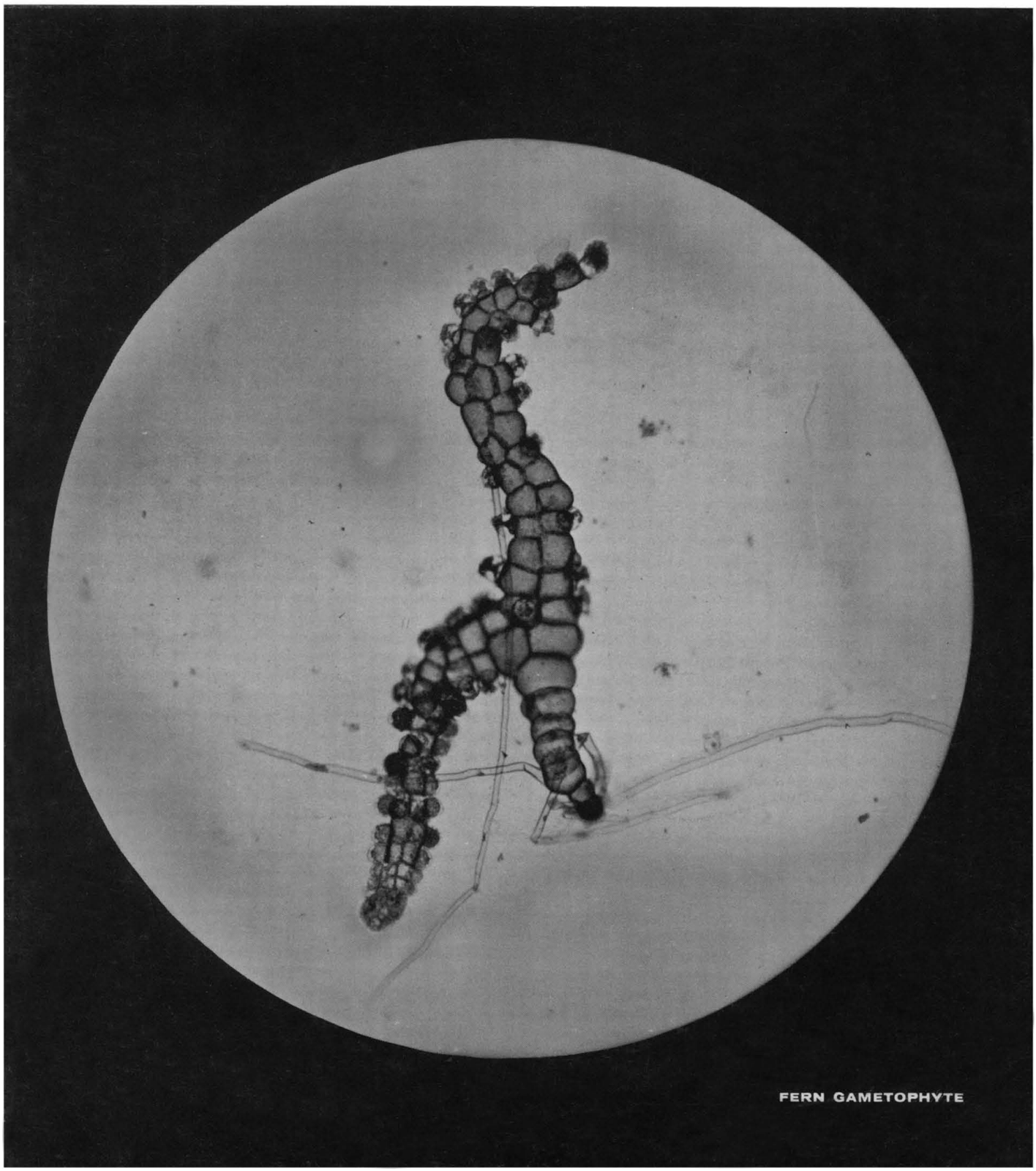
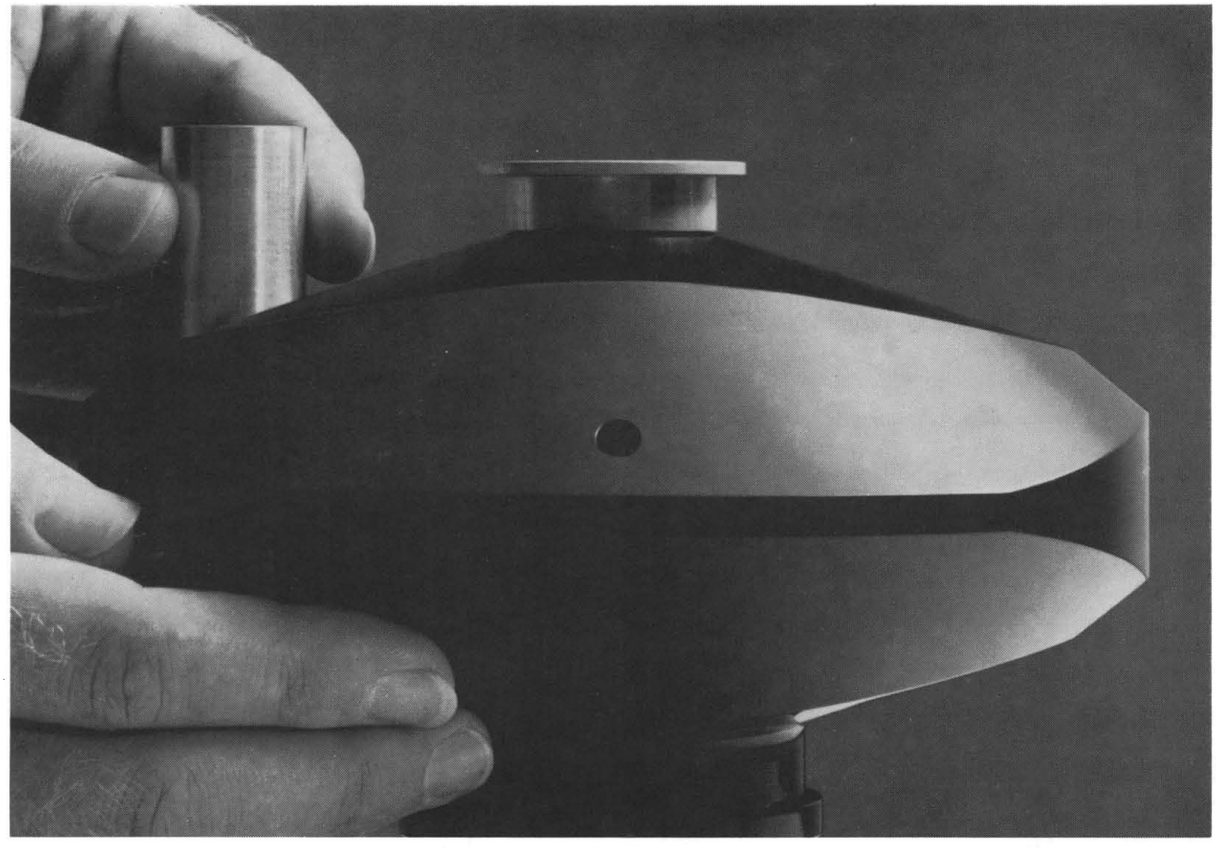
SCIENCE

26 May 1967
Vol. 156, No. 3778

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

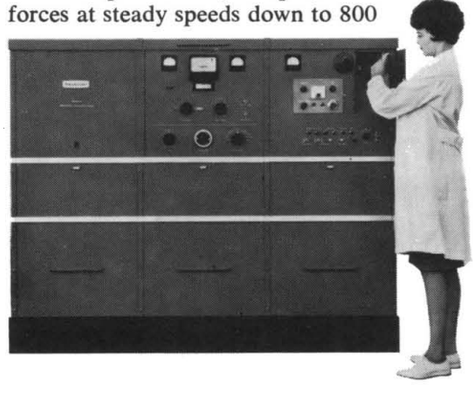


FERN GAMETOPHYTE



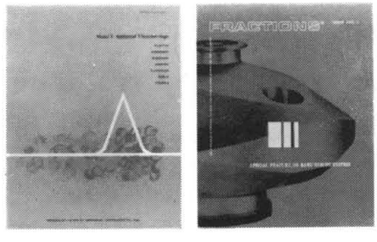
Large molecules and the Analytical Ultracentrifuge

How in touch are you with recent advances in that basic tool for making molecular measurements, the Model E Analytical Ultracentrifuge? Band sedimentation, the short column equilibrium technique, high temperature work with synthetic polymers, the use of computers, direct scanning and recording, higher forces at speeds to 68,000 rpm, lower forces at steady speeds down to 800 rpm for studies of extremely large molecules, new areas of investigation such as the correlation of molecular structure with function—all are steps forward that could very well enable the analytical ultracentrifuge to make a valuable contribution to your research.



