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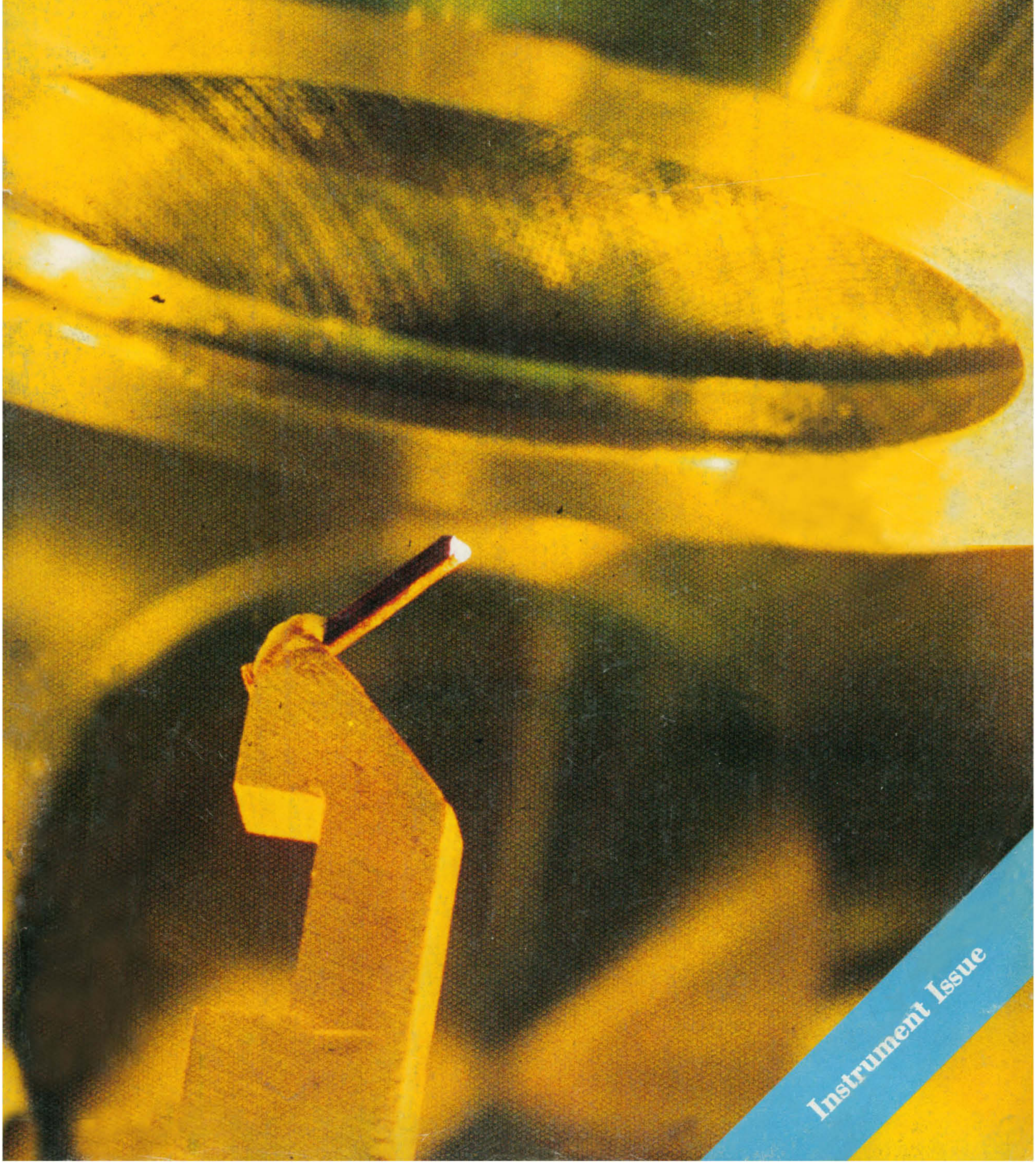

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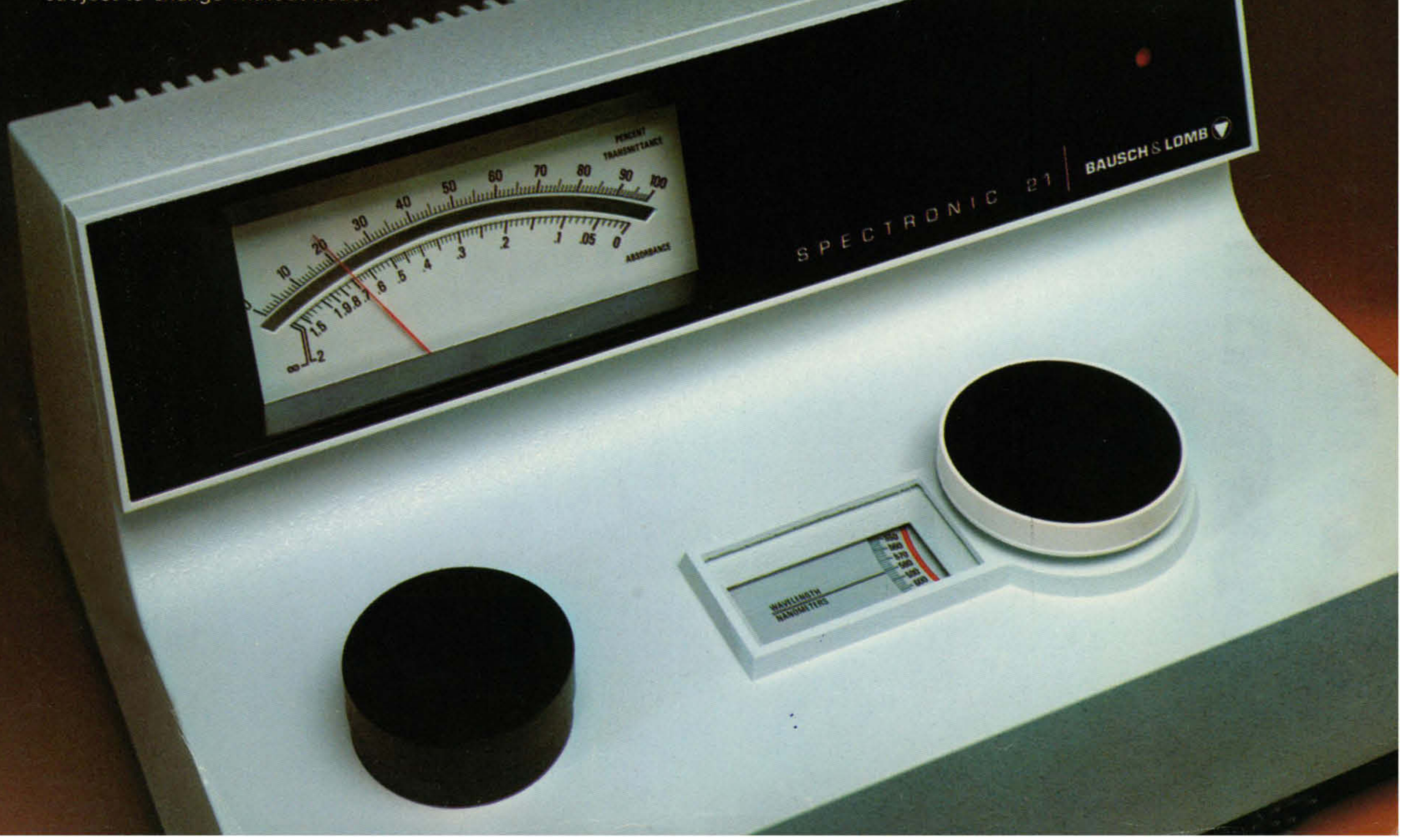

