SCIENCE

23 April 1976

Volume 192, No. 4237

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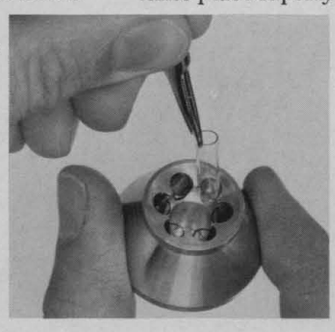

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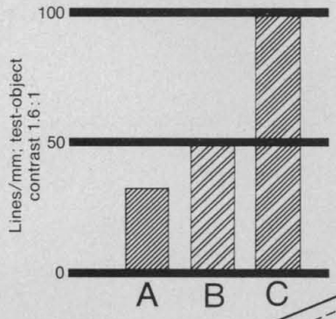

A comparison of the resolving power of three color transparency films. A is KODAK High Speed EKTACHROME Film; B is KODACHROME 25 Film; C is KODAK 2483 Film.

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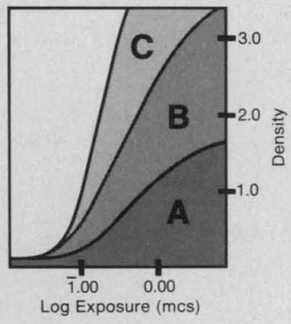

Characteristic curves for SO-410 Film. With appropriate development, the Contrast Index can be varied from 0.8 (curve A) to 3.4 (curve C), or values in between, such as 1.7 (curve B).

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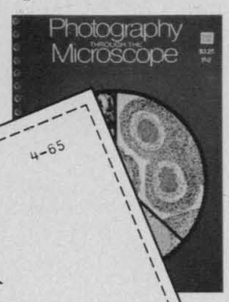

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"Pincushion grid." Note the illusion of criss-crossing diagonal white lines, which are intensified by rotating the cover 45 degrees. See page 389. [R. A. Schachar, Texoma Eye Institute, Denison, Texas 75020]

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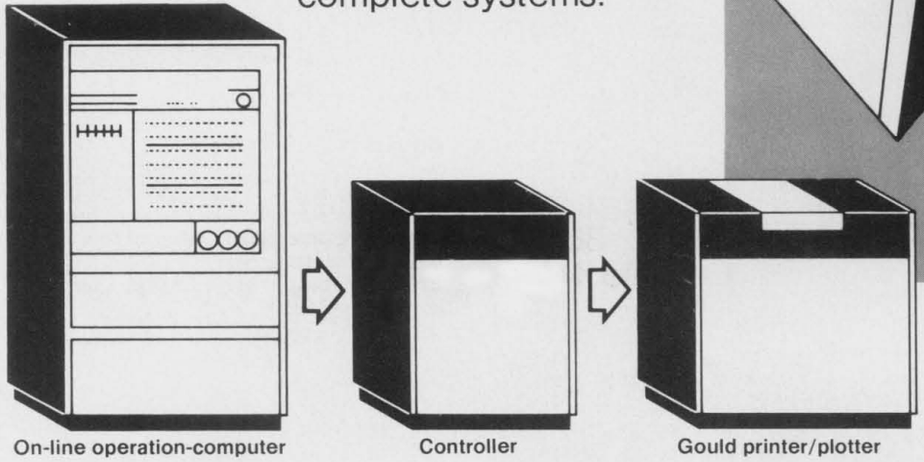

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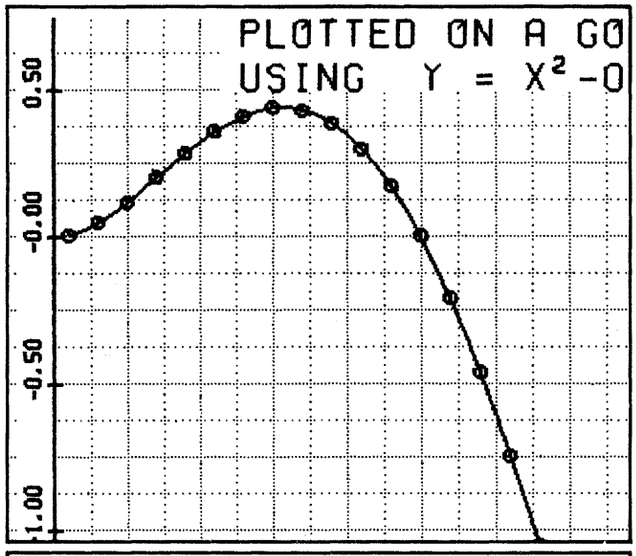

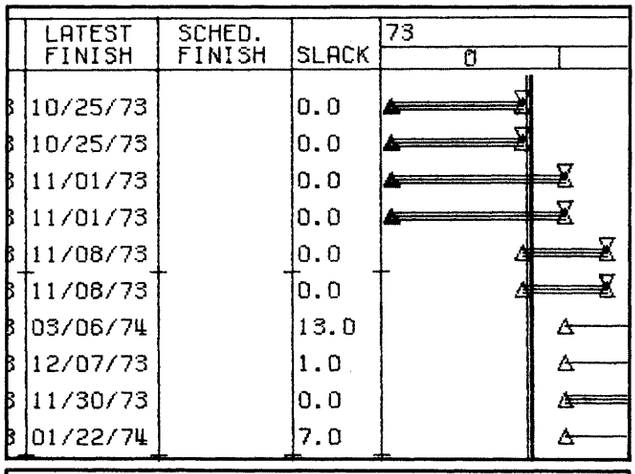

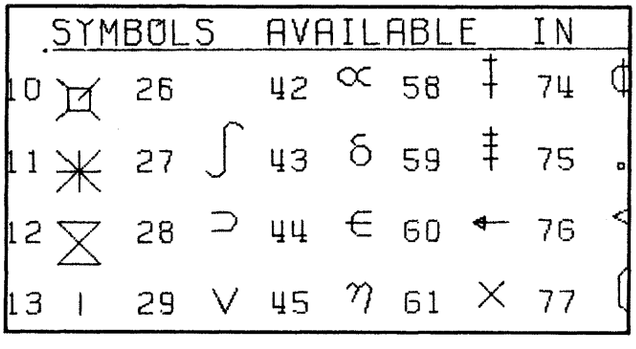

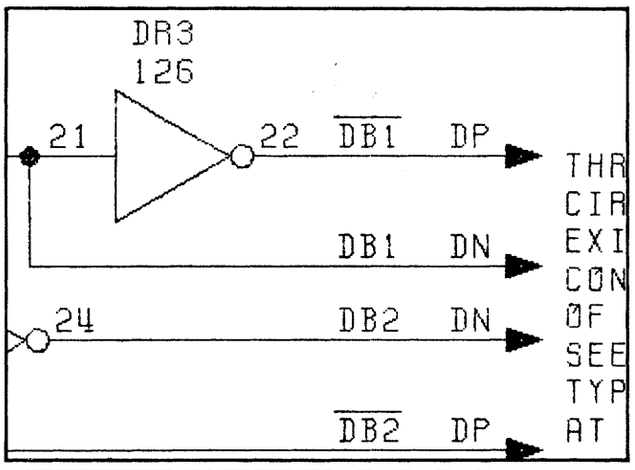

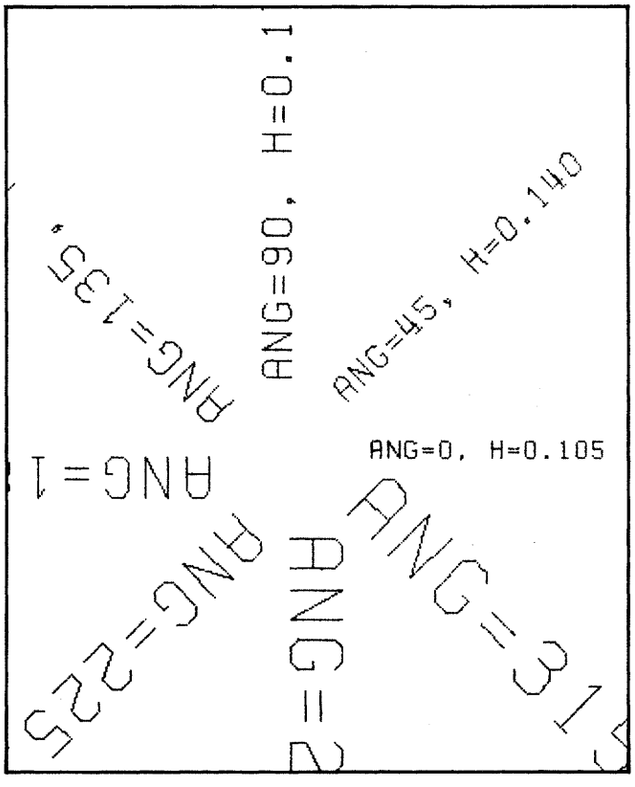

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LETTERS

EPA Pesticides Regulation

In his article "Pesticides: Three EPA [Environmental Protection Agency] attorneys quit and hoist a warning flag" (News and Comment, 19 Mar., p. 1155) Luther J. Carter seems to have fallen into the trap of journalistic sensationalism, something which should not be tolerated in a scientific journal. Carter should have done the necessary research to write an article which described the dilemmas of pesticide regulation and the honest struggle to reach sound solutions. Simply to put the white hats on the quitting lawyers and the black hats on the indecisive and fumbling bureaucrats serves little purpose.