Literature Available

If you've not been following the fast-developing field of analytical ultracentrifugation, we'd like to keep you up to date on advances in theory, technique, and instrumentation. One way is to send you the new brochure on the Model E. It reviews applications, measurements, and methodology, and describes the analytical ultracentrifuge of today. Ask for SB-189A.



Another way is to see that you receive *Fractions*®, our quarterly publication sent to users of Beckman instruments for biochemical research; a note on your letterhead to the Editor of *Fractions* will add your name to the distribution list. Extra copies of the two most recent issues are also available: they feature a review of band sedimentation in velocity studies, and a discussion of computers and the ultracentrifuge. Our address: 1117 California Ave., Palo Alto, California.

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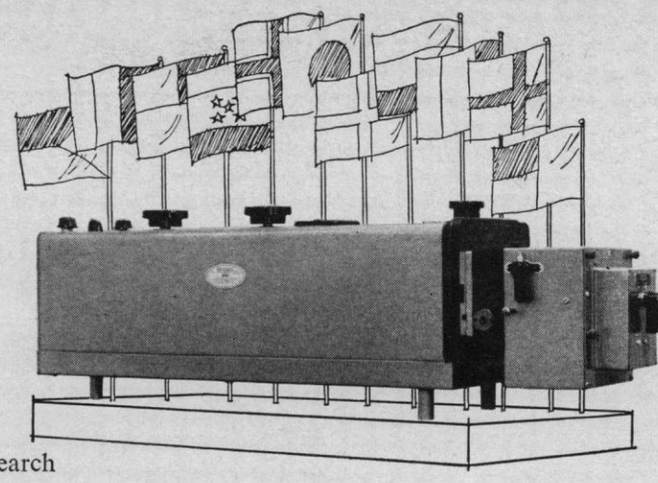

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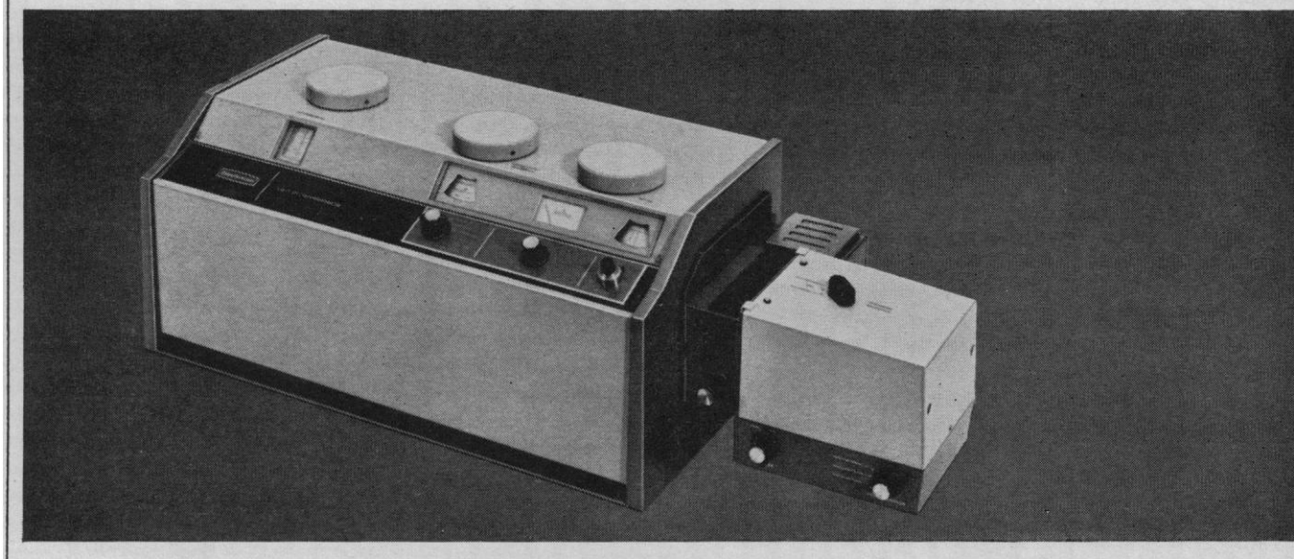
The Beckman DU® is one international issue on which all these nations agree—more than 25,000 are on the job in analytical and research laboratories throughout the world. Its widespread acclaim stems from a durable 25-year record of reliability and accuracy—the null-balance precision, optical and electrical excellence, and flexibility earned for the DU its reputation as "The Standard of the World."



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SCIENCE

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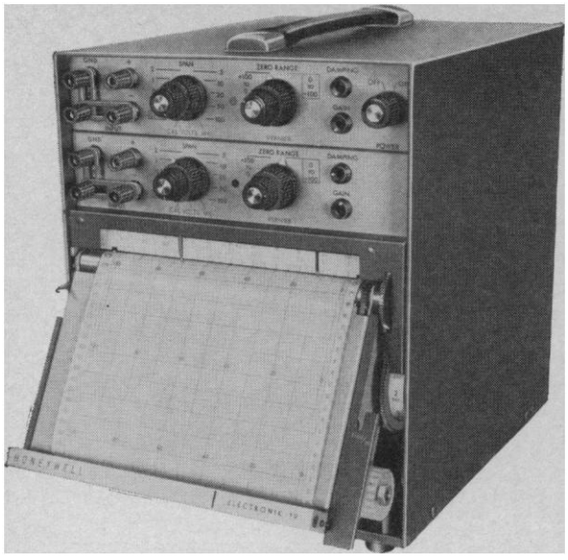
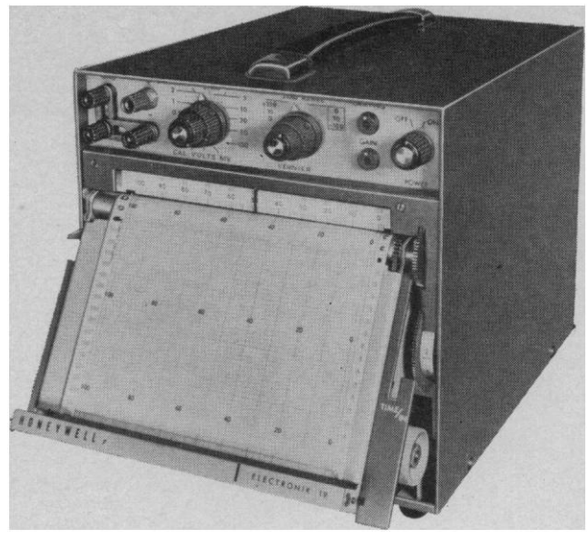
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Twenty-day-old fern gametophyte of fern species *Anemia phyllitidis*. Thread-like rhizoids originate from the basal cell of the gametophyte; the cell is still covered by a spine-studded, ruptured spore coat. Some of the numerous antheridia dotting the gametophyte are intact; others have collapsed after release of the sperm cells. Antheridia were initiated experimentally by applying a native antheridium-inducing factor (about × 85). See page 1117. [Ulrich Näf, Manhattan College, Bronx, New York]





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- *Simplified Ink System:* Disposable ink cartridge, easily replaced and primed without "splash." Manual pen lifter included.
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And it is *Rugged.*

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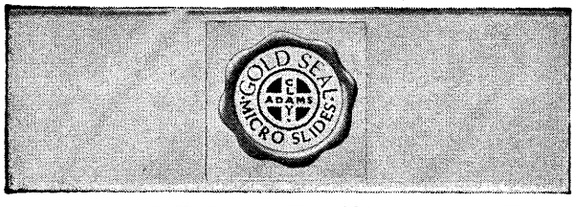