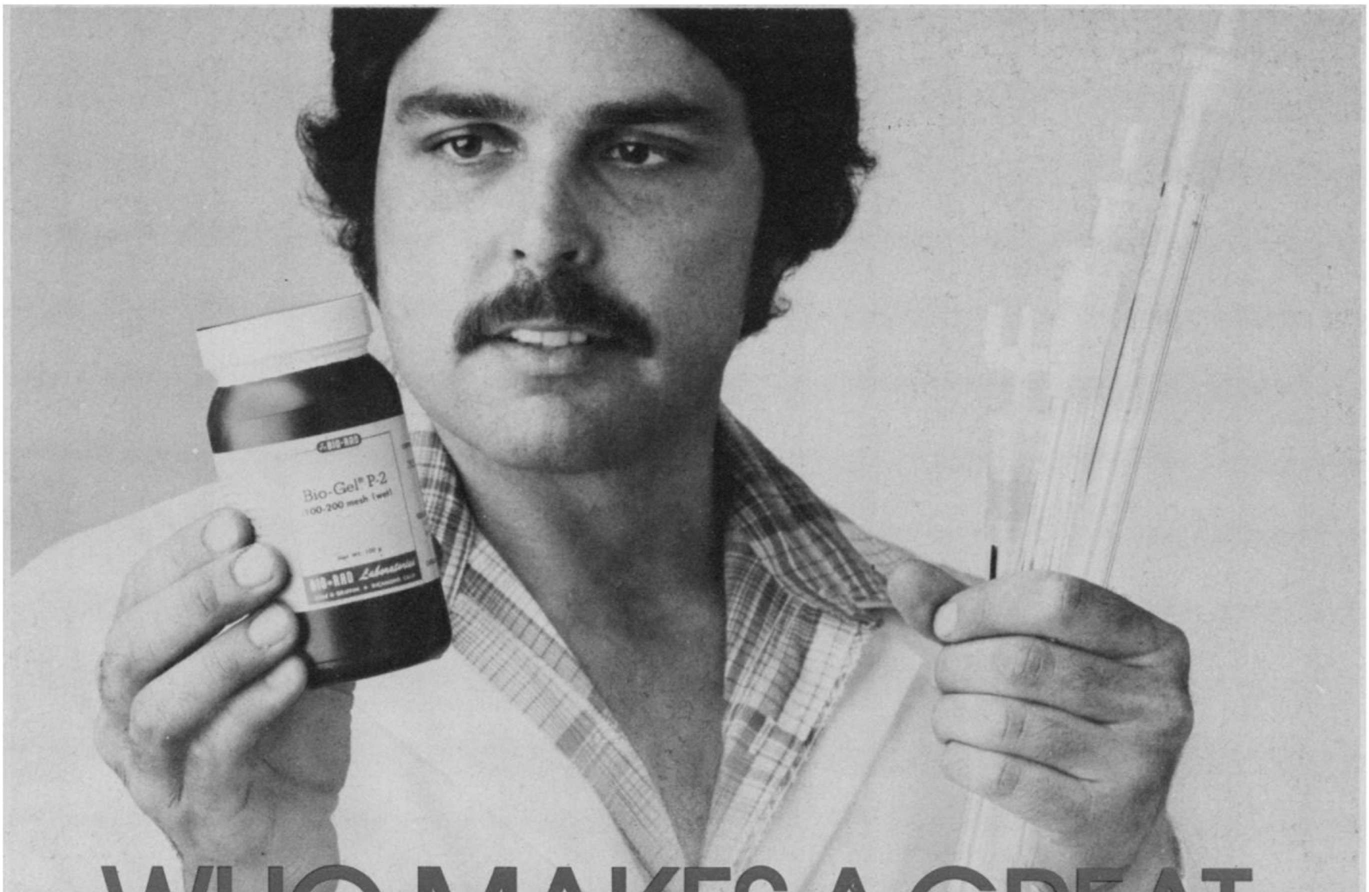
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ISSN 0036-8075

12 October 1979

Volume 206, No. 4415

SCIENCE

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COVER

Synchrotron radiation emitted by 240-megaelectron-volt electrons circulating in Tantalus I, the electron storage ring at the University of Wisconsin–Madison, hitting the tip of a single crystal rod of LaB_6. The sample in the ultrahigh vacuum photoemission chamber is at the focus of an electron energy analyzer. Electrons excited by soft x-rays and vacuum ultraviolet radiation escape through the crystal surface carrying with them valuable information about their energies and momenta inside the crystal. See page 151. [C. G. Olson, Ames Laboratory, U.S. Department of Energy]


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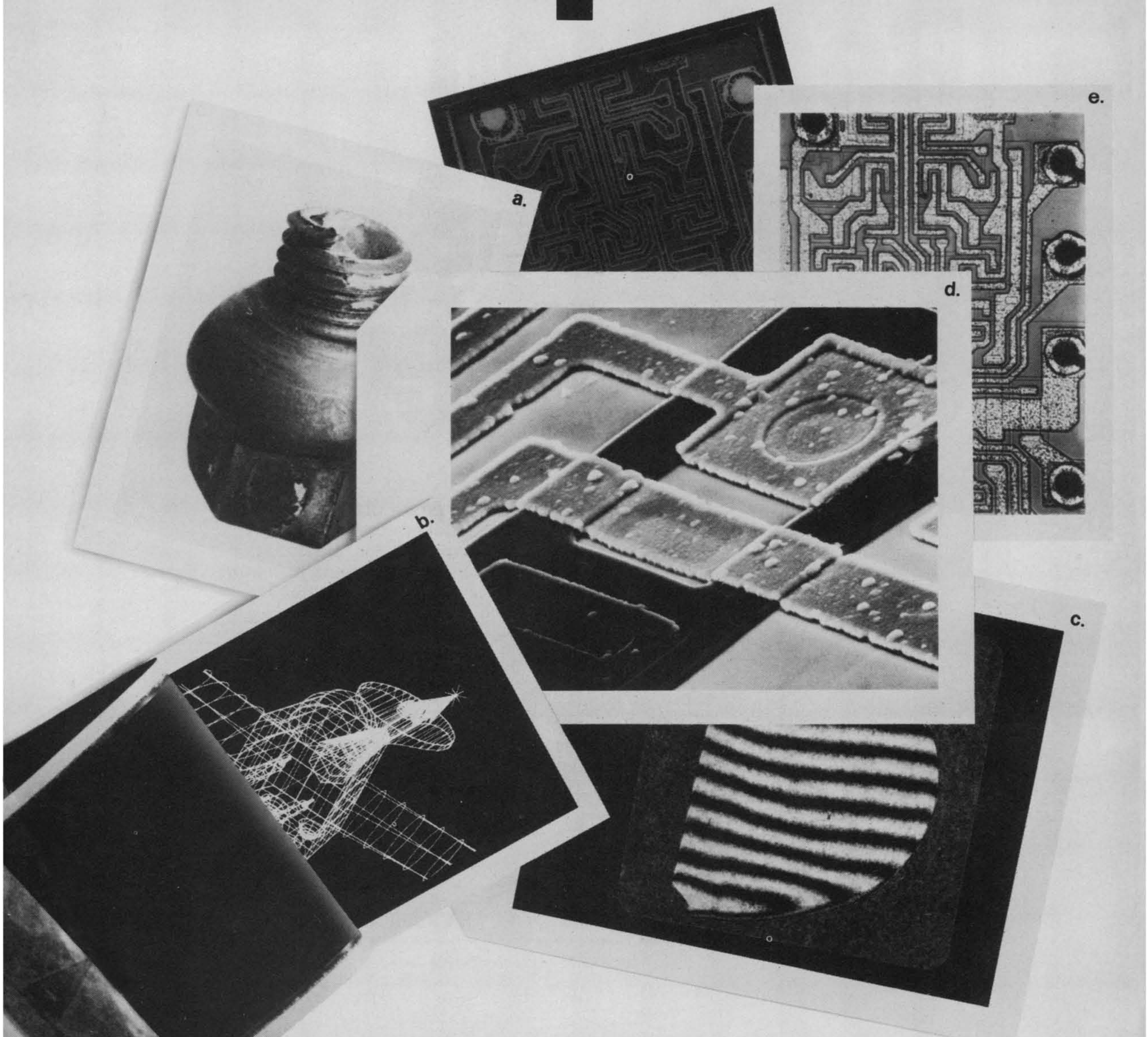

a. Torque test, axle bolt. Type 667 Coaterless film.
b. CRT graphic display. Type 084 film.
c. Interferometric evaluation of flat mirror with laser light. Type 57 High Speed 4 x 5 film.
d. Converter circuit inspection 700x, scanning electron microscope. Type 52 Fine Grain 4 x 5 film.
e. Memory circuit, 100x. Type 665 Positive / Negative film.

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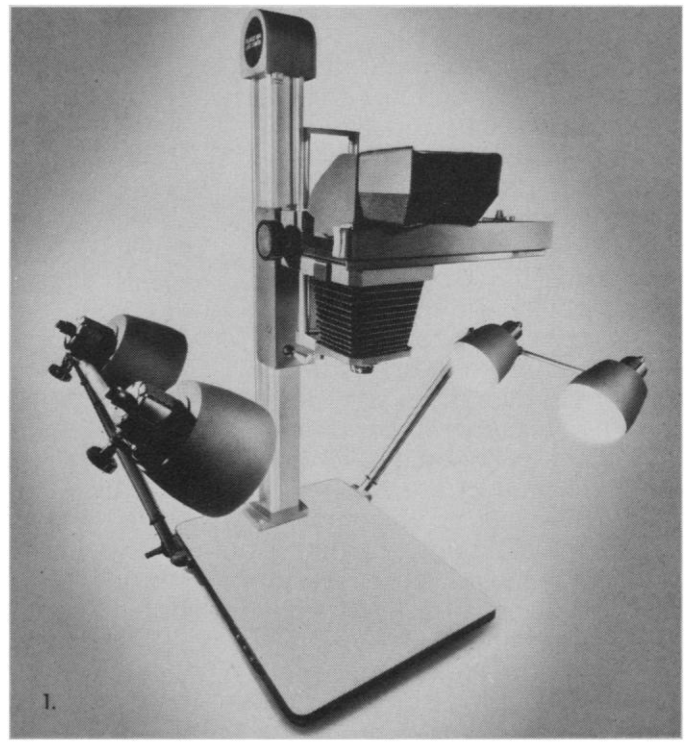

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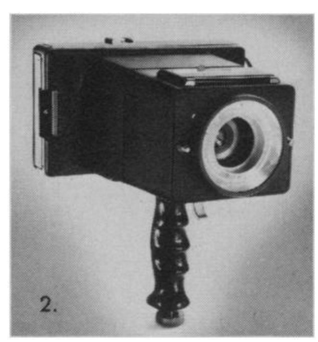

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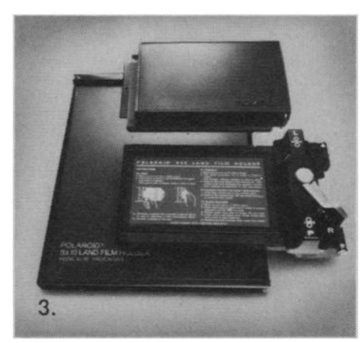