What then are some of the real problems? First, scientific knowledge is incomplete on such questions as how to unequivocally identify carcinogens and how to translate laboratory results to the human experience, both with regard to species differences as well as exposure rates.

Second, there is a difference between the legal and the scientific approach to a problem. The scientist can and must consider all available information; the lawyer's argument includes only those aspects beneficial to his client. At first glance this often makes the scientist appear to be indecisive and contradictious, whereas the lawyer appears uncompromisingly clear. But in order to arrive at the truth, the legal approach calls for an adversary opinion and finally for a jury or a judge to render a verdict. The scientific approach is based on argumentation among peers in order to come to a consensus opinion. A split decision is an acceptable outcome, but it does not indicate that someone is right and someone is wrong. Rather, it indicates that the available information can be interpreted in more than one way and that probably more detailed data are needed to arrive at a consensus.

I am not on the side of those who want to poison mankind and the environment for personal gain and treat our gene pool with noxious chemicals. I am on the scientific side, the side which does not quit when things get rough, the side which keeps asking questions and tries to resolve the problems. For the quitting EPA lawyers, the episode is merely another experience under their belt; for the scientists remaining at EPA the struggle goes on.

The EPA has many scientists whose training and experience *have* in fact prepared them for confronting the questions of chemical carcinogenesis, as well as other problems relating to pesticide safety. The question arises of how legal training prepares an individual for confronting these problems.

There is no doubt that the regulation of pesticides needs both legal and scientific support, but these two aspects must complement each other. A "prima donna" attitude on the part of either the lawyers or the scientists does not serve the purpose. We should also not lose sight of the fact that the problems related to pesticides are basically scientific (food production, carcinogenesis, disease eradication, public health, toxicology, biology, and biochemistry) and not legal.

RETO ENGLER
1233 Independence Avenue, SE, Washington, D.C. 20003

I take issue with Carter's insinuation that the pesticide decision-making process of the Environmental Protection Agency (EPA) should be the responsibility of its Office of General Counsel (OGC) rather than its Office of Pesticide Programs (OPP). This would not be in the best interest of either agriculturalists or environmentalists.

While I realize that scientists are not always unbiased, I cannot believe that decisions made by the scientists in the OPP will be more biased than those made by the lawyers of the OGC, who confess to having close ties with the Environmental Defense Fund. Although the course of study required to receive a law degree is rigorous, the receipt of a law degree does not instantaneously give an individual perfect insight into ecology or the science of carcinogenesis. To allow lawyers in the OGC to formulate pesticide decisions makes about as much sense as allowing the scientists in the OPP to handle the legal matters of the EPA.

As a member of the staff of the House Committee on Agriculture, I have known and worked with Edwin Johnson, EPA's deputy assistant administrator for pesticide programs. I feel that he is one of the most capable young men in Washington. His decisions have not always been agreeable to environmentalists, nor have they all been accepted with enthusiasm by agriculturalists; but no one can say they have been made with disregard for scientific evidence.

There are always at least two sides to most issues, and pesticide policy is no exception. Environmentalists seemingly are dedicated to banning all potentially toxic substances regardless of the effects on the economy and food production. Agriculturalists, on the other hand, see the benefits of pesticides to their industry and are hesitant to understand

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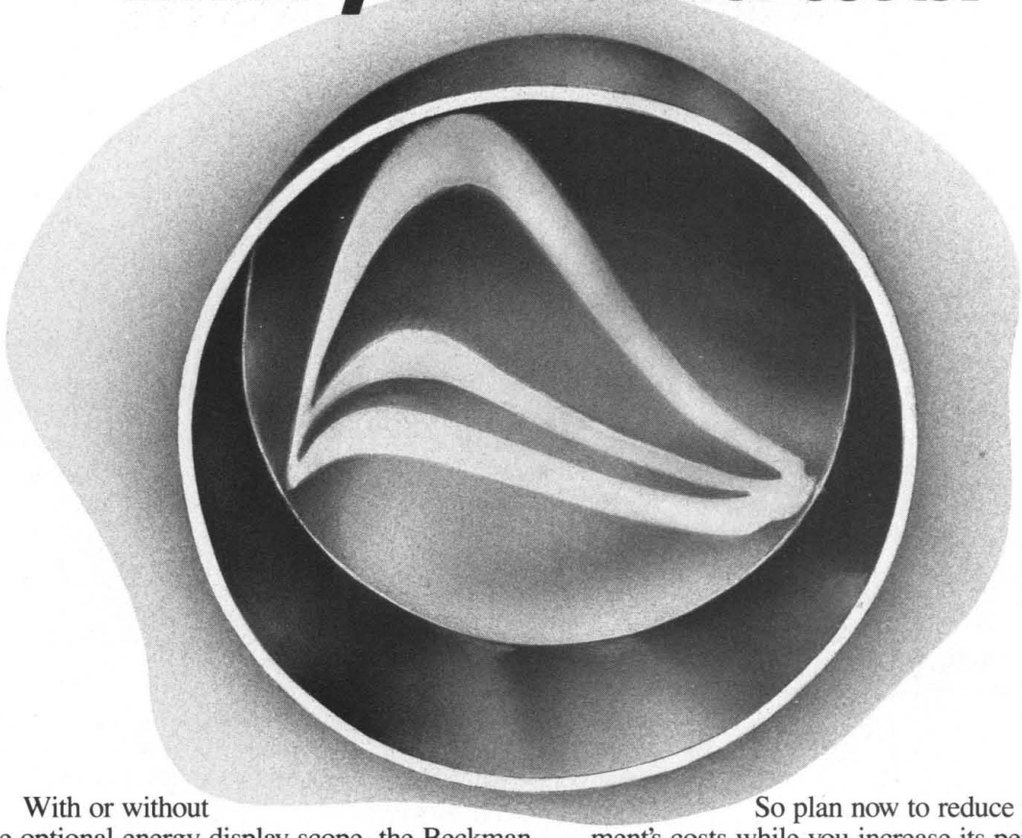

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the justification for pesticide cancellations. The only rational decision-making process is one which will balance costs versus benefits and utilize scientific data as a basis for pesticide policy.

It was with this goal in mind that Congress passed legislation amending the Federal Insecticide, Fungicide, and Rodenticide Act to require EPA to prepare and file statements on the impact of pesticide decisions on the agricultural economy, the supplies of food and fiber, and consumer food prices. Since this requirement can only act to benefit all Americans, it would seem to refute Carter's implication that Congress bowed to the agricultural lobby. It is more likely that special interest groups have had an undue influence on the three EPA lawyers, who admit turning to environmental groups for guidance and assistance in their policy-making efforts. The transfer of pesticide decisions back to the OPP should rectify this problem by putting the decisions back in the hands of scientists, who will base their decisions on scientific evidence rather than emotionalism.

JOHN C. BAIZE
1301 Longworth House Office Building, Washington, D.C. 20515

In response to the suggestion that I have engaged in "journalistic sensationalism," I merely point out that the resignation of the three attorneys—made in protest at what they perceived to be a bad turn in EPA policy—was in fact highly unusual, or, if you will, "sensational." Furthermore, I said quite plainly that the merits of their criticism of the organizational and policy changes at EPA must be judged later in light of how well or badly these changes work out in practice.

By insisting that I should have described the dilemma inherent in pesticide regulation, Engler really seems to mean that I should have emphasized how difficult it is for scientists in the Office of Pesticide Programs (OPP) to arrive at judgments on which regulatory decisions can be based. He shows little interest in the other horn of the regulatory dilemma—the necessity of protecting people and the environment from possibly harmful chemicals, even though the evidence as to their effects may be incomplete or ambiguous. When this dilemma is not squarely faced, the result is regulatory paralysis.

