added to the buffer considerably lower activities were found. Curve "a" shows that 1 µl of homogenate releases 2.8 µmole P_i per min if no inhibitor is added. Curve "b" was obtained when the suspension contained 1.0 µmole Ouabain per ml. Amplification $= 1/3 \cdot 10^5$





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Biological Investigations and Observations. A Series of Laboratory Sessions for Introductory Biology. Marland L. Madson. Burgess, Minneapolis, ed. 2, 1969. vi + 278 pp., illus. Spiral bound, $5.25.

Calculus. Vol. 2, Multi-Variable Calculus and Linear Algebra, with Applications to Differential Equations and Probability. Tom M. Apostol. Blaisdell, Waltham, Mass., ed. 2, 1969. xxiv + 680 pp., illus. $13.50. Pure and Applied Mathematics.

Catalog of Meteorological Instruments in the Museum of History and Technology. W. E. Knowles Middleton. Smithsonian Institution Press, Washington, D.C., 1969 (available from the Superintendent of Documents, Washington, D.C.). vi + 130 pp., illus. $3.25. Smithsonian Studies in History and Technology, No. 2.

The Chasm Ahead. Aurelio Peccei. Macmillan, New York; Collier-Macmillan, London, 1969. xviii + 302 pp. $7.50.

Chemical Separation Methods. John A. Dean. Van Nostrand Reinhold, New York, 1969. xiv + 402 pp., illus. $13.50

Chemistry and Chemical Engineering: A Survey of Research and Development in Canada. Prepared by a Study Group of the Chemical Institute of Canada. A. E. R. Westman, Study Director. Science Council of Canada, Ottawa, 1969 (available from the Queen's Printer, Ottawa). xxii + 104 pp. Paper, $2.50. Special Study No. 9.

Class and Conformity. A Study in Values. Melvin L. Kohn. Dorsey, Homewood, 111.; Irwin-Dorsey, Georgetown, Ontario, 1969. xxiv + 320 pp. Cloth, $8.65; paper, $5.65.

Classical Descriptions of Motion. The Dynamics of Particle Trajectories, Rigid Rotations, and Elastic Waves. Emil Jan Konopinski. Freeman, San Francisco, 1969. xvi + 504 pp., illus. $15.

Clinical Analysis by Thin-Layer Chromatography Techniques. Ronald M. Scott. Ann Arbor-Humphrey Science Publishers, Ann Arbor, Mich., 1969. xii + 228 pp., illus. $18.75.

Coastal Landforms of Cat Island, Bahamas. A Study of Holocene Accretionary Topography and Sea-Level Change. Aulis O. Lind. Department of Geography, University of Chicago, Chicago, 1969. xvi + 160 pp., illus. Paper, $4. Department of Geography Research Paper No. 122.

Comprehensive Chemical Kinetics. Vol. 2, The Theory of Kinetics. C. H. Bamford and C. F. H. Tipper, Eds. Elsevier, New York, 1969. xiv + 486 pp., illus. $36.

Contingencies of Reinforcement. A Theoretical Analysis. B. F. Skinner. Appleton-Century-Crofts, New York, 1969. xvi + 320 pp. $6.50. Century Psychology Series.

Critical Path Method. Introduction and Practice. A. T. Armstrong-Wright. Humanities Press, New York, 1969. xii + 116 pp., illus. Cloth, $3.50; paper, $2.

Cycles Biologiques et Psychiatrie. Third Bel-Air Symposium, Geneva, September 1967. Under the direction of J. de Ajuriaguerar. Georg, Geneva; Masson, Paris, 1969. 424 pp., illus. Paper, 50 F.

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G. Hardin, "The Tragedy of the Commons" (13 Dec. 1968), 8 pages

L. D. Harmon and K. C. Knowlton, "Picture Processing by Computer" (4 Apr. 1969), 12 pages

L. D. Jaffe, "Surveyor Lunar Landings" (16 May 1969), 16 pages

E. P. Adom, "The Strategy of Ecosystem Development" (18 Apr. 1969), 20 pages

A. T. Weil, N. E. Zinberg, J. M. Nelsen, "Clinical and Psychological Effects of Marihuana in Man" (13 Dec. 1968), 12 pages

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Down the Colorado. Diary of the First Trip through the Grand Canyon, 1869. John Wesley Powell. Photographs and epilogue 1969 by Eliot Porter. Foreword and notes by Don D. Fowler. Dutton, New York, 1969. 168 pp. Until 1 January, $25; thereafter, $30.

Dream Psychology and the New Biology of Dreaming. A symposium, Cincinnati, Ohio, October 1967. Milton Kramer, Ed., in collaboration with Roy M. Whitman, Bill J. Baldridge, and Paul H. Ornstein. Thomas, Springfield, Ill., 1969. xxvi + 462 pp., illus. $17.

The Economy of Death. Richard J. Barnet. Atheneum, New York, 1969. vi + 202 pp. $4.95.

Education and Identity. Arthur W. Chickering. Jossey-Bass, San Francisco, 1969. xvi + 368 pp., illus. $9.50. Jossey-Bass Series in Higher Education.

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