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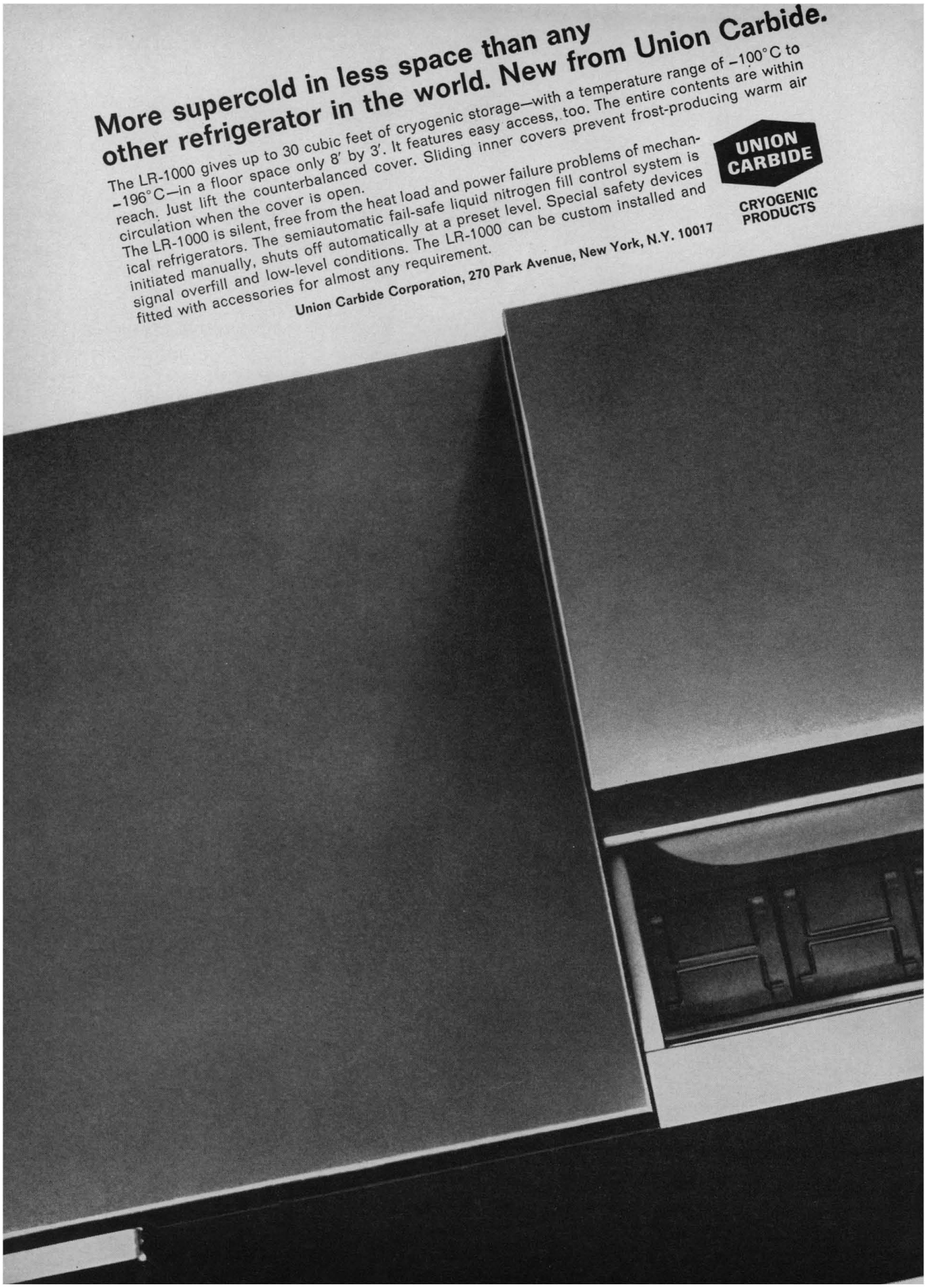
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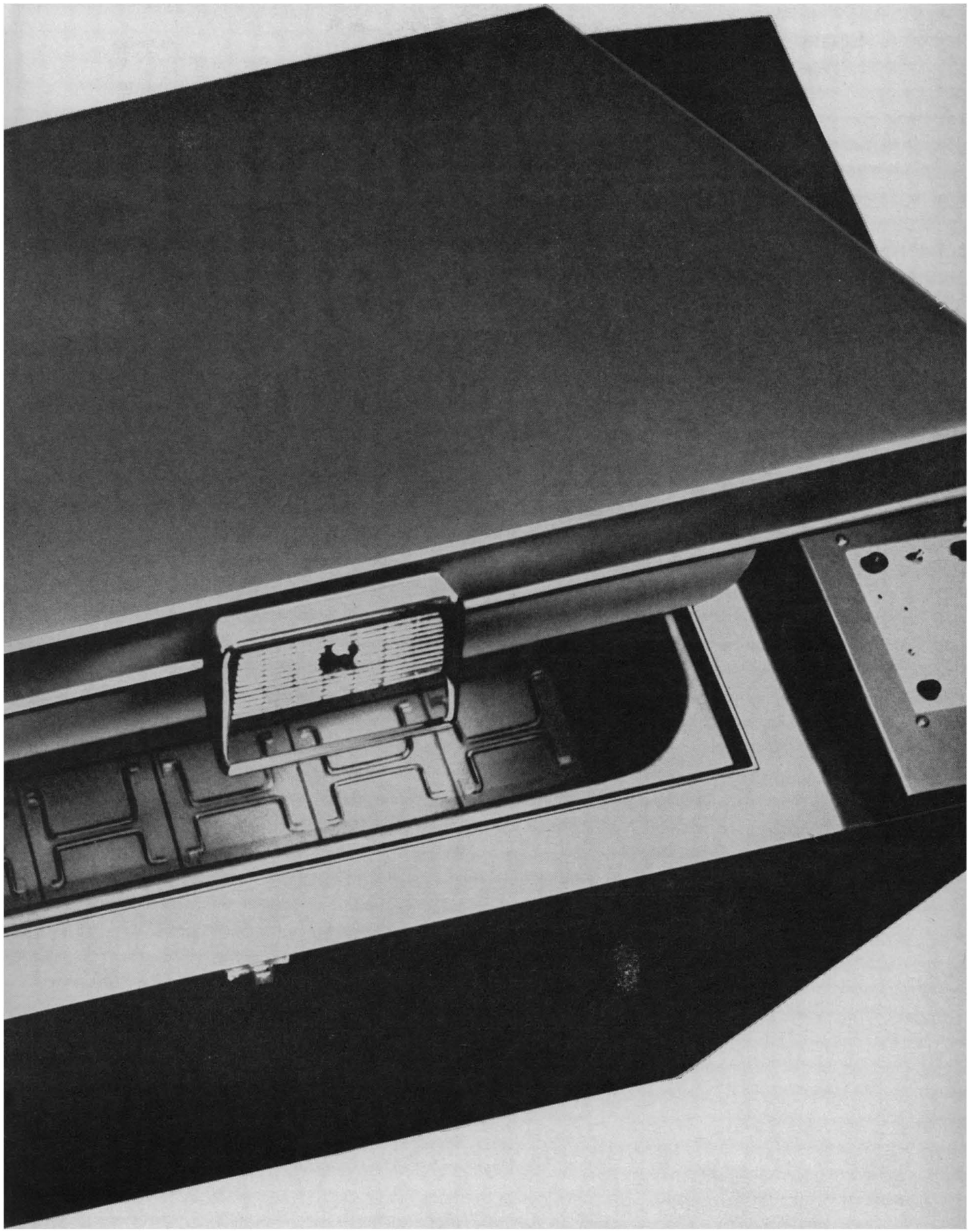

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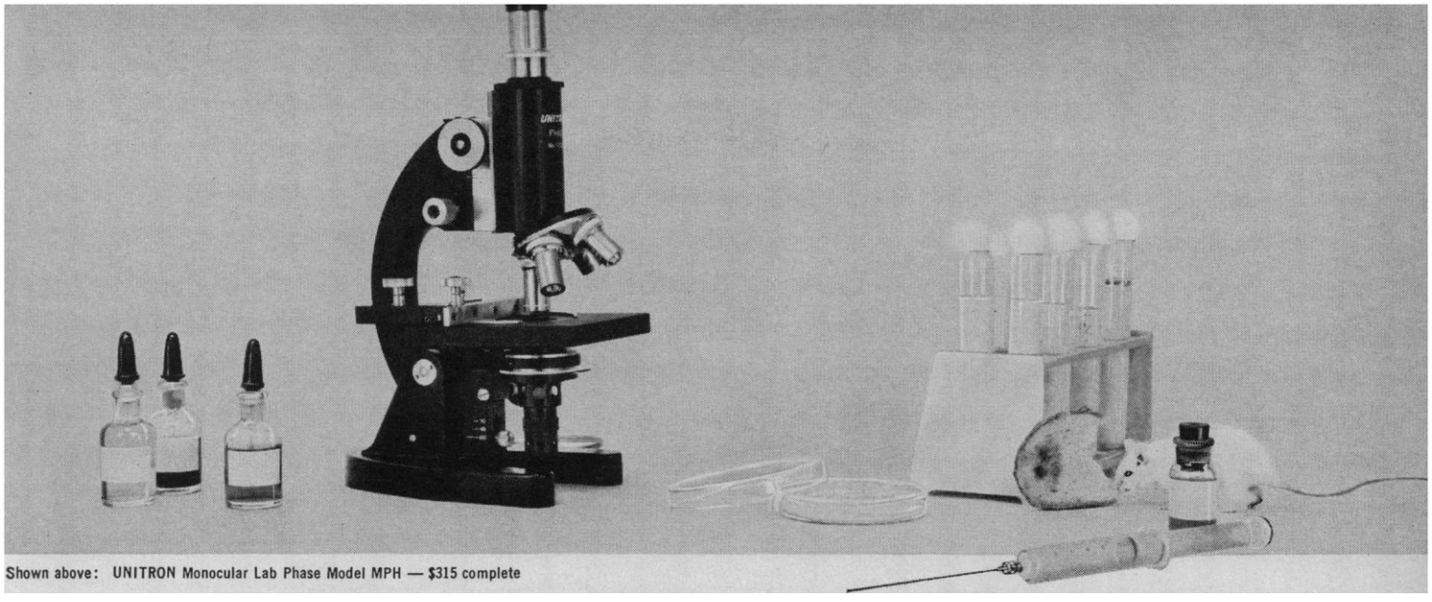

Shown above: UNITRON Monocular Lab Phase Model MPH — $315 complete

There are 3 microscopes in this picture

...at a distinctly singular UNITRON price

Most lab microscopes are used for ordinary *brightfield* studies.