Baize speaks highly of Edwin Johnson, the current head of the OPP, and seems to imply that my article puts him in a bad light. The fact is, Johnson, whose predecessor was transferred for failing to deliver, was only mentioned in order to point out that Administrator Russell E. Train has told him that the OPP is now on its mettle to "move ahead aggressively."

Baize also refers to my "implication that Congress bowed to the agricultural lobby." What I wrote was that, at the urging of chemical industry and agricultural interests, the House of Representatives came within only a few votes of adopting an amendment that would have gutted the Federal Insecticide, Fungicide, and Rodenticide Act by giving the Secretary of Agriculture an effective veto over the EPA administrator's decisions.—LUTHER J. CARTER

ESCA Systems

I wish to commend Arthur L. Robinson for the comprehensive nature of his article "Surface analysis: Multiple techniques for monolayers" (Research News, 26 Mar., p. 1255). However, there are some errors in the section on electron spectroscopy for chemical analysis (ESCA). Robinson notes that prices for ESCA instruments range from about $110,000 to more than $350,000 for our most complex machine. Much as we at AEI would like to be able to charge $350,000 for an ESCA system, we do appreciate that this is a highly competitive world and that such a price would severely limit our sales.

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B. E. P. BEESTON
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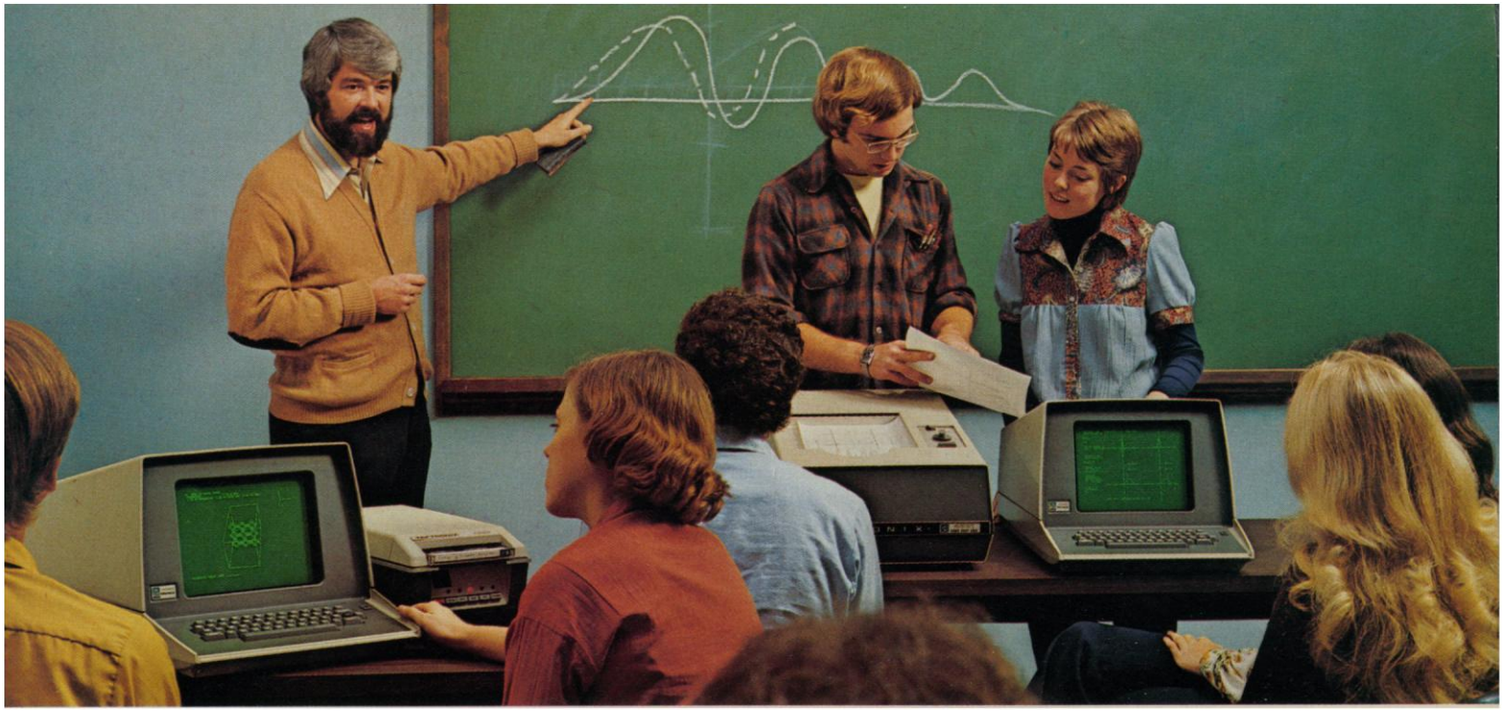
Protection of Archeological Sites

I would like to clarify a statement made by Rhodes W. Fairbridge in his article "Shellfish-eating Preceramic Indians in coastal Brazil" (30 Jan., p. 353). Fairbridge states that "although shell middens are theoretically protected by law in both Brazil and the United States,



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almost nothing is done to enforce it." In the United States, archeological sites, including shell middens, are provided a measure of protection by a variety of federal and state laws and regulations, the most important of which, at the federal level, are the Antiquities Act of 1906, the Historic Sites Act of 1935, the National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969, Executive Order 11593, and the Archeological and Historic Preservation Act of 1974.

Only sites located on federal lands are provided any total statutory protection. Unlike more recent laws which emphasize protection of sites from land development actions by federal agencies, the Antiquities Act, as well as many state and local laws, is aimed at preventing the indiscriminate excavation and sale of antiquities from public properties by unauthorized individuals. It is true that enforcement of the Antiquities Act has been difficult because of the vast extent of public lands; however, it has been our experience that vandalism of archeological sites has been most severe in the western portion of the United States. Rock art is particularly vulnerable to vandalism, as are midden sites, from which artifacts are stolen for collections, and small surface sites which are destroyed by off-road recreational vehicles. Shell middens are probably the least vandalized type of archeological site on public lands.

All of the recent historic preservation laws have emphasized identification, protection, and enhancement of those cultural resources in this country which are subject to adverse effects by federal or federally assisted projects. These laws have created the basis of a system whereby early planning affords substantial protection to archeological sites, as well as to other cultural resources. Compliance by federal agencies is still imperfect but is steadily improving.

It is primarily through the coordination and cooperation of federal, state, and local planning and preservation programs that these national laws can be fully implemented to provide better protection for our cultural heritage.

REX L. WILSON

National Park Service, Department of the Interior, Washington, D.C. 20240

Wilson's notes on the protection offered to midden sites on federal lands are helpful, though unfortunately a little late. In many cases, along our East Coast the middens were exploited for lime by the farmers in pre-Revolutionary days. At that time, however, I do not think the term "vandalism" would have been appropriate, but rather, "the exploitation of nature's bounty."

RHODES W. FAIRBRIDGE

Department of Geology, Columbia University, New York 10027

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DAVID K. BORAKER

Department of Medical Microbiology, College of Medicine, Given Medical Building, University of Vermont, Burlington 05401

Disclaimer

In his review (29 Aug. 1975, p. 712) of *Primate Aggression, Territoriality, and Xenophobia* (*1*), to which I contributed a chapter, Glenn Hausfater attributes to me the "conclusion" that "quantitative data on any aspect of monkey aggression is lacking despite many hours of observation by many different field workers." Nowhere in my contribution to that volume did I make such a statement, nor have I ever believed it.