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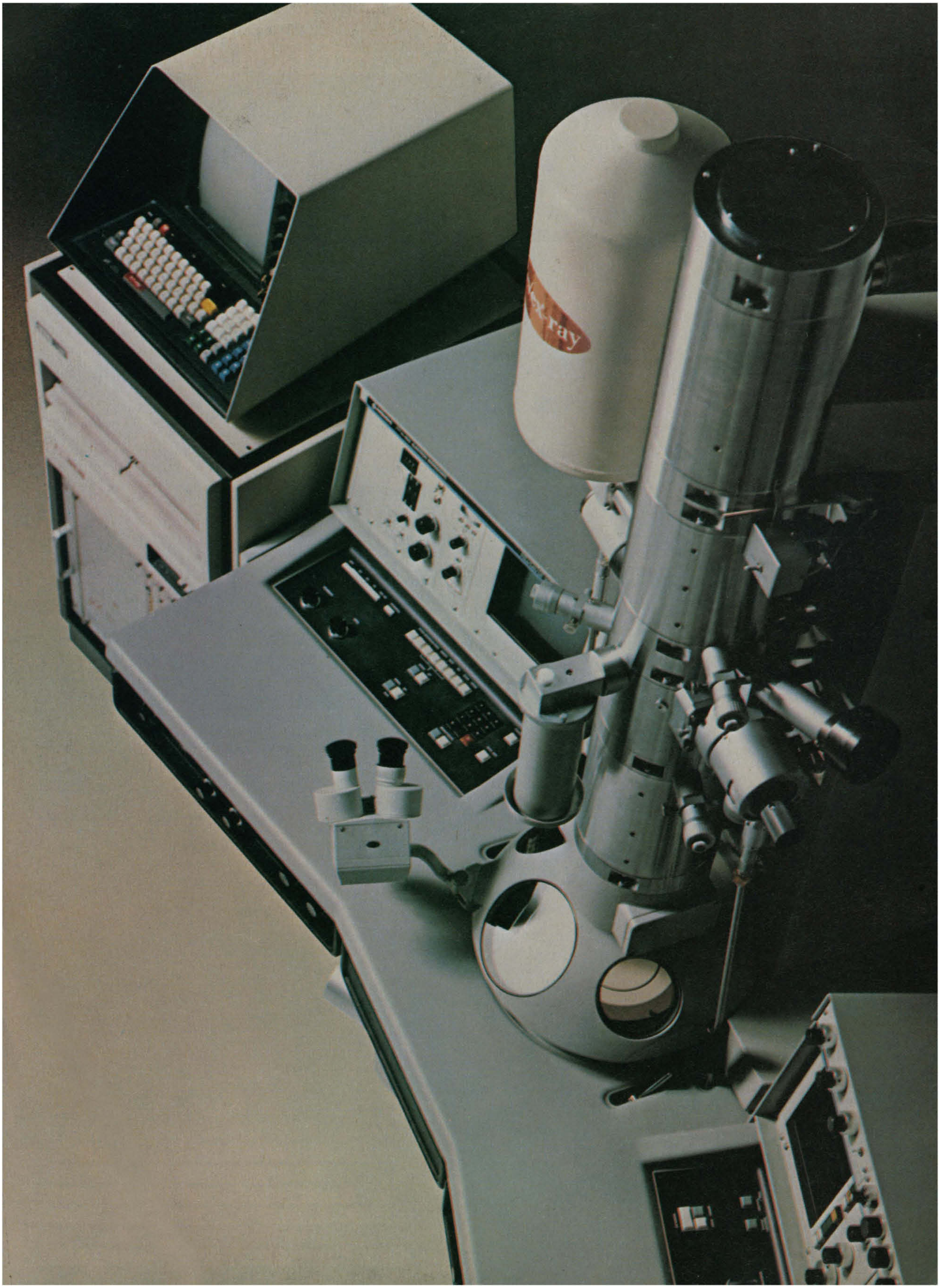

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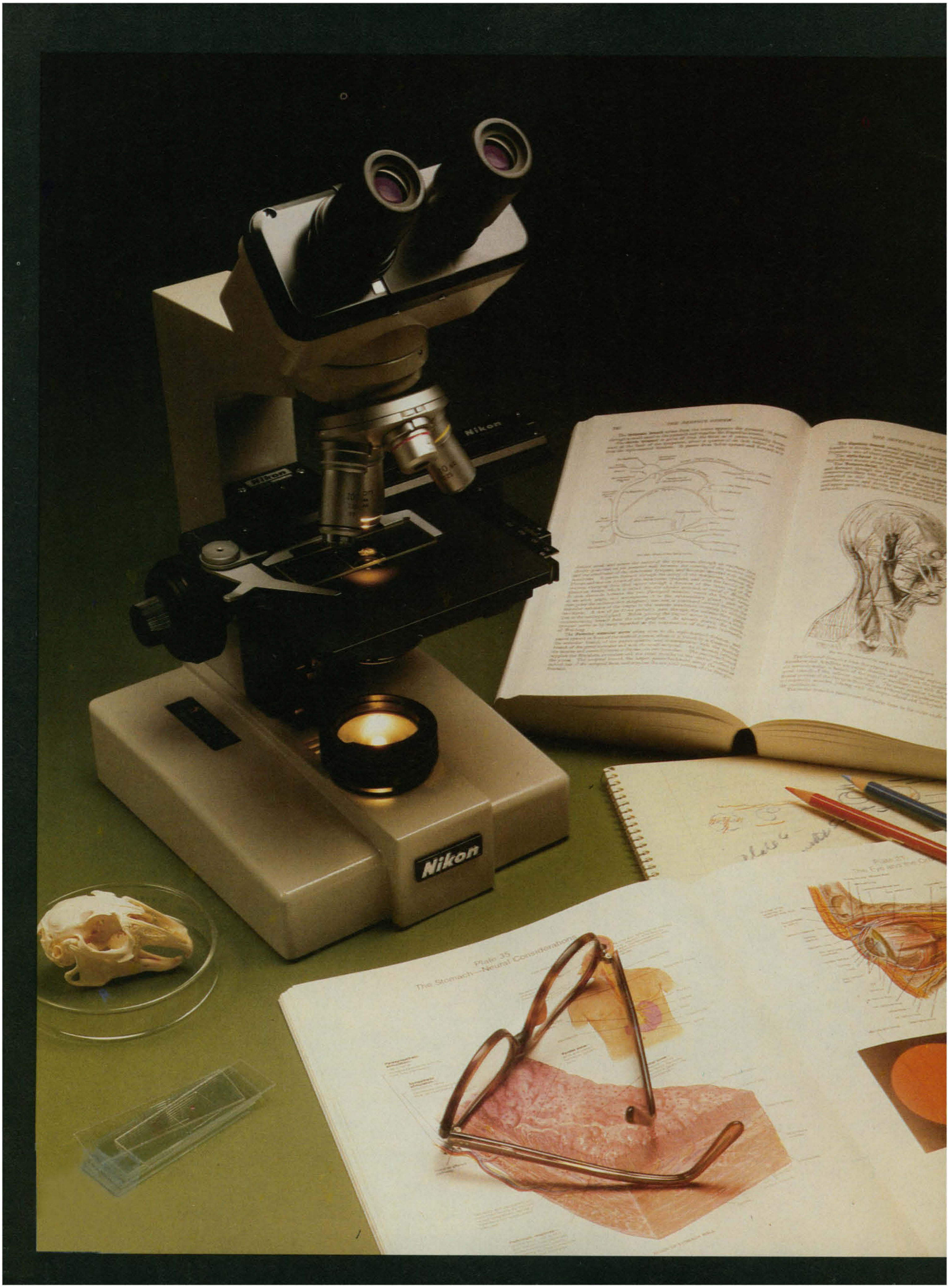
Nikon
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The Stomach—Neural Considerations