So is UNITRON's MPH.

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So can UNITRON's MPH.

Still other lab microscopes offer *phase contrast* to aid in the study of *living, unstained* material.

So does UNITRON's MPH.

Until now, no lab microscope has provided all 3 for the price of 1.

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That's not all. UNITRON's MPH gives you more than just the advantages of 3 specialized microscopes. It unites them in "Continuous-Transition Microscopy." With a turn of the condenser knob, you change from *brightfield* to *darkfield* to *phase contrast,* all in rapid succession. Operation is so easy, it's almost automatic. There are no accessories to attach and no time-consuming adjustments to make. Everything has been factory-centered for you. Even the light source is built-in and permanently aligned.

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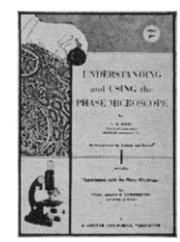

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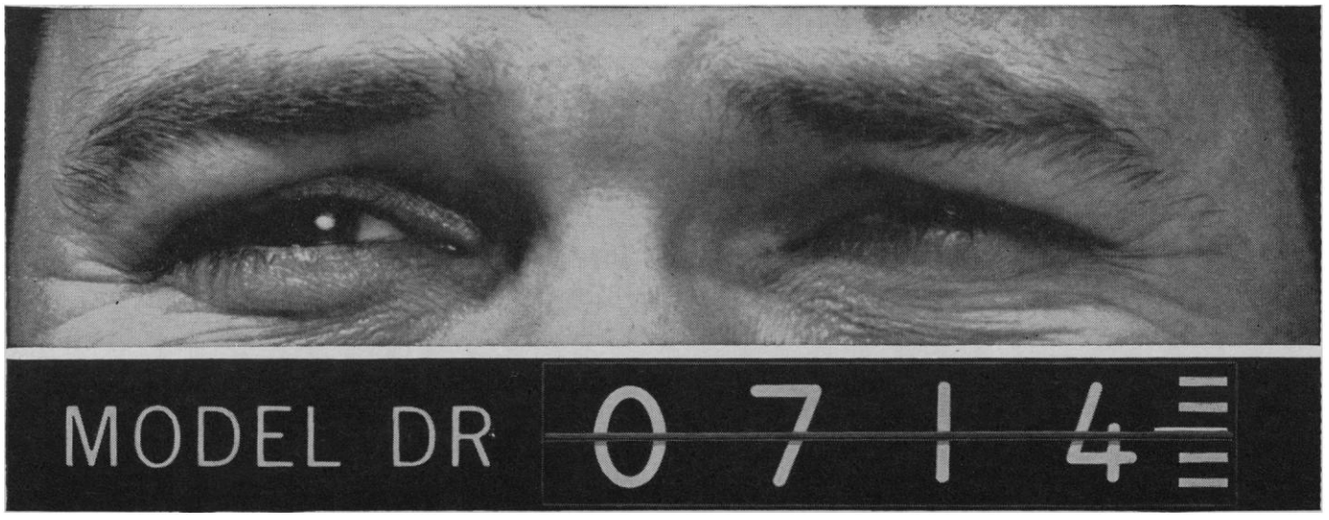

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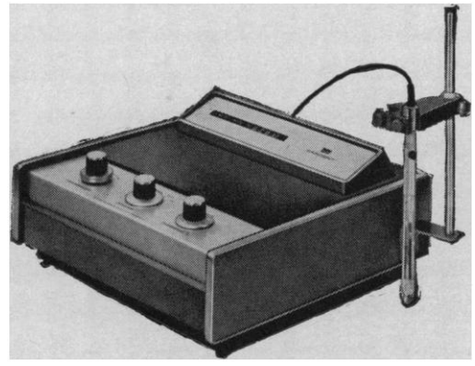

Sargent Model DR Direct-Reading pH Meter

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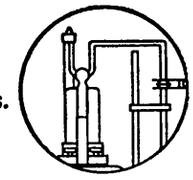
(SEE CIRCLED AREA IN PHOTO.)



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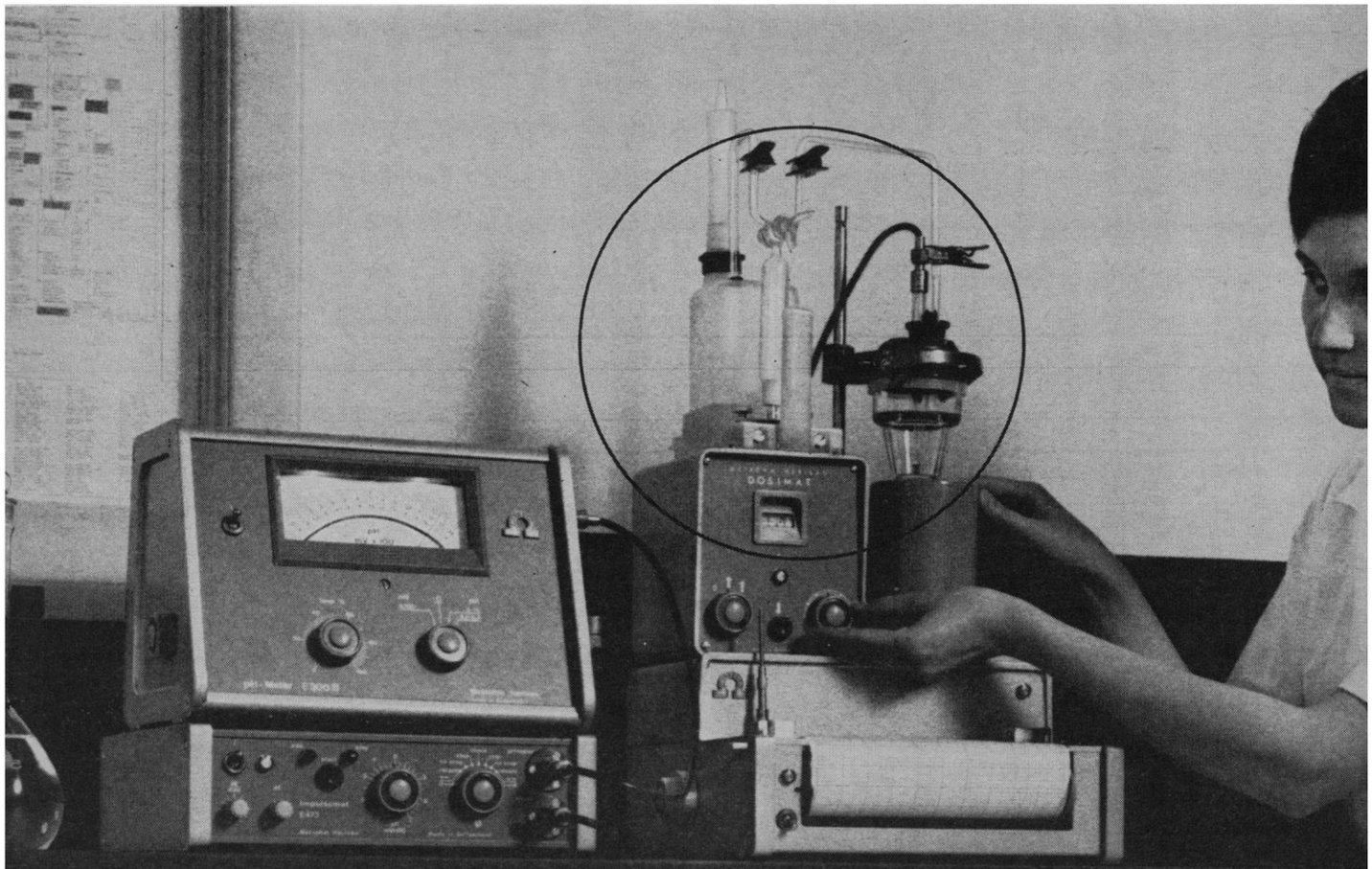