LEWIS L. KLEIN

Department of Zoology, University of Alberta, Edmonton, Canada

References

1. R. Holloway, Ed., *Primate Aggression, Territoriality, and Xenophobia* (Academic Press, New York, 1974).

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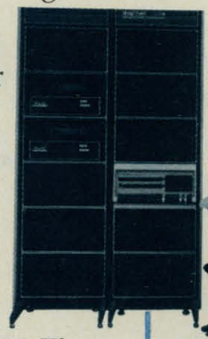

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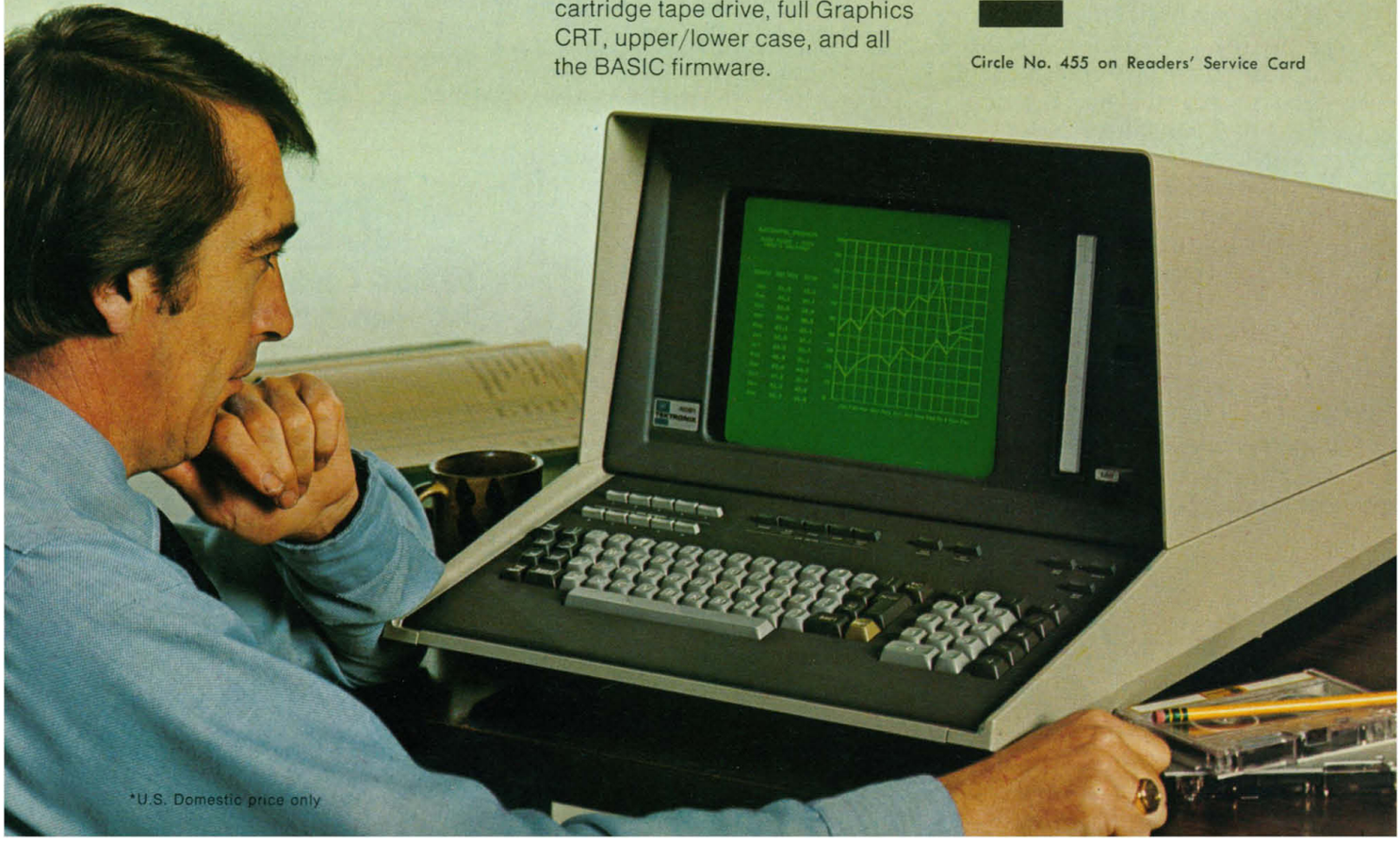

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23 April 1976, Volume 192, Number 4237 **SCIENCE**

Paper Mills

Public and campus concern with the term-paper industry has shifted rapidly from indignation to inattention, leaving the paper mills churning at higher speed. A recent study* concludes that "students at every major university in the country have access to at least one commercial firm that offers a variety of writing and research services ranging from term papers on any subject for undergraduates to M.A. theses and Ph.D. dissertations." Prices are reported to range from a bargain basement $2 per page for an undergraduate term paper (very likely one of many photocopies) to $10,000 for a custom-tailored "original" doctoral dissertation. According to the study cited, demand far outstrips supply; sales are limited chiefly by the firms' inability to retain a sufficient number of "qualified" ghostwriters. Other evidence suggests that some term-paper entrepreneurs overcome this limitation by making use of unwitting labor: papers are stolen from departmental offices and sold, with already-graded "A" papers commanding the highest rate.

Several university administrators and public officials concerned with higher education engaged in a short-lived, largely unsuccessful effort to close down the mills. The obstacles they encountered included the defense of private enterprise, First Amendment freedoms, and the individual's right to privacy. Paper mill executives argued that they sold the papers as "research material" and could scarcely be held responsible for the unethical usage many students made of them. Quite a few faculty, disgusted with the paper mills, became even more dismayed by what they saw as the "police tactics" their administrations advocated to catch students involved.

Indeed it does seem that the proper place for an educational institution to combat the unethical and anti-intellectual patronage of paper mills is at its source: student cynicism regarding the true aims and values of the educational process. A good deal more is at stake than the authenticity of the credentials the university provides its graduates, or the maintenance of academic standards. A university must view as one of its main missions to instill in its students a respect for intellectual integrity and a sense of the value of learning for its own sake and of advancing their careers by legitimate means. After all, there is only a short distance from submitting a purchased Ph.D. to doctoring one's research findings and to other unprofessional and unethical practices.

The task is a very difficult one. Society is undergoing a period of soul-searching in which the media carry daily reports of unethical conduct by corporation executives, government officials, and professionals. Contact between the faculty and the students in many colleges is limited in scope and intensity, which curbs the opportunities for moral standard setting, emulation, and education. Nor is it quite clear how best to proceed.

Preaching in classrooms, exhorting the student government (if one exists), and having chaplains make appeals are measures that are hardly going to help. A grand dialogue of the faculty and the students on the issues involved may help but may be neither attainable nor sufficient. A highly punitive approach might well be rejected by many faculties, and might not educate the students, even if it led them to purchase fewer papers.

Possibly, as a first step, the American Council on Education, the AAAS, and the many other associations available to academia should set aside more of their symposia, workshops, and convention time to face the question: What is to be done about students who, in effect, purchase their degrees, cheat themselves of education, and drain their degrees of substance? Can colleges disregard this reportedly rampant practice, and not in a sense be paper mills themselves?—AMITAI ETZIONI, *Center for Policy Research, Inc., 475 Riverside Drive, New York 10027*

*R. J. Simon, E. Smith, J. Leckenby, M. Long, S. Young, "The term paper business," unpublished report, University of Illinois, p. 1.

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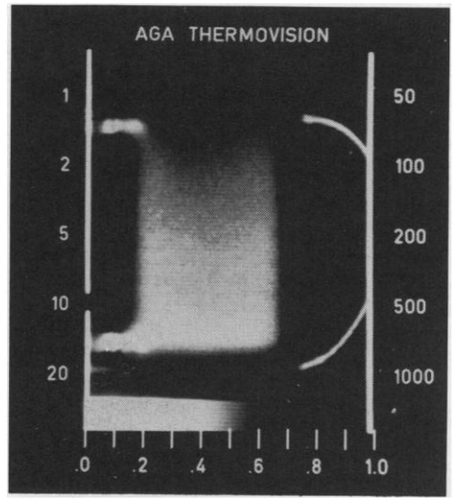

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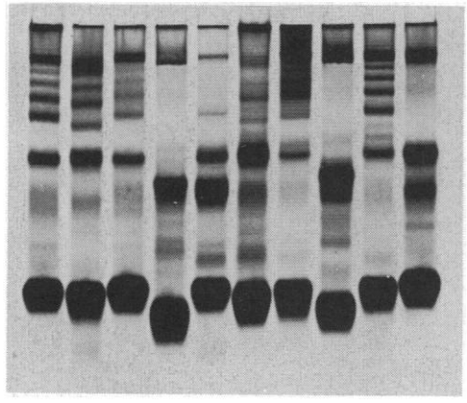

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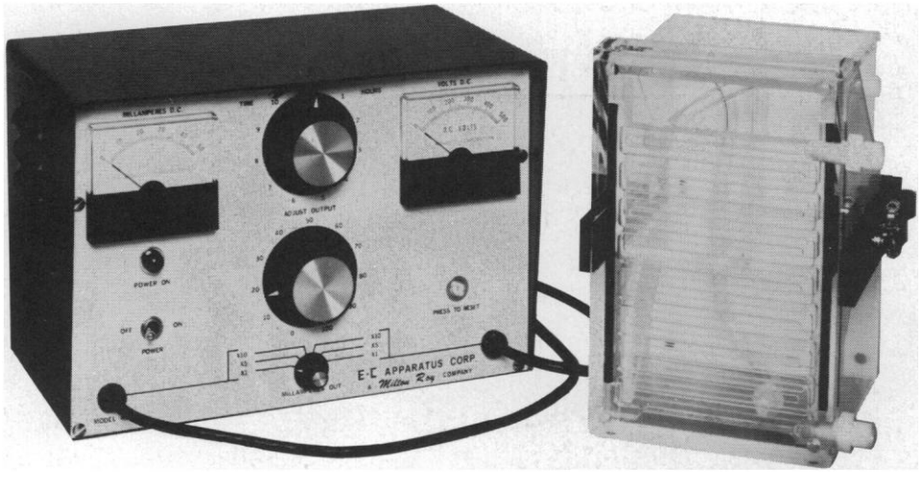