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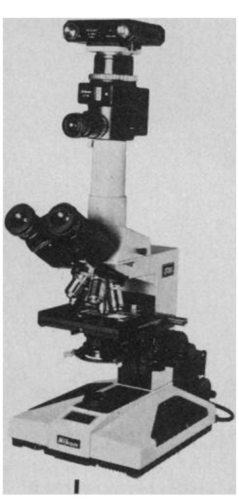
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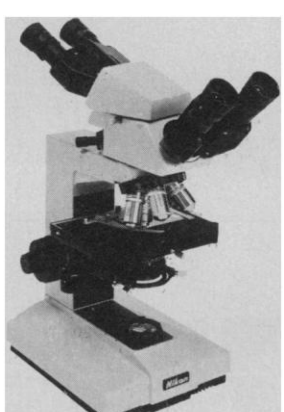
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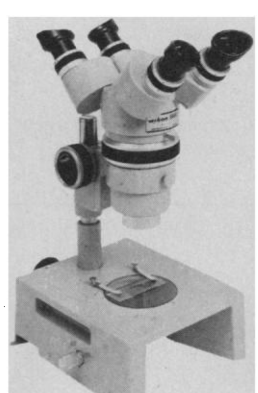
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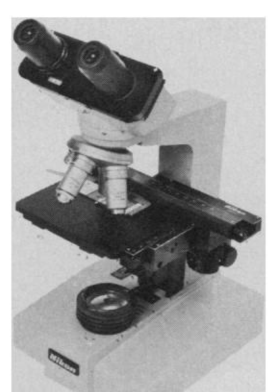
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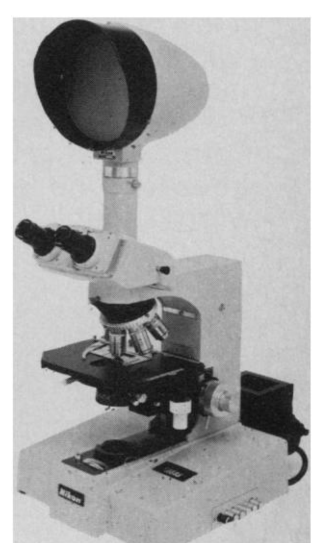
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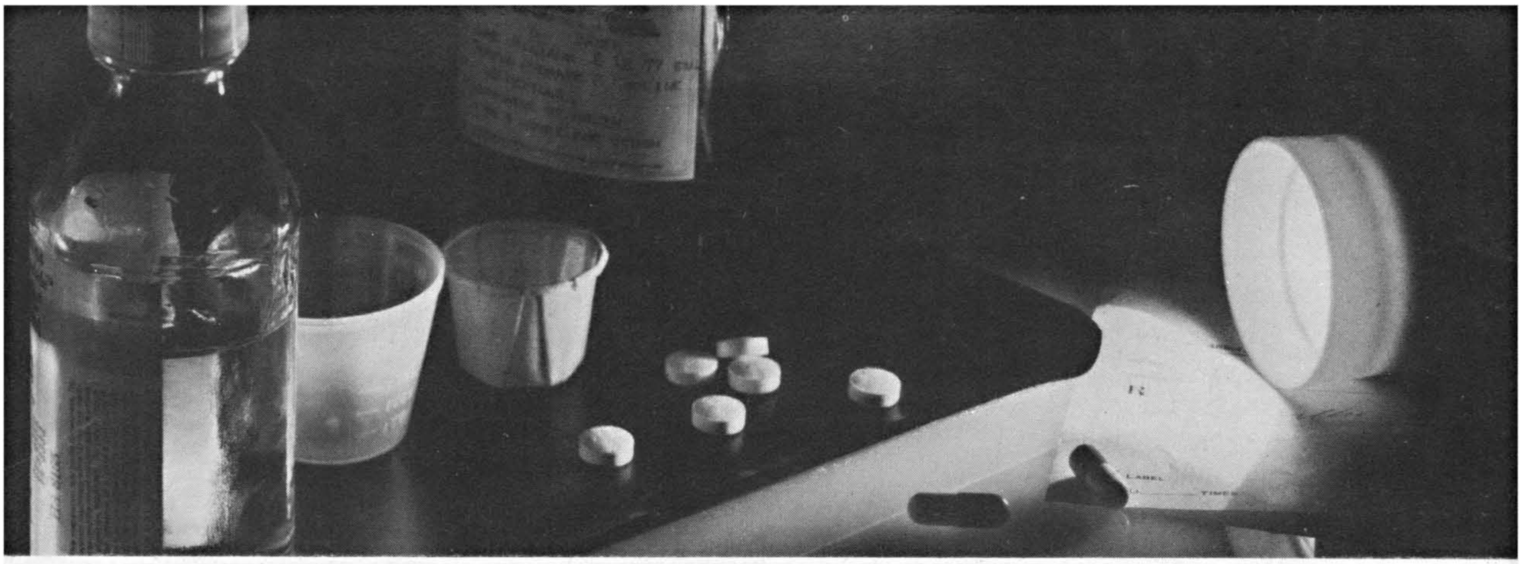

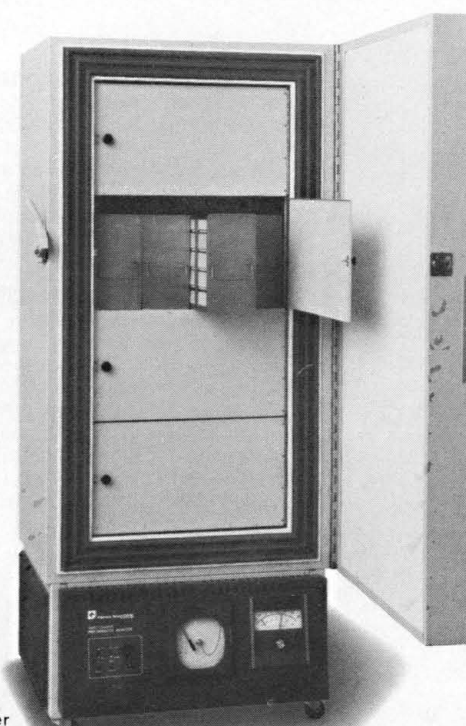

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Salts and sterile deionized water—Selected and prepared to minimize potential ionic or enzymatic inhibition of the system.

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The protocol is straightforward, and it includes suggested final assay procedures. So that's our message. Now add yours. Call us toll free for details.

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Translation cocktail All the necessary components for proper translation conditions, including buffer, biogenic polyamine, and energizer.

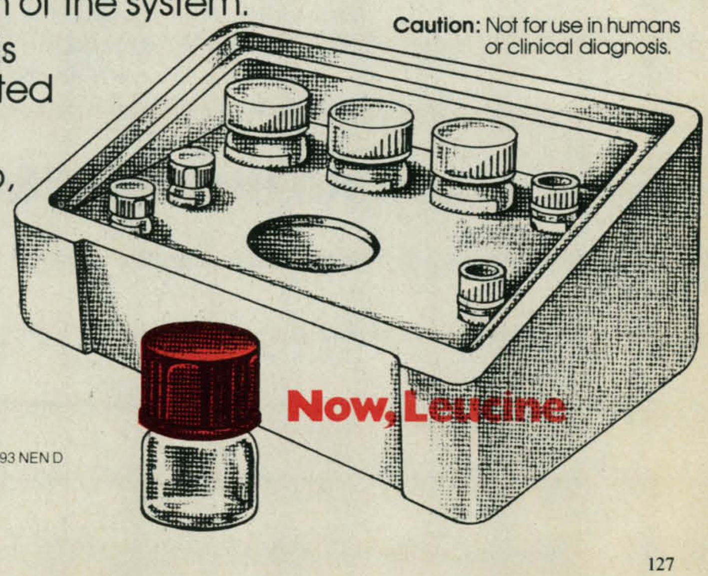
Control mRNA Purified mRNA to check the biological activity of the system.

Salts and sterile deionized water Selected and prepared to minimize potential ionic or enzymatic inhibition of the system.

Caution: Not for use in humans or clinical diagnosis.

Instructions for use The protocol is straightforward and includes suggested assay procedures.

So now there are two, and only two, translation kits. Call us toll-free for details on either or both.



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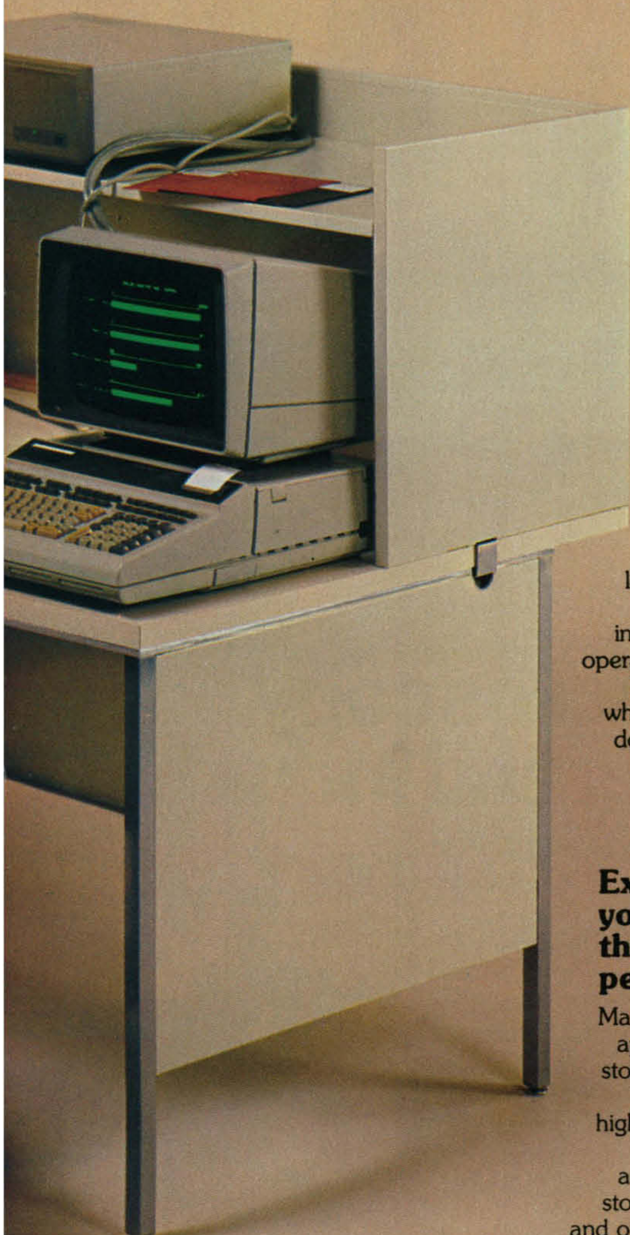

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Photomicrograph of villus in section of small intestine, 125X magnification, is a simulated video image. Photomicrograph by Jack Kath, from Nikon's Small World Contest.