Combititrator-3D accuracy versatility compactness

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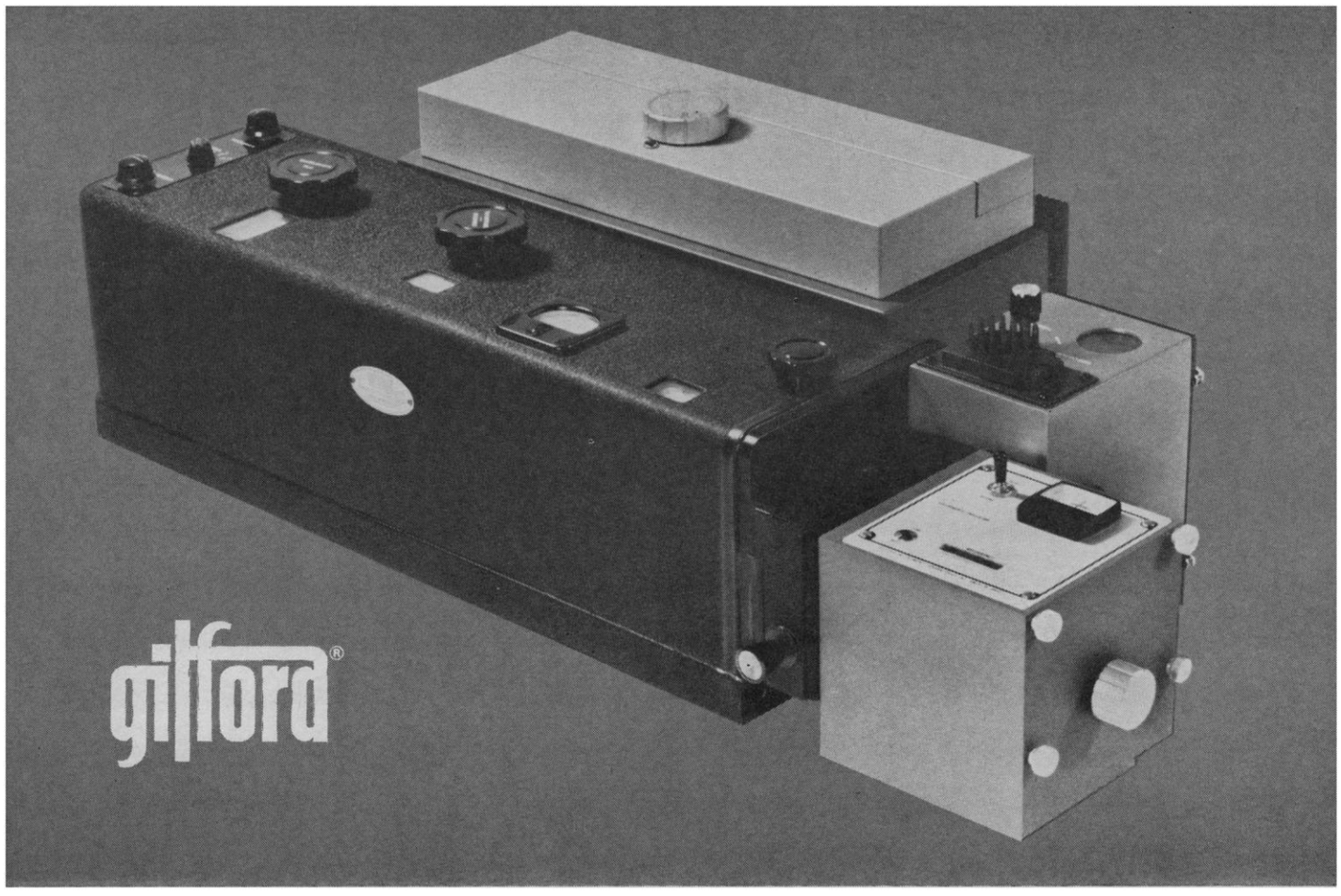

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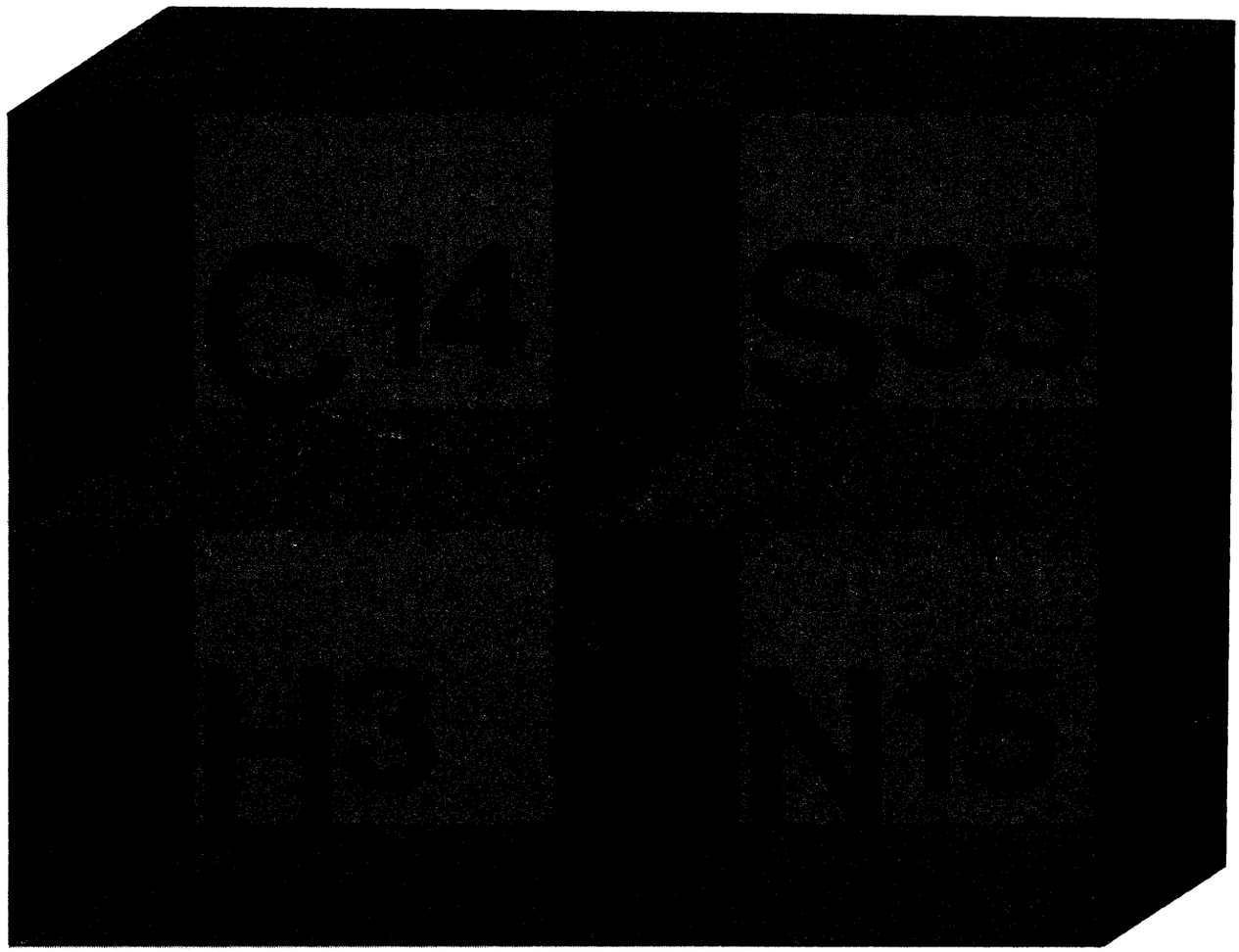