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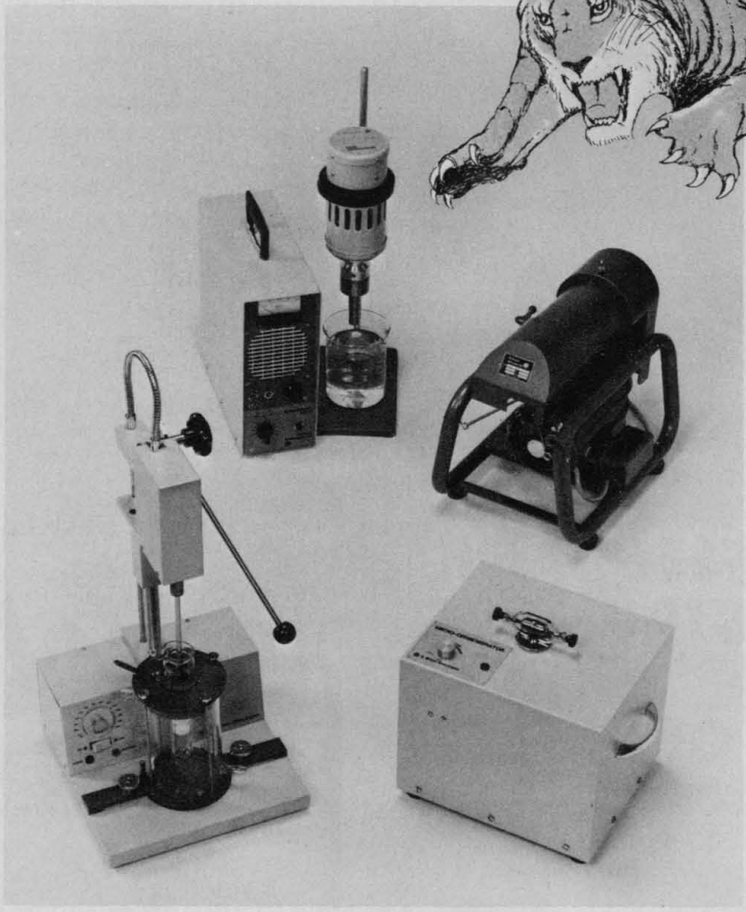

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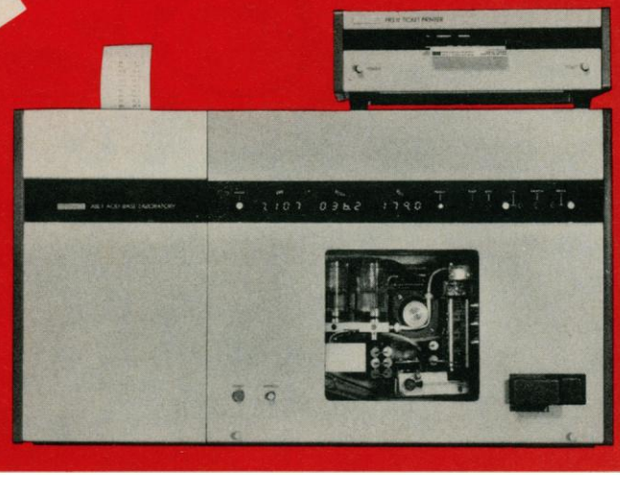

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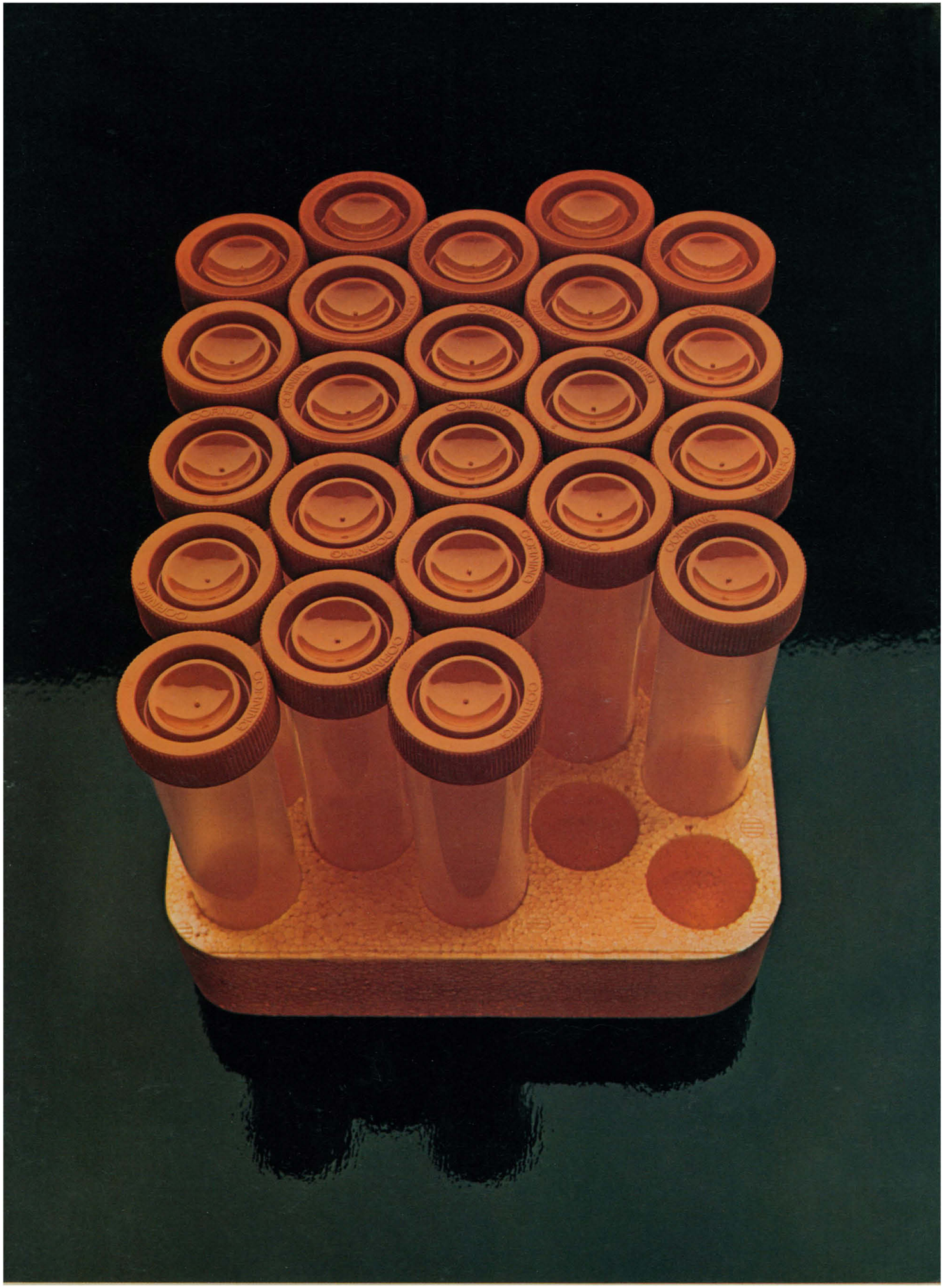
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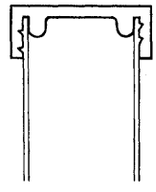

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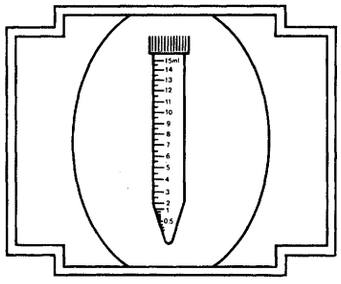

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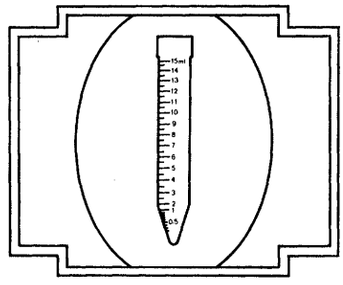