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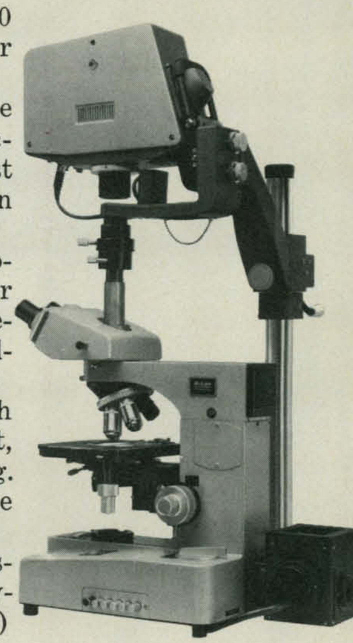

What the human eye can see through the microscope the Ikegami ITC-240 color TV camera can deliver to an Ikegami (or any other) TV monitor or video tape recorder. And it does this job precisely and easily.

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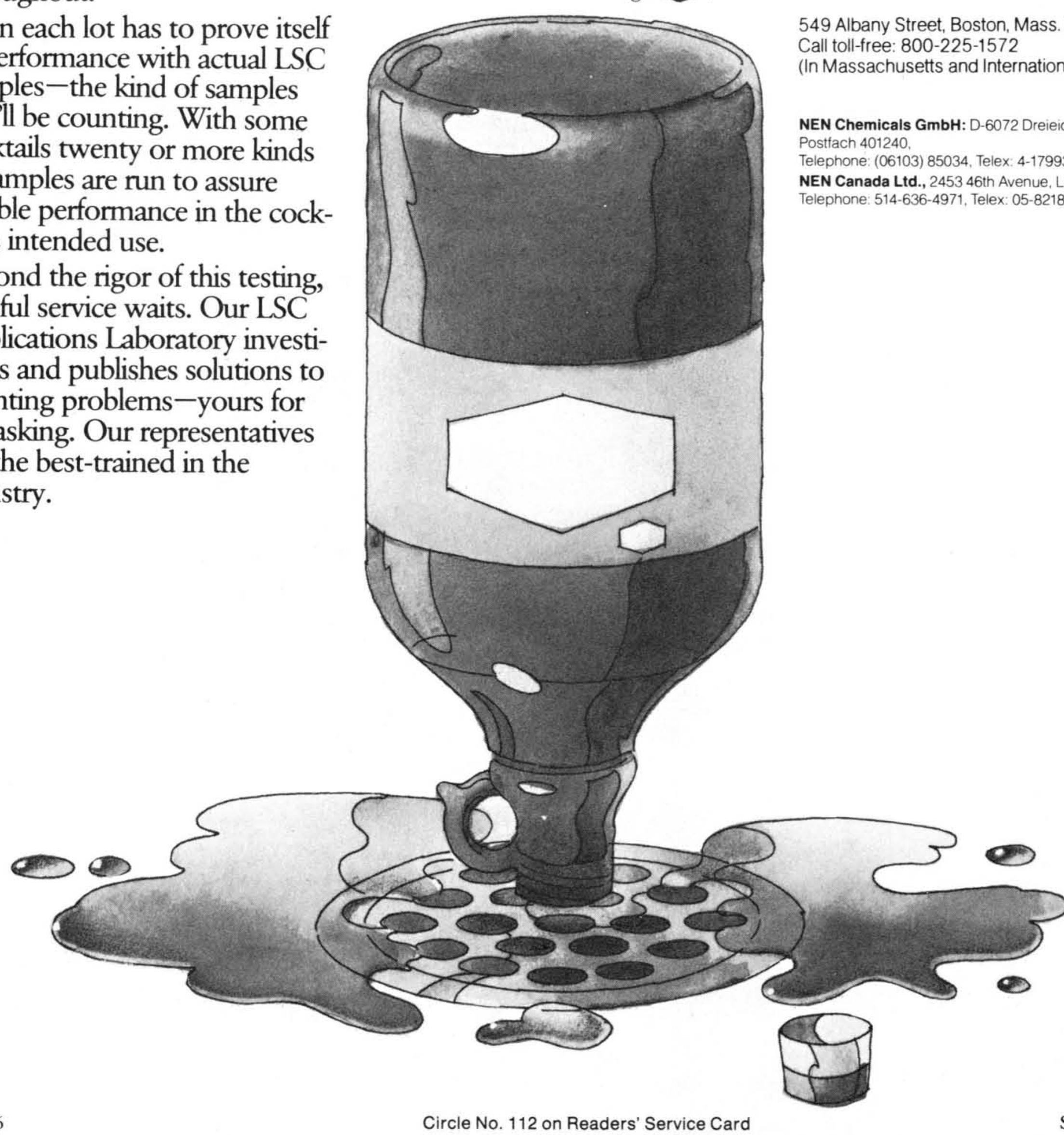


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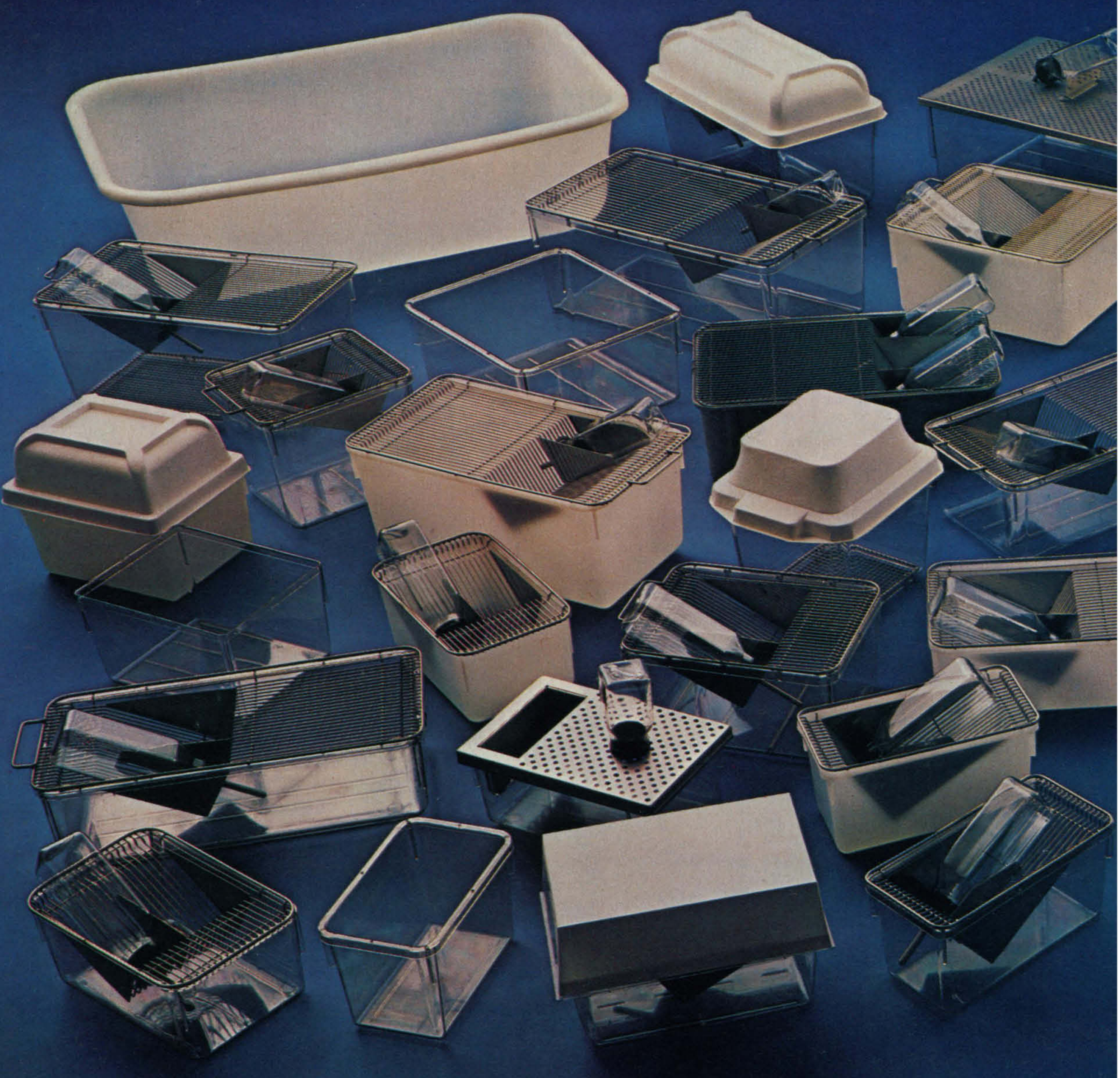