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✓	**Need Quick Response?** — All models of our FR Series respond to line and load changes within 50 μs—less than 1 cycle.
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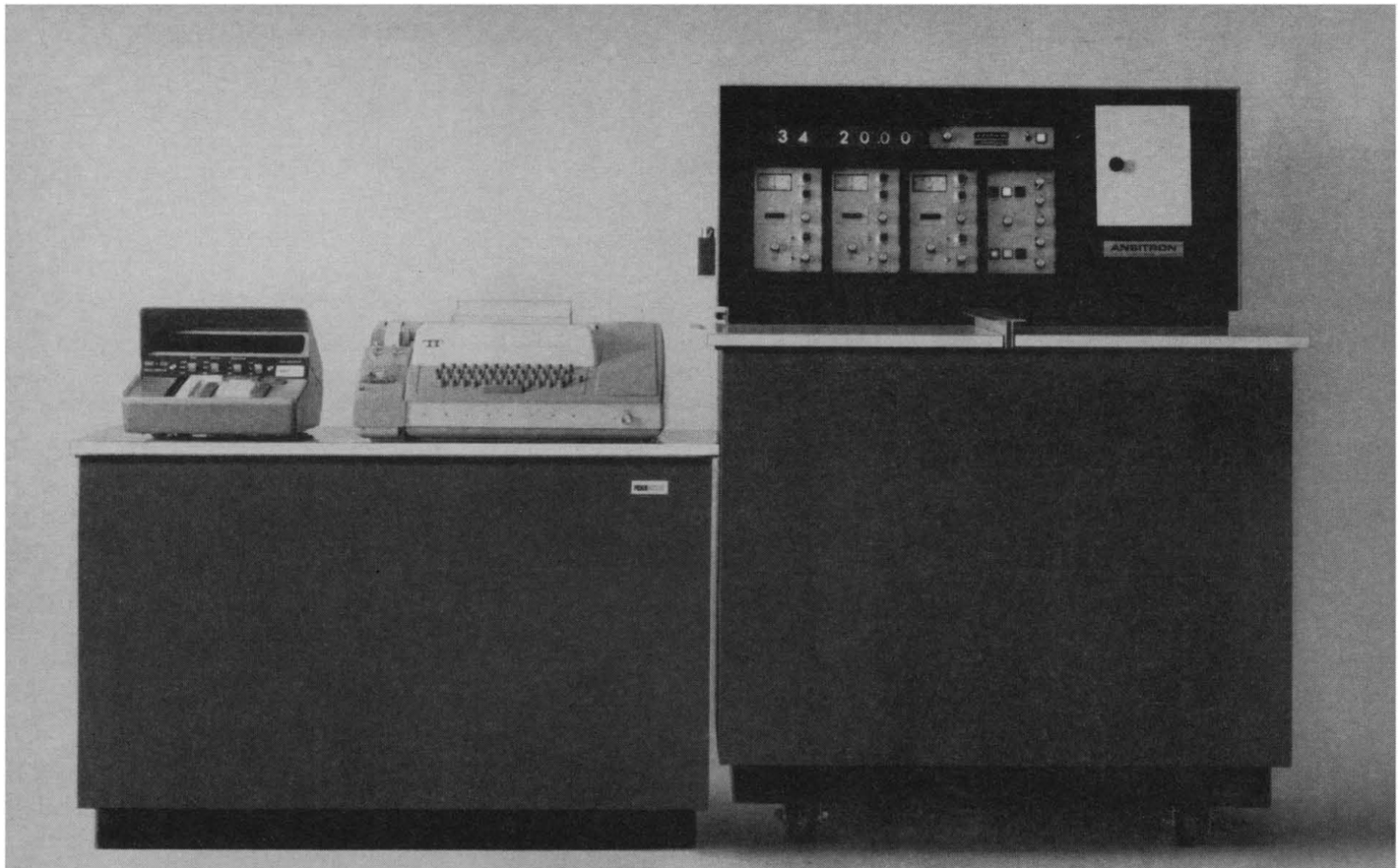
However demanding your AC regulator checklist, the Sorensen line can bear a good hard look. Whatever your needs, chances are Sorensen has a unit for your application. We offer a broad range of off-the-shelf line regulators to choose from in the range 150VA to 15kVA. Our ACR Series, for example, feature silicon controlled rectifier regulation, printed circuit maintainability, and require minimal rack space. The .01 Series provides high precision regulation, ±0.01%, for applications demanding the strictest accuracy and stability. Where fast response is an important consideration, the FR Series is unsurpassed. Sorensen's magnetic-amplifier S Series offers excellent low-cost regulation for a variety of applications.

Each Series is a carefully designed combination of power, performance and packaging,—to fill your specific requirements. Sorensen's AC regulation capability spans 25 years of experience in the design and production of regulators. Our standard product technology provides the firm basis for an outstanding custom design capability. Whatever your AC regulator problems, — check with Sorensen.

For details on Sorensen AC regulators, or for standard/custom DC power supplies or frequency changes, contact your local Sorensen rep. or: Raytheon Company, Sorensen Operation, Richards Ave., Norwalk, Conn. 06856. Tel: 203-838-6571.

RAYTHEON



Our introduction of this new computerized liquid scintillation system further complicates your purchase decision.

(But greatly simplifies your life thereafter. Guaranteed.)

This new system (called DiRAC™ to suggest that this is a "disintegration rate computer") marries a liquid scintillation counter to an "in-lab computer"™ to give you *both* data and data processing. Answers, not just numbers. And with a computer to cope with the reduction of complex data, one is encouraged to undertake mathematically involved work. Double labeling, for example. Constant instrument calibration becomes practical. Any of the quench correction techniques now available can be utilized; to their fullest. In general, this system will yield more reliable data. Faster. The DiRAC will actually save one minute of data analysis time per sample – while eliminating the need to send data to a processing center. (Ask for proof.)

The liquid scintillation counter of the DiRAC system – the Ansitron™ II – yields data *worthy* of computer analysis. The performance of this instrument will challenge that of any other competitive unit. And this is the easiest liquid scintillation counter to operate. One example: the availability of "β-set" plug-in discriminators which provide preset control settings for commonly used isotopes and mixtures. (Ask for proof.)

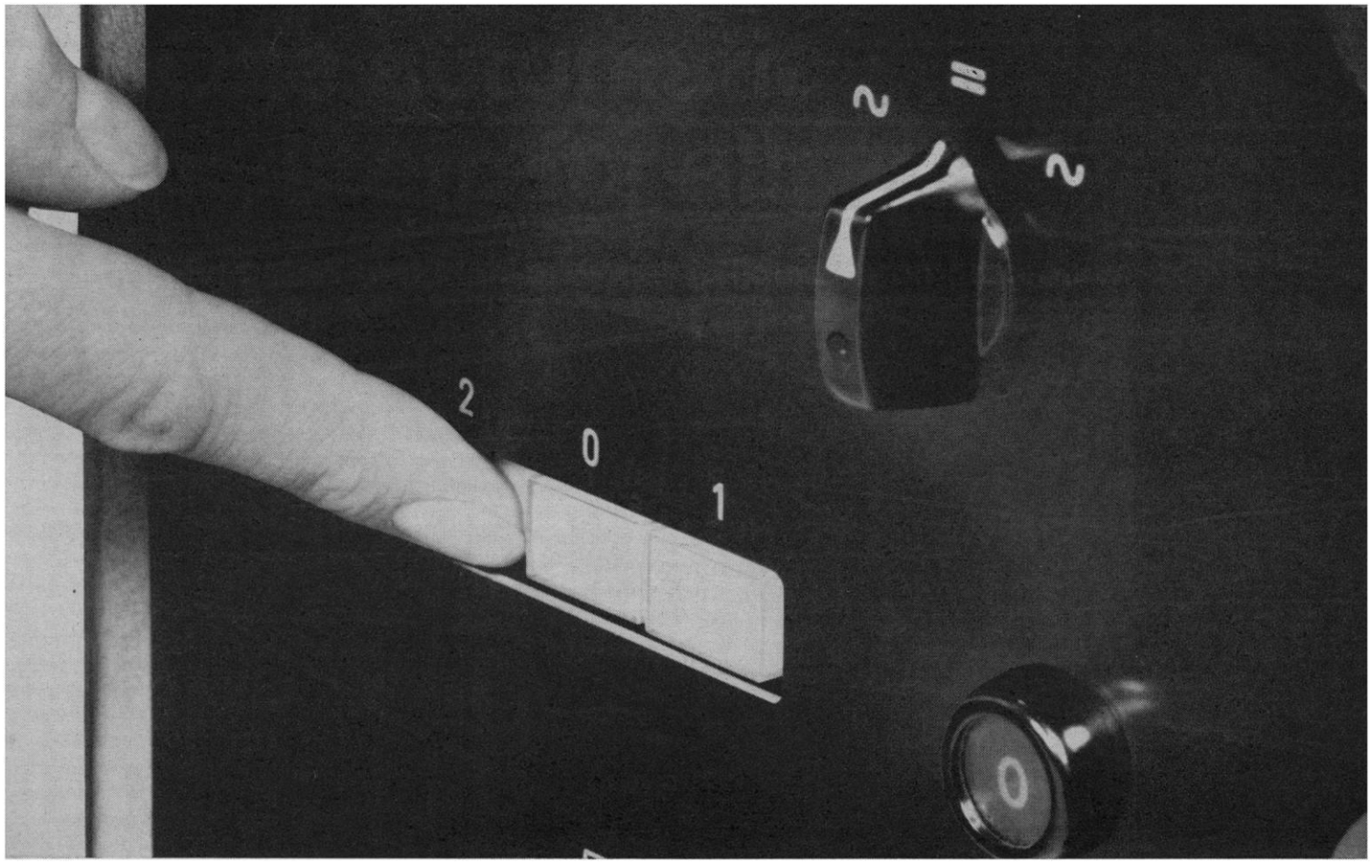
The computer of the DiRAC system is Picker's DAC™ "in-lab computer". And although the marriage of this computer to the liquid scintillation counter gives the practical convenience of an on-line computer, it is done in such a way as to make the "in-lab computer" available for other uses. The DAC and its interface will accept teletype data from any other instrument. Hence you can also marry it to your other devices that now generate data (not answers). Too: the DAC computer is a full-fledged computer and can be used by itself for polynomial computations, statistical analysis, curve-fitting, interpolation, and as an everyday calculator for more mundane computations. (Ask for proof.)

Finally: (1) we offer the needed software for the operation of the DiRAC, and (2) we take complete "systems responsibility" for its proper functioning and for your continued satisfaction with it. (Now get proof, ask for file 128S).

PL 67-128

Picker Nuclear, 1275 Mamaroneck Avenue, White Plains, New York 10605.