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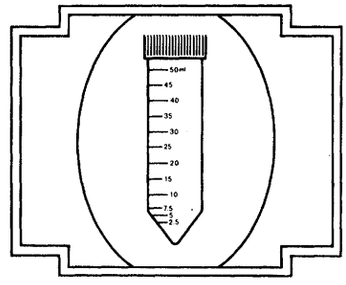

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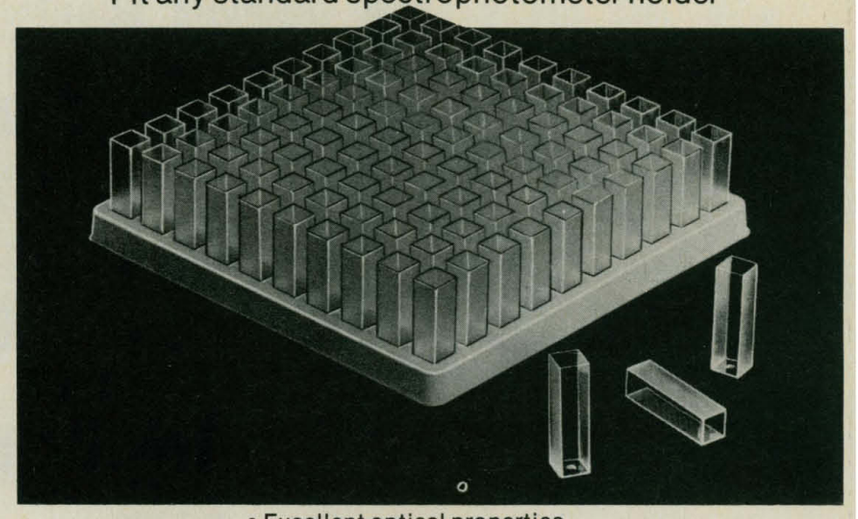

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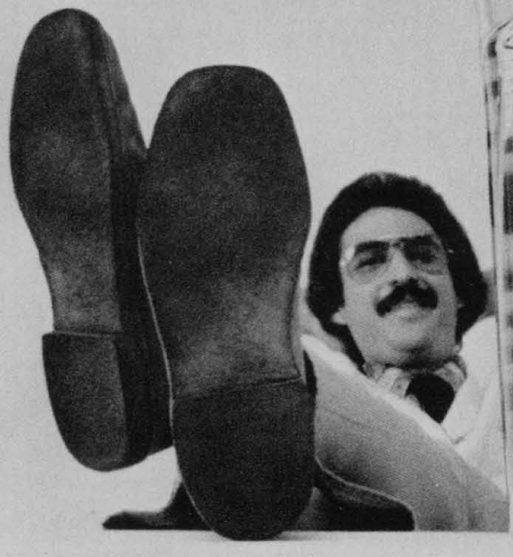

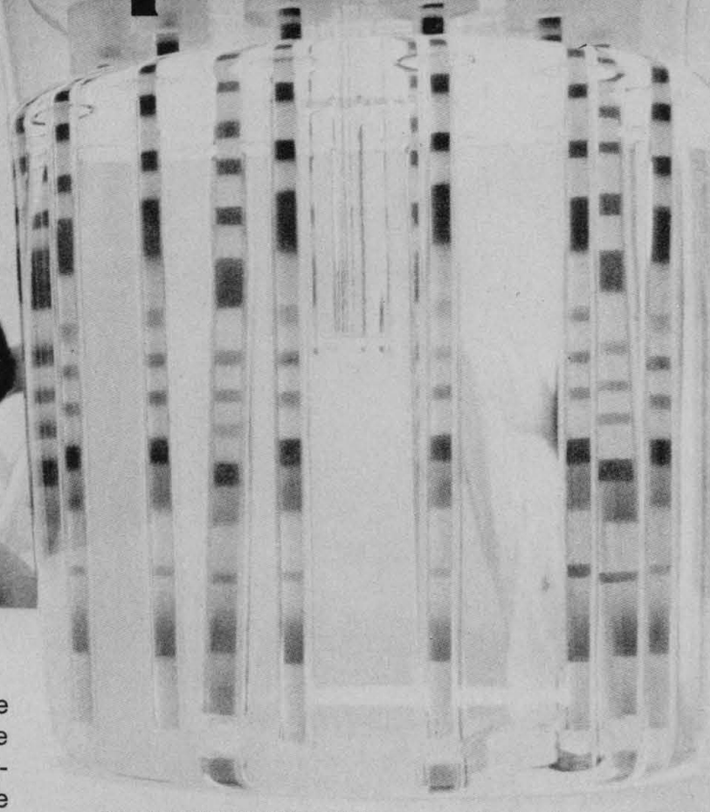

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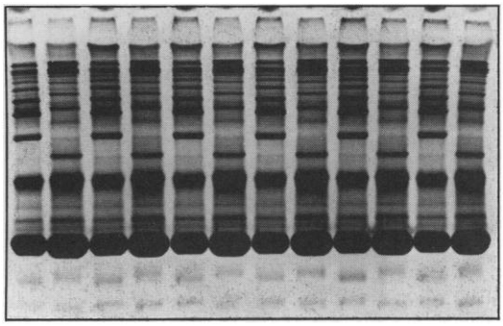

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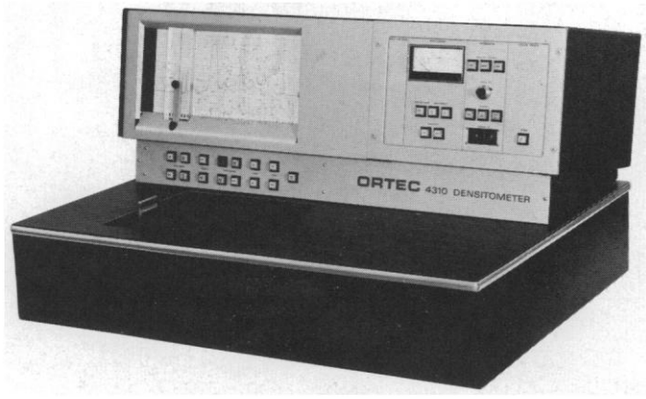

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THE UNCOMMON COLD.

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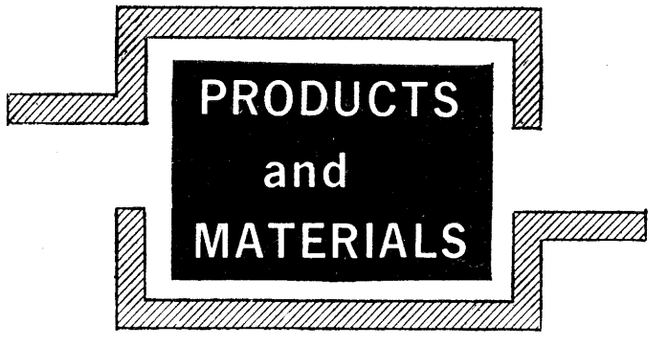


Perfusion Indicator

The HP47205A perfusion indicator allows the operator to inspect the upper part of a patient's ear optically and determine whether the blood flow is adequate to obtain an accurate measurement of arterial oxygen saturation with the HP47201A oximeter. High perfusion readings indicate correspondingly high accuracy of readings with the oximeter. This noninvasive technique permits screening of patients whose peripheral vasoconstriction might limit the use of the oximeter. Hewlett-Packard, Medical Electronics Division. Circle 646.

Pipette for Platelet-Rich Plasma

The PRP micropipette eliminates mouth pipetting of plasma. Pipetting may be accomplished without changing tips. The device is calibrated for 3.3 and 6.6 microliters and may be used for any volume up to 10 microliters. A spring-loaded adjustable piston fits snugly within a precisely bored capillary. The piston cleanly loads and completely empties the capillary when depressed and released by one finger. Streck Laboratories. Circle 647.

Anaerobic Workbench

The 75A workbench consists of a Plexiglas isolator equipped with a vacuum airlock, an incubator, a filtration-catalyst system, glove port inserts, and with optional accessories such as lighting, additional glove ports, and others. The workbench is constructed for maximum visibility and even the incubator is made of Plexiglas. Thus, conventional techniques may be used to grow anaerobic organisms within the workbench. Even organisms that require environments with less than 5 parts of oxygen per million in the atmosphere may be cultured, observed, and manipulated. Electric outlets are provided within the isolator for centrifuges, mixers, and other bench-top apparatus. Germfree Laboratories. Circle 649.