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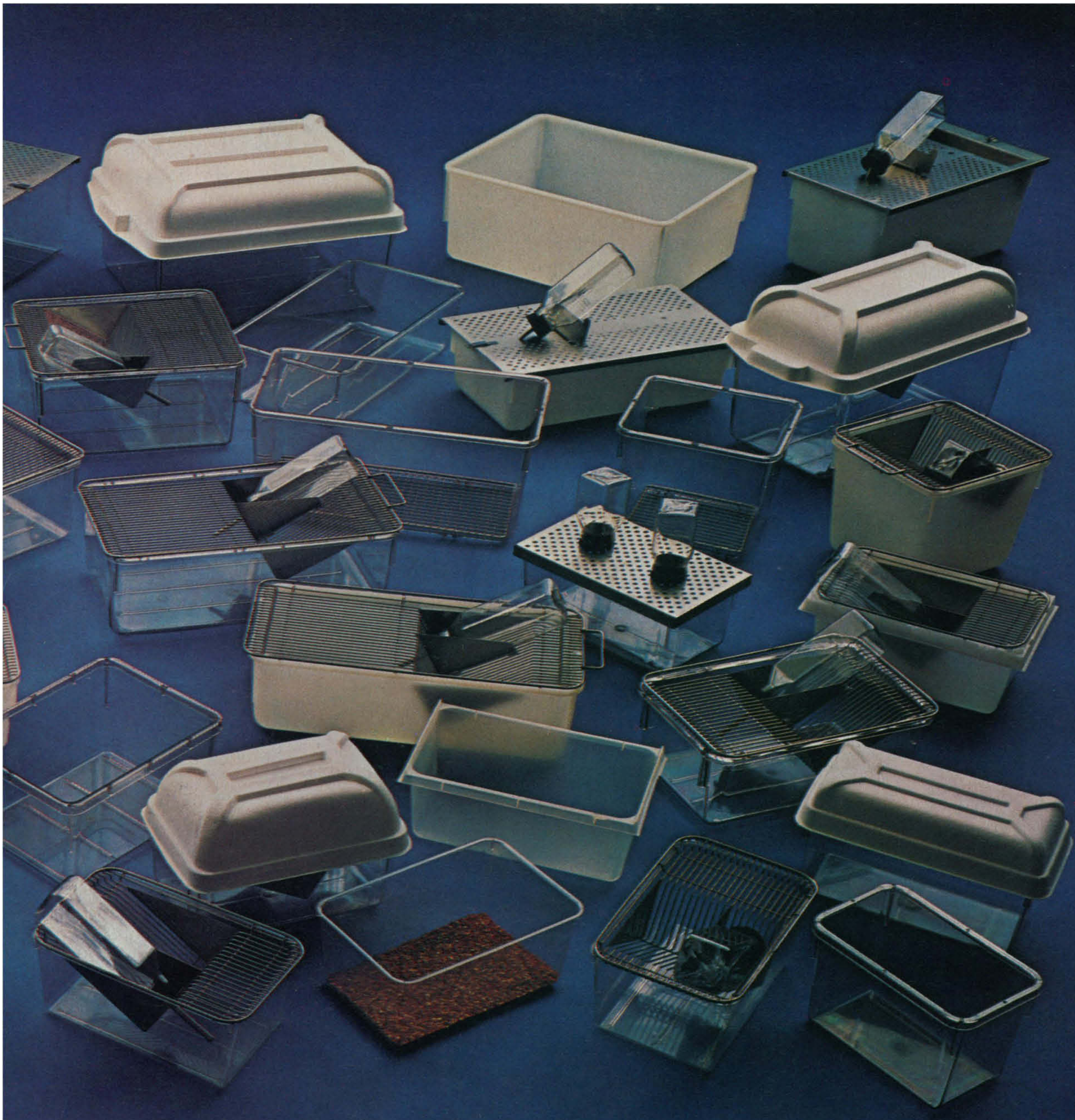

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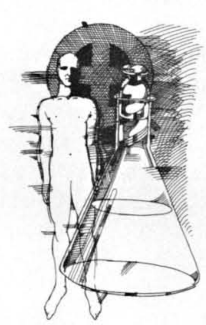

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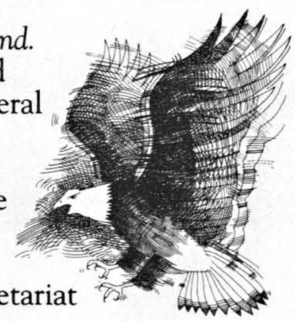

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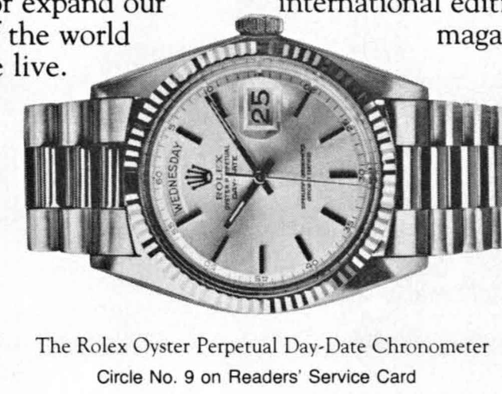

ROLEX

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whether he did so. The evidence for the fabrication was presented in my original article, which I ended thusly (p. 1184):

> The final judgment on Burt's honesty as a scientist will rest with future historians of behavioral science. It is hoped that the foregoing analyses will contribute to a fair and reasoned judgment in this matter.

Finally, I believe that Hearnshaw has provided us with a fair and reasoned judgment in this matter.

DONALD D. DORFMAN
Department of Psychology, University of Iowa, Iowa City 52242

References and Notes

1. Some other corrections to the letter from Rubin and Stigler are the following: (i) I did show that rescaling the IQ assessments to fit a normal curve and then reweighting along rows does not imply that the column totals will fit a normal curve; (ii) since Burt did not rescale his assessments of social class to fit a normal curve, there is no a priori reason why his tables should be "approximately multivariate normal." Moreover, marginal normals do not imply linear regression.
2. P. E. Vernon, *Intelligence: Heredity and Environment* (Freeman, San Francisco, 1979).
3. Indeed, Quetelet presented that distribution of Scottish chest-circumferences as a striking example of a normal curve in his Lettre XX of the work cited by Rubin and Stigler [A. Quetelet, *Lettres . . . sur la Théorie des Probabilités Appliquée aux Sciences, Morales et Politiques* (Bruxelles, 1846)] and fitted it to the normal curve. The fit was striking.
4. According to Hearnshaw, the Conway of 1959 was an invention of Burt's [L. S. Hearnshaw, *Cyril Burt: Psychologist* (Hodder and Stoughton, London, 1979)].
5. J. Conway, *Brit. J. Stat. Psychol.* **12**, 5 (1959).
6. K. Pearson, Ed., *Tables for Statisticians and Biometricians*, Part II, (Biometric Laboratory, University College, London, 1931).
7. I am deeply indebted to Roger Milkman for invaluable assistance and to Robert Hogg for some statistical assistance.

The Future of Education

In his editorial, "Education for the 21st century" (14 Sept., p. 1087), Philip H. Abelson addresses one of the most fundamental issues of our time—how to reshape and relate our educational system to the future condition and needs of American society and "somehow manage to avoid enormous trauma during the transitions that lie ahead." He singles out for discussion the threat of "a shortage of trained people [scientists and engineers] capable of meeting society's physical needs" and shows how the educational system suffers from mediocre performance "in counseling the young." He highlights various aspects of this particular educational problem and suggests appropriate solutions.

This is excellent as far as it goes; but the title of the editorial calls for much more. The tremendous changes that lie ahead for our society will be traumatic and, as Abelson says, "Education stands out as the best basis for hope. . . ."

In addition to the future physical needs of society that will require more adequate training of scientists and engineers, there will be increasing and more traumatic social, psychological, economic, and political needs that must be met. To provide adequate training of personnel to meet such needs, the educational system must undergo basic changes, in substance and method, at various levels. Another aspect of the problem is the lag between the national educational establishment and the rapidly expanding field of future studies. A wealth of knowledge about probable future trends and alternatives, in all aspects of society, has been accumulating rapidly in recent years, by which training institutions could be guided in measuring up to changing conditions and demands.

A third feature that must be addressed relates to the inner space of man. The startling findings of scientific research in recent years, at the frontiers of physics, chemistry, biology, psychology, physiology, neurology, and other fields, have been converging in such a manner as to create a revolutionary concept of human nature and its world. The traditional image of man and his perception of reality, to which the educational system has been anchored, is steadily fading away. A new image is arising with outstanding components, such as human potential for creative unfolding is infinite; the child is born with an innate biological pattern that should be the primary guide for its education and development; the structure and functions of the brain (or rather brains) are revealed and understood as never before, opening the door for new insights into human perception, motivation, emotion, memory, learning, consciousness, and self-awareness; and new and baffling dimensions of reality are encountered in the realm of subatomic physics.

The crucial question that concerned leaders of thought and policy must answer is how to bring this emergent, revolutionary image of man and his world into the heart of the educational method at all levels.

AFIF I. TANNOUS
*6912 Oak Court,
Annandale, Virginia 22003*

In his editorial of 14 September, Abelson calls for better career guidance of able youths. In the Study of Mathematically Precocious Youth (SMPY) at the Johns Hopkins University, we have worked out and tried what is called the 4D (Discovery, Description, Development, and Dissemination) model with more than 10,000 mathematically gifted junior high school students (chiefly seventh graders). We believe it provides the guidance and educational flexibility needed.