PICKER NUCLEAR



We took your tip to speed up electron microscopy.

The most important tip on the Zeiss Electron Microscope EM 9A is your fingertip. With it, you can activate time-saving automation never before possible.

Your fingertip gives you complete control of the error-free, automatic vacuum system which saves time during start-up and shutdown.

A flip of your fingertip is all it takes to activate a completely automated photomicrographic system that sets correct exposure, takes the picture, numbers micrographs sequentially and neatly stacks up to 75 negatives without reloading.

You save still more time in several other ways. Alignment is exceptionally fast and stable with the EM 9A's new adjustable single condenser that gives 15 to 20 times more brightness than was possible before.

Specimen airlock is not only fast, but foolproof, too. Specimen exchange can be made within 10 seconds.

Which all adds up to more time to concentrate on microscopy . . . rather than on the microscope.

The EM 9A's resolving power: 10-12Å. Operating range: 900x-40,000x. Astigmatism compensation: new, easy-operating electrostatic stigmator. Focusing: easy, because the unique fine-focusing device with digital read-out combines advantages of both step and continuous focusing. Binocular: 10x with exceptionally high light transmittance; special high-eyepoint eyepieces for people who wear glasses.

For more information, write Carl Zeiss Inc., 444 Fifth Ave., New York, N. Y. 10018. Complete service facilities available.

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them in 10 minutes more?

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cellular suspensions?

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all on one apparatus?
and for less than $1000?

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It's a very unique device, nothing before like it . . . uses a combination of electrophoresis, hydrostatic pressure, dialysis, and some black magic involved in the complex capabilities of a special electrolyte. It does so many things that we're hard put for a single name that describes all of its functions. For instance you can:

- *concentrate ten 20 ml aliquots* to 10x in only 15 minutes! Or up to ten of 200 ml each in 150 minutes! Or larger volumes at 3 liters per hour!
- *continue to concentrate* to 100x in 15 minutes more!
- *recover* 80 to 100 percent of starting protein!
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- *filter and sterilize continuously and without clogging*—producing up to 50 ml clear filtrate per minute (3 liters per hour) of the most hard-to-filter isotonic biological mixes.
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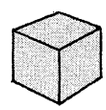
- *and wash* less-charged from more-charged components (like extra-cellular enzymes from bacteria, or glycerol from red cells) at comparable rates!



all this from a little bench device, which measures only 10″ cubed . . . great for the space-pressed researcher

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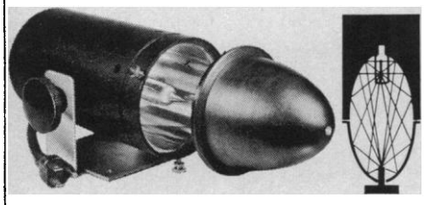
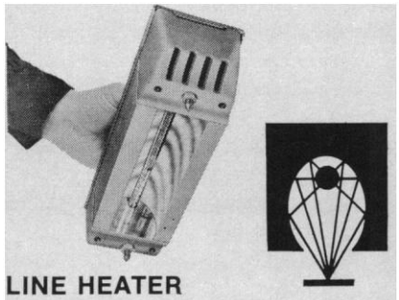


SPOT HEATER

Ellipsoidal reflector concentrates entire output of a small 250w. to 750w. lamp onto a small target (3/16" diameter spot). Will produce temperatures to 2200°F.

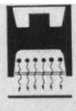
USES: Sealing, melting, vaporizing, igniting materials inside transparent enclosures; testing materials; decoating; soldering; micro-brazing.



LINE HEATER

Elliptical reflector directs heat from linear lamp up to 25 inches long onto a narrow line. Produces heat flux densities up to 450w. per linear inch.

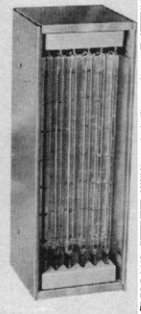
USES: Sealing, pre-bend heating, filament heating, linear joint soldering, testing.

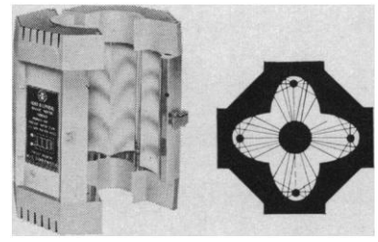


HIGH INTENSITY HEATING

Narrow panels up to 16 in. long have flat water-cooled reflector and six lamps in compact array. For application of radiant energy at rates up to 100 kw/ft^2.

USES: High-rate surface heating, weld stress-relieving.



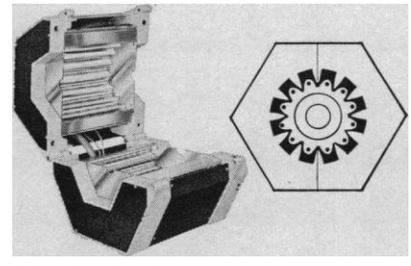


QUAD-ELLIPTICAL OVEN

Tubular oven employs four iodine cycle lamps, each in an elliptical reflector, all focused sharply on the longitudinal axis. Lamps are air cooled and reflectors are water cooled. Effective heating lengths: 2, 5, 10, 16, 25 inches. Specimen diameters to 2.5 inches.

This configuration concentrates up to 2400w. per lineal inch on a tube, filament or long narrow specimen at the oven's center to produce temperatures up to 3000°F. depending on specimen absorbtive characteristics.

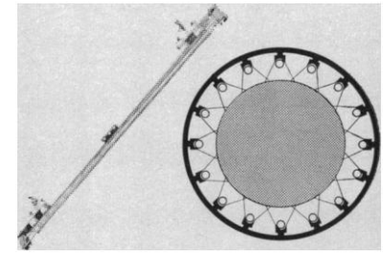
USES: Heating filaments rods, tubes, cylinders for boiling, heat treating, testing, etc.



PARABOLIC CLAMSHELL OVEN

When six or more lamps are required in one tubular oven, the oven is made up of a circular array of lamp holders with individual water-cooled parabolic reflectors. Several standard oven sizes contain from six to 24 lamps and accommodate cylindrical workpieces from 1.5 to 9 inches in diameter. Heated length 5 to 38 inches. Workpiece temperatures to 2500°F.

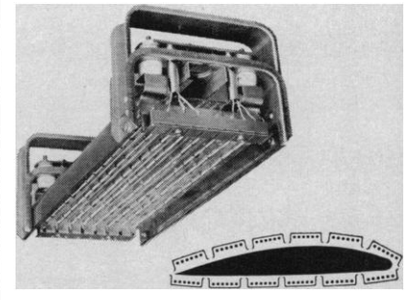
The oven opens longitudinally for easy loading.



SOLAR HEAT SIMULATION

Special wide-angle reflector modules have been designed for space heat simulation in cryogenic test chambers. These have narrow silhouettes for minimum blockage of the cryopanels and their light weight facilitates mounting in dispersed arrays with a minimum of supporting structure.

Normally solar heating modules are connected in zones and automatically programmed to simulate the changing intensity of space radiation as a vehicle moves in relation to the sources of radiation. (We are prepared to furnish the controls and complete system engineering as well.)



AERODYNAMIC HEAT SIMULATIONS

Heating panels consisting of multiple tubular quartz lamps mounted in flat air-cooled reflector modules are widely used for simulation of aerodynamic heating effects on fast moving surfaces. These panels are easily attached to supporting structures to form contoured enclosures appropriate to the test objective. Wired in zones they are programmed to simulate changing heat intensities. Modules are offered in various lengths and widths. Can be purchased individually or integrated into a complete test system with structure and controls included.

R I

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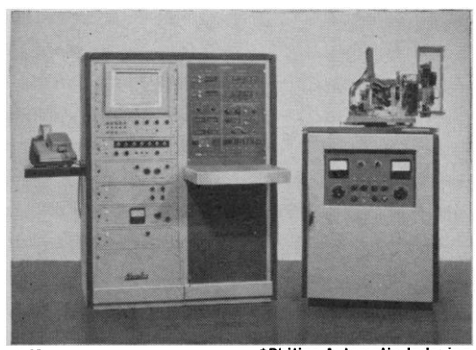
Field-use comments testify to its reliability —accuracy—versatility—time optimization and economy in experimental procedures. This instrument performs as specified.

Flexibility has been maintained to do diffuse scattering and anomalous dispersion studies. Systematic errors are minimized by the design concept.

X-ray data is collected on punched paper tape, magnetic tape or punched cards for computer analysis. FORTRAN language computer programs for the crystallographer are available from Philips. Data also permanently recorded on digital print-out tape and strip-chart recording.

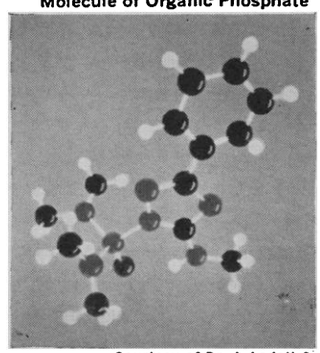
For more detailed information please write— Philips Electronic Instruments, 750 S. Fulton Avenue, Mount Vernon, New York 10550.