Immunofluorometric System

The FIAX system features a sampling device called a StiQ Sampler. StiQ is an acronym for surface technique for immuno-quantitation. Each sampler has a specially prepared surface with affinity for a given serum constituent located at one end. When the sampler is inserted in a diluted sample, the surface captures the desired constituent in proportion to its presence in the sample. Two incubations in which the sampler is moved from tube to tube complete the preparation for counting. Counting is done in the FIAX fluorometer. Determination of immunoglobulins G, A, and M may be made in 1 hour including the 5-second readout of the results. International Diagnostic Technology. Circle 650.

Refrigerated Low-Speed Centrifuge

The J-6 operates at speeds up to 6000 revolutions per minute and can process up to 6 liters of sample in a single operation. It also features Multi-Disc adapters to permit the use of virtually any popular size of centrifuge tube. For example, up to 222 5-milliliter tubes may be accommodated by stacking the adaptors. There is a rotor-imbalance detector that shuts the instrument off in case of an imbalance that could damage either the rotor or the drive. Five rotors are offered including 4- and 6-liter swinging-bucket models and a special rotor for radioimmunoassay racks. Beckman Instruments, Spinco Division. Circle 651.

Yeast Identification System

The UNI-YEAST-TEK system is designed to identify 18 common clinically significant yeasts. The system consists of incubation plates, sucrose assimilation tubes, glucose beef extract media tubes, and an identification logic wheel. The plates consist of 11 sealed peripheral wells with solid media for urea, carbohydrate, and nitrate tests and a center well for morphological examination of the specimen. Based on the specimen's appearance and behavior in the various tests, the logic wheel is used to identify the specimen. Corning Glass Works, Medical Division. Circle 652.

Literature

Diffu-Gen Immunology Systems are now augmented by a set of reference tables designed to accompany each production lot and simplify calibration and standardization. Oxford Laboratories. Circle 653.

microNOVA, a minicomputer for medical and instrumentation applications, is the subject of an illustrated brochure. Data General. Circle 654.

Cardiac Output Trend Monitor describes an instrument for continuous indication of cardiac output. Dynatech R & D. Circle 655.

Digiglobin Hemoglobinometer is characterized in an 8-page brochure. The device is designed for use in hematology, pulmonary, intensive care, and other laboratories. Fisher Scientific. Circle 656.

Clinti-Chem is a unit-dose technetium dispenser for radiodiagnostic organ scans. Union Carbide, Clinical Diagnostics. Circle 657.

Clinical Diagnostics are covered in an extensive price list catalog. Calbiochem. Circle 658.

Muscle Re-education System is a biofeedback device for physical therapy and behavioral research. Cyborg. Circle 659.

CO_2 Laser Scalpel is the subject of a 4-page data sheet. This surgical laser has many medical and research applications. Coherent Radiation. Circle 660.

Cardiotherm 500 Thermo Dilution Computer measures blood temperature and other cardiac output parameters. Columbus Instruments. Circle 661.

Space-Stat 30 Sodium-Potassium Analyzer makes these determinations on a whole blood sample in 1 minute. The analyzer is described in an illustrated brochure. Orion Research. Circle 662.

Human Platelet Reference Control is the subject of a product bulletin. Diagnostic Aids. Circle 663.

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 326A and 398A) and placing it in the mailbox. Postage is free. —RICHARD G. SOMMER

Which Büchi/Brinkmann Rotary Evaporator should you get?

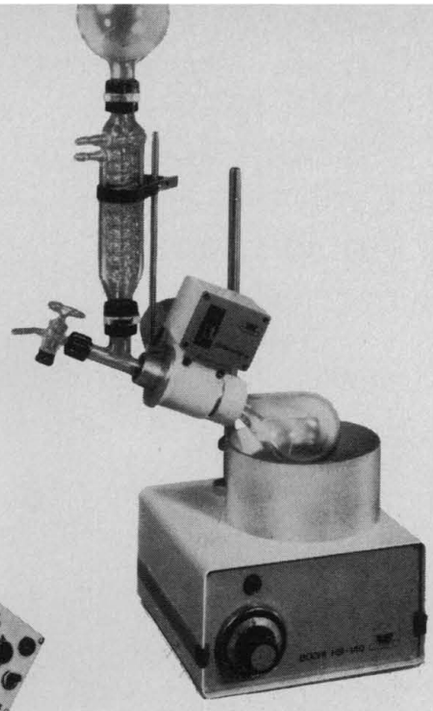
We make the choice hard, to make the extraction easy.

Büchi/Brinkmann offers rotary evaporators in a variety of models to facilitate all types of extractions.

There is a rotary evaporator for volumes as small as 5 ml, and Pilot Plant Models for volumes as large as 50 l. In between, there are models with variable speed electronic motors, sparkless induction and explosion-proof motors, quick-action jacks, stainless-steel heating baths, and a wide selection of flasks, condensers and accessories.

If the rotary evaporator you need is not shown here, you'll find it in the new Büchi/Brinkmann brochure. For your copy, write: Büchi Division, Brinkmann Instruments, Cantiague Road, Westbury, N.Y. In Canada: 50 Galaxy Boulevard, Rexdale (Toronto), Ont.

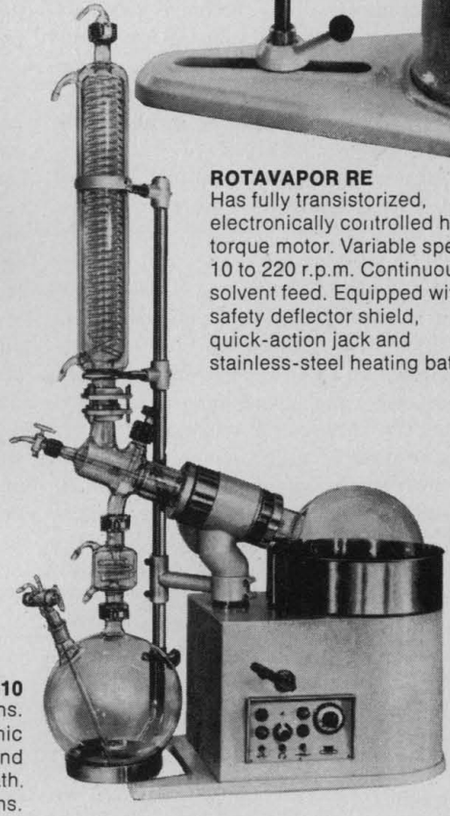
Büchi/Brinkmann Rotavapors



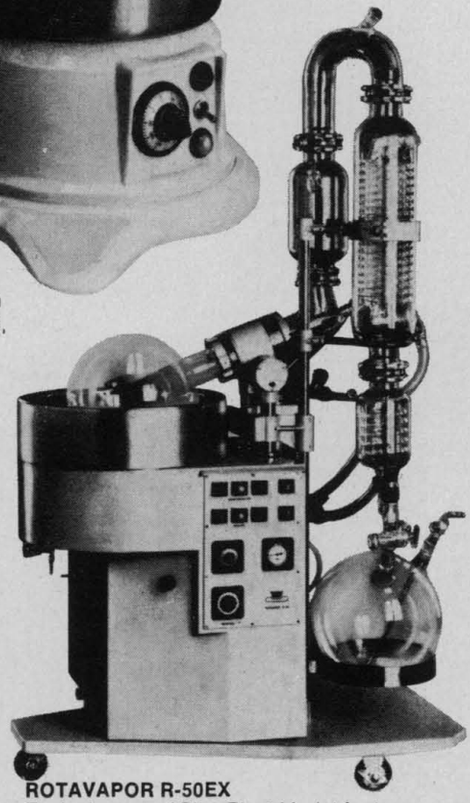
SMALL VOLUME ROTAVAPOR M
For evaporations, organic synthesis, and analysis of volumes 5 to 100 ml. Rotates at 150 r.p.m. All glassware is threaded. Comes with 4 evaporating and 3 receiving flasks plus extra vacuum seals. Less than 2 ft. wide.

ROTAVAPOR RE
Has fully transistorized, electronically controlled high torque motor. Variable speed, 10 to 220 r.p.m. Continuous solvent feed. Equipped with safety deflector shield, quick-action jack and stainless-steel heating bath.

ROTAVAPOR EL
Specially designed distribution head with built-in duct permits applications not possible with other rotary evaporators. Also has electronically-controlled motor, quick-action jack and stainless-steel heating bath.



ROTAVAPOR R-10
Designed for large volume applications. Has 10 liter flasks, mechanical lift, electronic speed control (10 to 150 r.p.m.) and thermostatically-controlled heating bath. For batch or continuous-feed operations.