The first step is to locate intellectually talented youths who attend school in a seven-state area (Maryland, the political entities that touch it, and New Jersey), chiefly by means of an annual talent search. Any seventh grader, or a youth in a higher grade who is of seventh-grade age, who scores in the top 3 percent on national norms for the mathematical, verbal, or total composite score of a school-administered standardized achievement-test battery such as the Iowa Test of Basic Skills may register for the talent search with our Office of Talent Identification and Development (OTID) and take the College Board's Scholastic Aptitude Test (SAT) in the nationwide January administration. The key concept is that this three-part (verbal, mathematical, and English composition) SAT is difficult enough to assess the mental power and precocity of these youths, most of whom are four or five school grades below the last 2 years of senior high school, when the test is usually given. We consider that a participant in the talent search reasons exceptionally well mathematically if he or she scores at least 500 on the SAT, which is above the average of college-bound 12th-grade males and roughly the upper 1 percent of 11- to 12-year-old boys. About one-fourth of the males and one-eighth of the females in the talent search do this well. Comparable criteria are 430 for the verbal SAT and 43 for the Test of Standard Written English, on the latter of which SMPY's girls exceed the boys.

Although the SAT is invaluable for identifying highly able youths, even with three scores it has little *diagnostic* power. The high scorers need to be further studied with tests difficult enough to determine their specific knowledge and aptitudes. For example, how well do they score on the College Board's Mathematics I and II achievement tests or the mathematics test of the American College Testing (ACT) Program? How much general science do they know, as evaluated by the ACT-Natural Science Reading test, the college level of Educational Testing Service's Sequential Tests of Educational Progress (STEP) in Science, or the College Board's Physics achievement test? How much Algebra I can they do, even before taking the course? How apt are they in mechanical reasoning (for example, as measured by one of the Psychological Corporation's tests), spatial relationships, nonverbal reasoning (we like the 36-item, difficult Raven Progressive Matrices Test), and so forth? What are their vocational interests, attitudes, and values? How extroverted or introverted is

(Continued on page 238)

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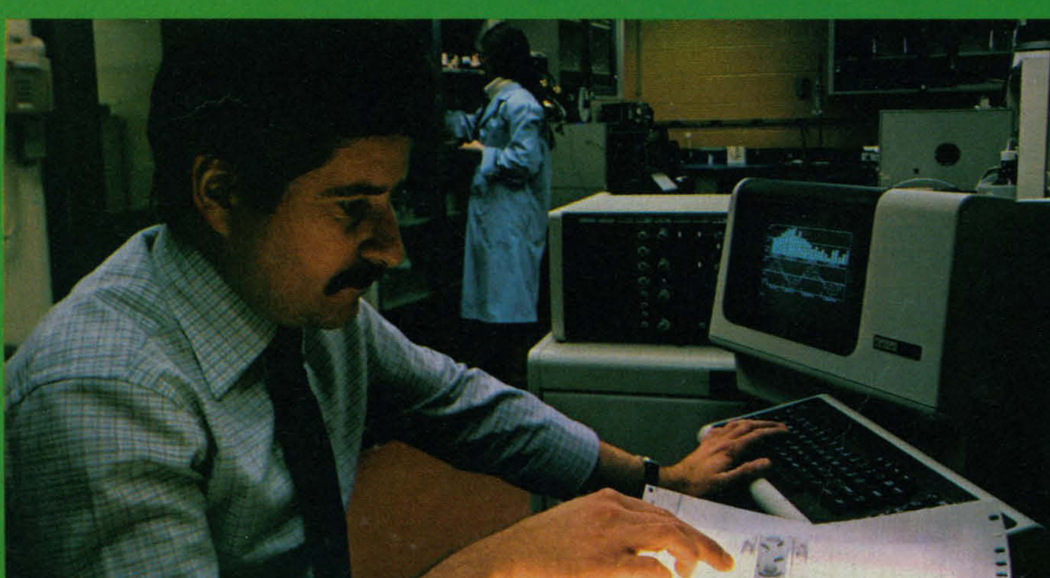

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12 October 1979, Volume 206, Number 4415

SCIENCE

Department of Energy–University Relationships

It is important that we utilize and increase research capabilities in energy-related disciplines at universities. Support should be provided to maintain vigorous long-range research programs and thus enable faculty and graduate students to contribute more effectively to the solution of national energy problems. Sustained research support to universities would also ensure a continuing flow of energy research scientists and energy managers as graduate students complete their studies in energy fields.

Universities must also be involved in energy research if they are to function effectively in energy information transfer. This can be accomplished through formal classroom instruction, adult education and continuing education programs, and organized extension programs such as the Department of Agriculture-university Cooperative Extension Service. Current federal programs to promote energy conservation and the use of solar energy are good examples of programs that will require continuing local and regional educational efforts to gain public acceptance and to ensure wise consumer response.

Much has been said about building an effective working relationship between the Department of Energy (DOE) and universities, but relatively little has been accomplished other than through programs carried over from the Atomic Energy Commission. Sustaining research agreements have been developed between DOE and a very limited number of universities and some attention has been given to more effective handling of unsolicited research proposals. Most research support, however, is still being allocated to federal laboratories and industry while university efforts are largely purchased rather than supported. A task force has been appointed by DOE to study procurement practices, but much more positive action is needed.

Some question whether we can hope to see significant changes in DOE-university relationships before legislation is developed that specifies university involvement in national energy efforts and the national energy organizational structure is stabilized. The national energy effort has suffered severely because of the continued reorganizations—from the Federal Energy Agency to the Energy Research and Development Administration to the DOE—which have involved changes in leadership, reassignments of individuals, and changes in program emphasis.

The DOE should recognize the serious manpower problems that are developing at the graduate level in energy fields and initiate corrective action now rather than wait for a crisis. Of particular importance is engineering manpower at the doctoral level. Forty-four percent of all Ph.D.'s employed in energy-related fields in 1977 were engineers. Yet between 1972 and 1977, the number of those receiving Ph.D.'s in engineering per year fell 24 percent, from 3476 to 2641. The numbers of U.S. citizens who obtained Ph.D.'s in engineering decreased even more sharply, from 2329 to 1507, a reduction of 35 percent. It should be noted that 42.8 percent of the engineering Ph.D.'s awarded in 1977 in the United States went to noncitizens. Despite increases in the numbers of undergraduate engineering students, not enough students are currently enrolled in graduate engineering programs to produce the Ph.D.'s needed to fill engineering faculty positions and provide leadership in energy-related research. Shortages will become even more critical as major synfuel production efforts are launched and solar research and development activities are increased.

It is in the best interest of our country that the DOE take positive steps now to ensure significant levels of university participation in national energy programs through research, education, and public service activities. It is also critically important that the DOE provide strong leadership to ensure the future availability of manpower essential to our long-range energy efforts.—ROY A. YOUNG. *Chancellor, University of Nebraska-Lincoln, Lincoln 68588*

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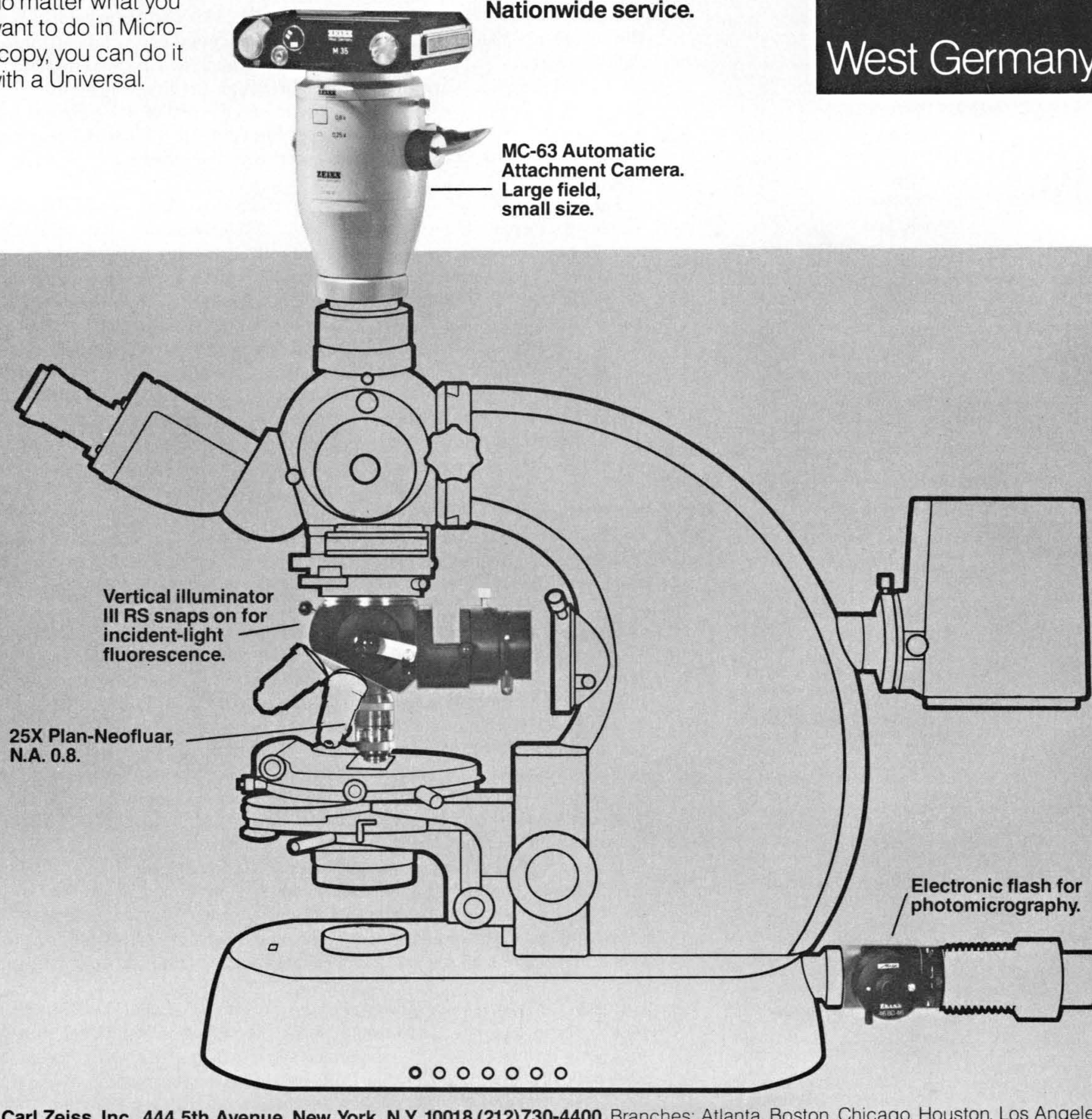

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Spectrometer

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Literature

Photosensitizing Dyes are included in a price list. Most of these products have absorption maxima included. Accurate Chemical & Scientific. Circle 757.