ROTAVAPOR R-50EX
Explosion-proof Pilot Plant Model for large volume extractions. 50 liter capacity flasks, high throughput of solvent. Variable speed motor. For batch or continuous-feed operations.

RESEARCH NEWS

(Continued from page 362)

x-ray diffraction and electron microscopy to determine the structure of glutamine synthetase, are among the few who have reported results with this technique. Groups at Brandeis, the University of California, Berkeley, and the University of Wisconsin-Madison also have research under way. Outside the United States, there are active groups at the Biozentrum of the University of Basel, the Institute of Crystallography in Moscow, and the Max Planck Institute for Biochemistry in Munich.

Reasons cited for this state of affairs do not include the expense of equipment. A good quality electron microscope, a scanning microdensitometer, and computation facilities are neither cheaper nor more expensive than much equipment common in other types of experiments in structural biology, such as protein crystallography and nuclear magnetic resonance spectroscopy. But, three-dimensional image reconstruction is not a trivial technique. Rather, a group of researchers willing to forego the possibility of quicker results from other types of experiments must spend considerable time mastering the various aspects of the method (especially finding and preparing suitable specimens) before they will have publishable results.

Seen in this light, the spectacular results of Unwin and Henderson may be just as important for the boost they may give to others to take up image reconstruction as for their scientific value. There is, however, one outstanding question mark, namely, how generally applicable is their method?

Besides the glucose fixation method of the MRC investigators, there are at least two other ways to prepare hydrated, unstained specimens for electron microscopy. Donald Parsons and S. W. Hui of the Roswell Park Memorial Institute in Buffalo have devised an environmental chamber in which it is possible to maintain a specimen in its natural hydrated state by differential pumping; that is, near the sample, the vacuum is poor, but elsewhere the vacuum is typical of all electron microscopes. And at the University of California, Berkeley, Kenneth Taylor and Robert Glaeser carefully freeze specimens in liquid nitrogen. The frozen samples do not dehydrate when under vacuum. Electron diffraction patterns of catalase crystals prepared by both methods indicate that structural details with dimensions of 2 to 3 angstroms are preserved. In addition, there is accumulating evidence that radiation effects are much less severe at cryogenic temperatures that at room temperature.

But how many biological molecules are there that naturally align themselves into two-dimensional periodic structures or that crystallize into such a form? Glaeser and Donald Caspar of Brandeis think there may ultimately be quite a few. Besides membrane proteins which would seem to be natural candidates for crystallization into two-dimensional forms, Caspar is enthusiastic about the possibility of imaging large animal viruses. Such viruses may be too formidable for x-ray crystallography to tackle, in part because of the phase problem, but would be easier subjects for image reconstruction because both amplitude and phase information are available. Robert Horne at the John Innes Institute, Norwich, England, has recently reported on a method for preparing highly ordered two-dimensional arrays of viruses that may be applicable to image reconstruction.

Glaeser points out that, within cell membranes, many apparently crystalline materials exist, but as yet no one has been able to crystallize them outside the cell in a form suitable for electron microscopy. Glaeser also feels that, because image reconstruction from electron micrographs is a faster and less arduous technique than x-ray diffraction, it may be the method of choice in cases where both two- and three-dimensional crystals are available, provided that the resolution of electron microcrospy can be increased to that of x-ray diffraction.

To this end, Glaeser and Ivy Kuo at Berkeley have been experimenting with image intensifiers and with nuclear track photographic emulsions in order to increase the sensitivity of the electron recording process. In Unwin and Henderson's experiments, perhaps six or seven electrons struck one picture element in the digitized micrograph. The Berkeley researchers want to decrease this to one electron, and foresee that by so doing, they may achieve a spatial resolution of 3 angstroms.

Some scientists think it may be possible to prepare two-dimensional arrays of molecules (for example, elongated molecules could be tied to a substrate at one end), but each molecule could be oriented slightly differently at its binding site. Joachim Frank of the State of New York Department of Health, Albany, has been exploring theoretical methods for averaging data from arrays of identical objects that are not periodic. If such methods were to be perfected, then, in the words of one scientist, the sky would be the limit.—ARTHUR L. ROBINSON

Chromatographic compatibles from Bio-Rad

Three new best buys in chromatographic instruments

To monitor, record and collect chromatographic separations Bio-Rad introduces three sensibly priced instruments — UV Monitor, Strip Chart Recorder and Fraction Collector — all loaded with convenience features you have come to expect from Bio-Rad products.

Model 1300 UV Monitor

Here's a UV monitor with all the features you always wanted, at a price you can afford — $1,395.

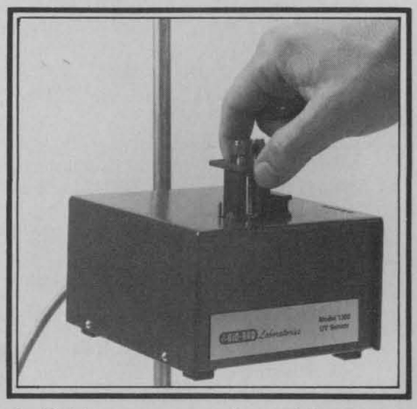
1. Double wavelength. Just pull the knob on the sensor to switch from 254 to 280 nm.

2. Direct readout — in absorbance units.

3. Six interchangeable flow cells. Standard: (as equipped) high sensitivity with 1.5 mm bore arms.

Optional: Microcell, Density Gradient, High Absorbance (0.05 to 20 OD), Dual Path Flow and Quantitative.

Cell changing is easy, positive positioning pin insures correct alignment.



4. Cold room operation. All components are stabilized for continuous cold room operation. (**All** these compatibles are designed for cold room use if desired.)

5. Event marker. For peak delineation.

6. Convenient mounting. Sensor can easily be located near separation source, or wall mounted if desired. Mounting bar at rear of sensor simplifies this operation.

7. Range. A 7 position range selector gives the Model 1300 tremendous flexibility.

8. No high voltage in connecting cables.

Reader service no. 426

Model 1320 Fraction Collector

The Model 1320 has all the features Bio-Rad has looked for in fraction collectors, but never found before in one instrument. Look what $795 can buy.

1. Indexing. (Includes automatic digital counting.)
Timed (standard)
1 to 199 seconds
1 to 999 minutes
Volume (optional)
1 to 999 drops

2. Turntables. With the standard and optional turntables you can run one, two or three columns simultaneously, run a preparative column or collect directly into scintillation vials.

Standard (shown in photo)
Single 136 x 10 ml test tubes

Optional
Double 136 x 10 ml
Preparative — 50 x 75 ml test tubes
Spot Collection
Single 160 x 1 ml
Double 160 x 1 ml
Triple 160 x 1 ml
Scintillation Vial Turntable
50 x 20 ml vials

3. Dual event marker.
Switch closure
5-volt pulse

4. Three powered outlets. For use with accessories such as pumps, recorders, etc.
Power — activated whenever master switch is on.
Run — activated only while collection is in progress. Turns off at conclusion of run.
Finish — activated after last collection.

5. Overflow protection.

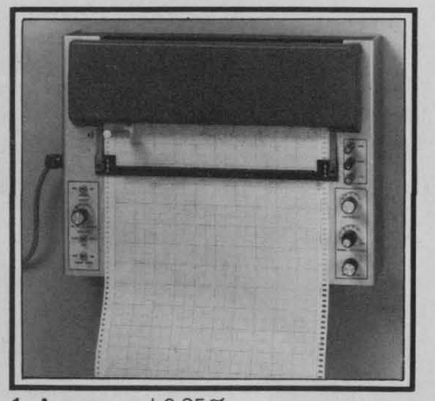
6. Manual advance button.

7. Cold room compatible.

Reader service no. 540

Model 1310 Strip Chart Recorder

The Model 1310 has strip chart features rarely found at $695. It can be wall mounted or bench mounted and has all the other attractions shown below.



1. Accuracy: ±0.25%

2. Repeatability: 0.1%

3. Linearity: ±0.5% full scale

4. 12 chart speeds
0.5, 1.0, 2.0, 5.0, 10.0 and 20.0 inches/minute
0.5, 1.0, 2.0, 5.0, 10.0 and 20.0 inches/hour

5. Accessory power outlet. Lets you run other apparatus in conjunction with the recorder.

6. Ranges. 16 calibrated full scale ranges from 1 mV to 100V.

7. Scale expansion. Up to 3X on all ranges. Any input from 1 mV to 300V can be accepted for full scale reading.

8. Zero adjust. Twice full scale reading.

9. Automatic pen lift.

10. Cold room compatible.

Reader service no. 541

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