Solvent Delivery System is the subject of a brochure for HPLC users. Micromeritics Instrument. Circle 758.

Solar Heating is a 120-page catalog that includes a product guide and a list of resources for most apsects of this technology. Department of Energy, Mines and Resources of Canada. Circle 759.

Engineering and Computers is a newsletter with broad coverage of advances, new products, and uses of computers in the engineering profession. Engineering Computer Applications. Circle 760.

Magnetic Memory Systems describes media for data storage including all types of disks and tapes. Nashua. Circle 762.

Process pH Electrodes is devoted to replacements for a variety of applications. Sensorex. Circle 764.

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 Reader Service Card (on pages 126A and 238A) and placing it in the mailbox. Postage is free.
—Richard G. Sommer

LETTERS

(*Continued from page 145*)

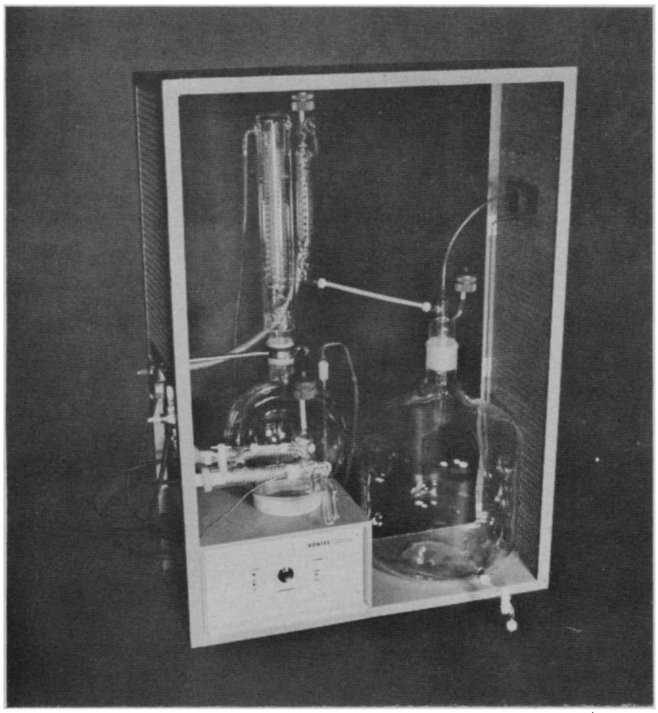
each of them? How neurotic? (We do not, however, probe deeply into personalities or seek personal problems unless already obvious.) What factors in their homes, including the educational attitudes of parents, are likely to affect the use of their intellectual talents? Also, of course, talents for the various performing arts are important, though SMPY and OTID are not well equipped to assess them.

Identifying the youths and studying their characteristics will usually be nonproductive, however, unless from that point on they are helped educationally in major ways. SMPY's specialty is the area of mathematics; students are instructed in fast-paced special classes from Algebra I through the first year of college calculus. Virtual miracles of acceleration can be accomplished in this individualized manner, such as an 11-year-old youth's scoring extremely high on the college-level Advanced Placement Program examinations in Calculus BC, Physics C1 (Mechanics), and Physics C2 (Electricity and Magnetism). Quite a few eighth and ninth graders can readily complete the first year of college calculus well, as judged by this calculus exam. Some youths we have helped went on to receive their baccalaureates at ages as young as 15 and their master's degrees at 17. Within a few years a number of them seem likely to earn Ph.D.'s from top-level universities many years sooner than the age 30 or so that is average for most scientific fields. The increase in person-years of expertise should be invaluable to the individuals themselves and also to society.

Further information about SMPY's pioneering can be found in five books already published by the Johns Hopkins University Press or in press there: *Mathematical Talent* (1974), *Intellectual Talent* (1976), *The Gifted and the Creative* (1977), *Educating the Gifted: Acceleration and Enrichment* (1979), and *Women and the Mathematical Mystique* (in press). Also, reprints of certain relevant articles are available from SMPY. We do not discuss here the newly created OTID role in verbal areas. Inquiries about that and the 1980 talent search should be addressed to OTID director George.

JULIAN C. STANLEY
Study of Mathematically Precocious Youth, Johns Hopkins University, Baltimore, Maryland 21218

WILLIAM C. GEORGE
Office of Talent Identification and Development, Johns Hopkins University



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[1] Patent No. 4,089,749

[2] Karamian, Narbik A., American Laboratory, March 1976

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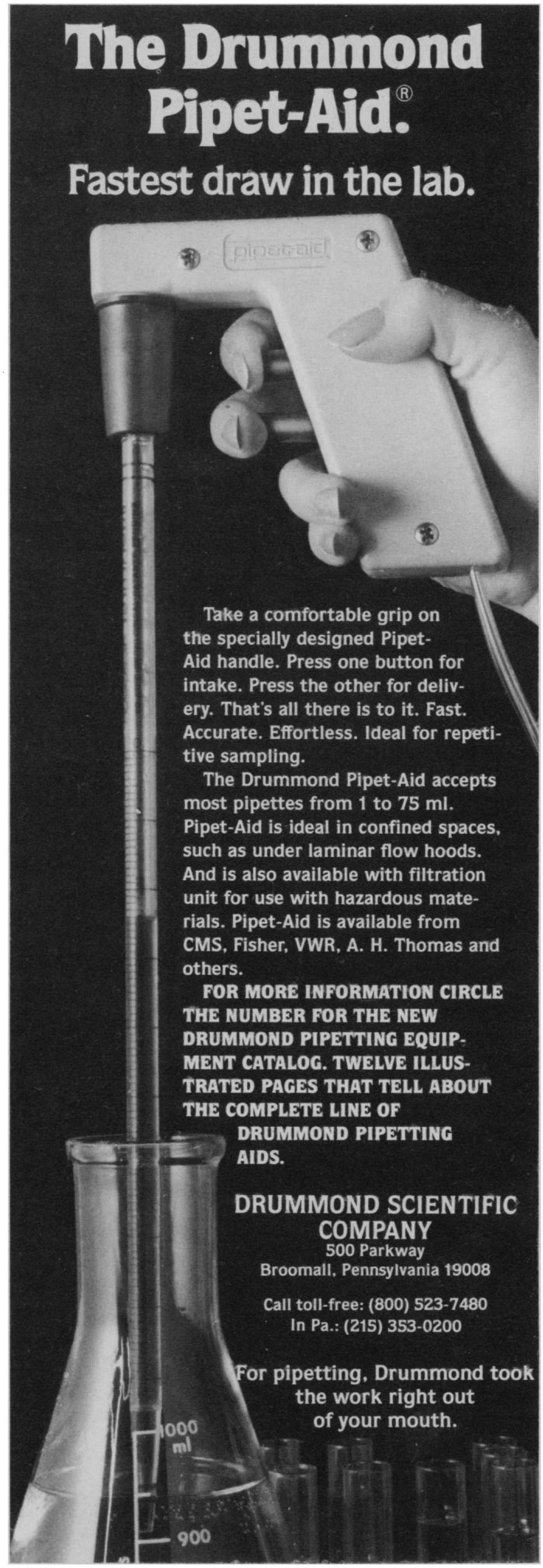

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BOOKS RECEIVED

(Continued from page 213)

Fracture Mechanics in Engineering Practice. Papers from a conference, Sheffield, England, 1976. P. Stanley, Ed. Applied Science Publishers, London, 1977 (U.S. distributor, International Ideas, Philadelphia). xiv, 420 pp., illus. $59.

French Weights and Measures before the Revolution. A Dictionary of Provincial and Local Units. Ronald Edward Zupko. Indiana University Press, Bloomington, 1979. xlviii, 208 pp. $22.50.

Fundamentals of Electronics. Charles M. Thomson. Prentice-Hall, Englewood Cliffs, N.J., 1979. xviii, 600 pp., illus. $17.95.

Geomathematics. Past, Present, and Prospects. A Volume to Commemorate the 10th Anniversary of the Founding of the International Association for Mathematical Geology. D. F. Merriam, Ed. Syracuse University Department of Geology, Syracuse, N.Y., 1978. 74 pp., illus. Paper, $3. Syracuse University Geology Contributions, 5.

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