AI-27

*Philips Automatic Indexing Linear Reciprocal-space Exploring Diffractometer.

Typical PAILRED determination — Molecule of Organic Phosphate



Courtesy of Dr. J. Ladell & Dr. P. Goldstein, Philips Laboratories

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The Hasselblad system... and a few reasons why the scientific and industrial photographer needs it.

The applications of photography in science and industry are numerous and undisputed. It would require many volumes rather than this single page just to list, let alone discuss, these applications. Both as a research tool and a recording device, photography has certainly proved not only convenient, but in many cases of sophisticated scientific and industrial research, invaluable.

Obviously, the single most important feature of photography is its ability to produce a permanent record of a visual happening. Something that may or may not be visible to the human eye. That may occur at a speed which would not make it visible to the human eye or that may occur in a place where it would not be convenient or even safe for a human observer to be.

It has long been acknowledged that the single most superior camera for most research purposes is the single lens reflex camera. Because all viewing and focusing is through the lens and is completely free from parallax error, then regardless of the combination of supplementary lenses, extension tubes and bellows extensions used, the image seen on the viewing screen is identical with the final picture.

Unfortunately, most of the single lens reflex cameras available to the researcher use the 35mm format and consequently suffer from lack of image quality when the negative is enlarged to any degree. This problem is overcome by the use of the 2¼ square format as in the Hasselblad system.

The simple fact is that there is not one camera system available today which offers the scientific or industrial photographer the choice of camera bodies, interchangeable film magazines, accessories and attachments, plus the superb optics of Carl Zeiss lenses with built in Synchro Compur shutters allowing the use of both flash and strobe at all speeds, that the Hasselblad system does.

Here's what the Hasselblad System consists of. Firstly, the 500C, the standard camera in the system[A]. It accepts all seven lenses available for the Hasselblad, and is a single lens reflex viewing camera. The 500C always shows you exactly how your final picture will turn out on the ground glass screen, in the same way a view camera does. This allows you to concentrate on the setting up and composition of your picture, no matter what lens or accessories you are using on the camera.

The lens, magazine, focusing hood and winding knob of the 500C are all instantly interchangeable.

Next is the Hasselblad Super Wide C. The camera that caused a breakthrough in 2¼ square photography. Equipped with a 38mm, 90° angle of view Zeiss Biogon f/4.5 lens, this camera allows you to take pictures previously considered impossible. The superb optics of the lens assures perfect distortion-free horizontal and vertical delineation, with sharpness of image from corner to corner of the negative area, even at full aperture. Depth of field at an aperture of f/22 is from 26 inches to infinity.

The newest camera in the Hasselblad System is the electrically driven Hasselblad 500EL. This camera automatically advances the film and cocks the shutter, allowing a rapid series of exposures to be made, either by use of the camera release or long release cords, timer or remote radio control. The 500EL accepts all the lenses and most accessories available for the 500C. Obviously one of the advantages of this camera is that the photographer is freed from the actual mechanics of picture taking and can therefore, devote himself completely to the subject.

The use of the 500EL with the Hasselblad 70mm film magazine, (up to 70 exposures on cassette loaded 70mm film) allows the photographer, working on a job where a large number of exposures are required, to handle his work load much more quickly and efficiently.

There are seven Carl Zeiss lenses in the Hasselblad System, 40, 50[B], 80, 120, 150, 250[C] and 500mm. Each lens has a built in Synchro Compur shutter, with automatic stopping down at the moment of exposure and manual preview for depth of field checks. Every lens has both M and X synchronization allowing the use of flash and strobe at all speeds up to 1/500th of a second.

Five different instantly interchangeable film magazines are available. These magazines allow the photographer to make 12 or 16 exposures on 120 film[D], 24 exposures on 220 film[E] and 70 exposures on 70mm film. The magazines also allow the choice of 3 formats, (2¼ square, 2¼ X 1⅝, 1⅝ X 1⅝). This allows not only for speed of operation, but the convenience of being able to change either film type or format in mid-roll.

Completing the system is a huge range of accessories that includes extension tubes and bellows extensions for close up work, filters, transparency copy holders, cut film backs, eye level prism finders[G], sports view finders, sun shades, rapid winding crank[I], quick focusing handles[J], grips[K], underwater housings, ring lights, tripod quick coupling[L], microscope attachments and carrying cases.

We have purposely avoided discussing specific applications to which the Hasselblad system might be applied. Not only because of the limitations of the space available, but because the number of applications is almost infinite.

Hasselblad systems are being used today in many branches of science and industry. And are even a part of the NASA space program. Shown below are just a few parts of the system that seem to have become particularly popular with many people engaged in some aspect of science or industry.

This description of the Hasselblad system has been necessarily brief. If you would like a Hasselblad catalogue or further literature or if you have a specific technical inquiry write to Paillard Inc., 1900 Lower Rd., Linden, New Jersey 07036.

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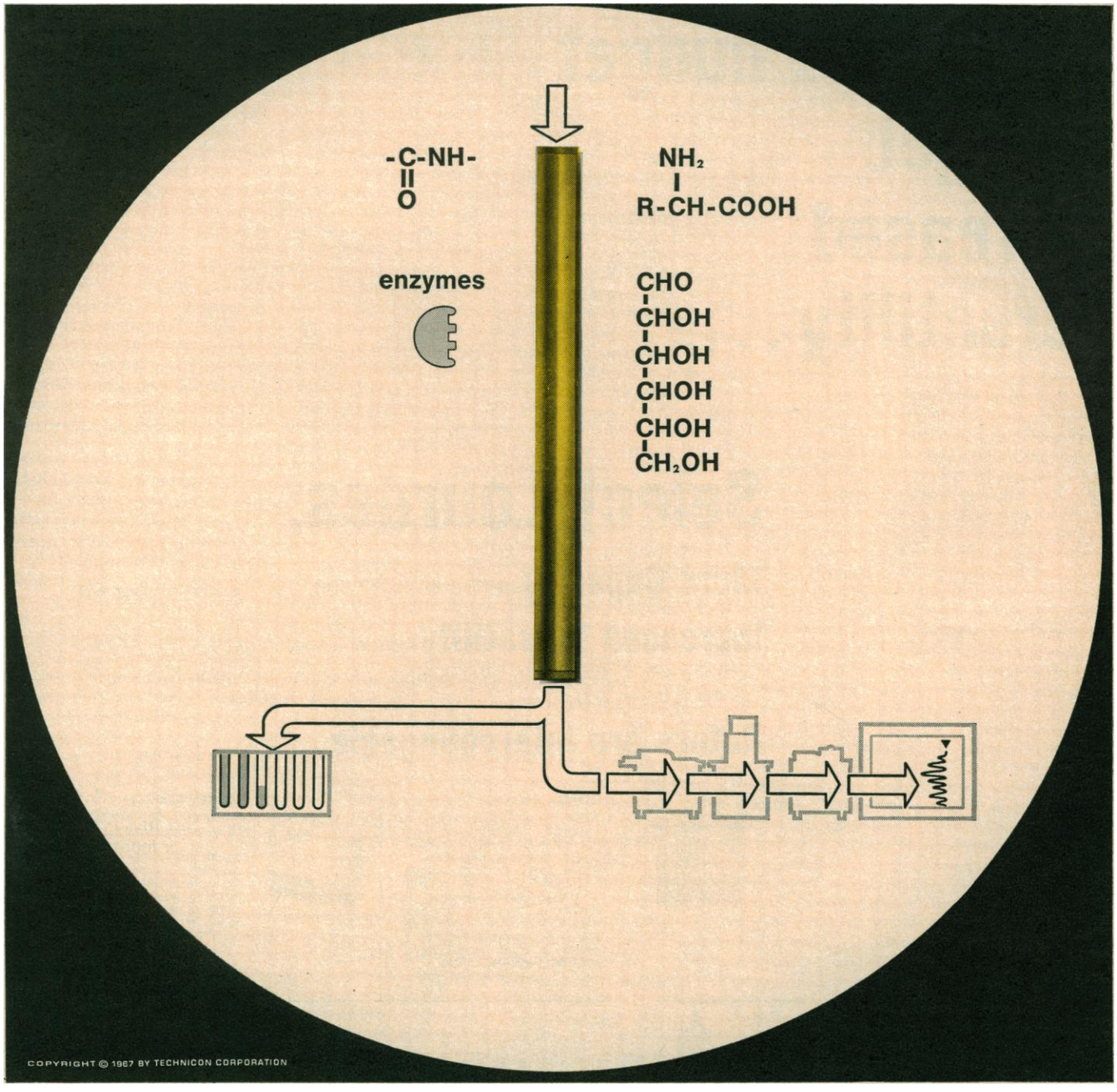
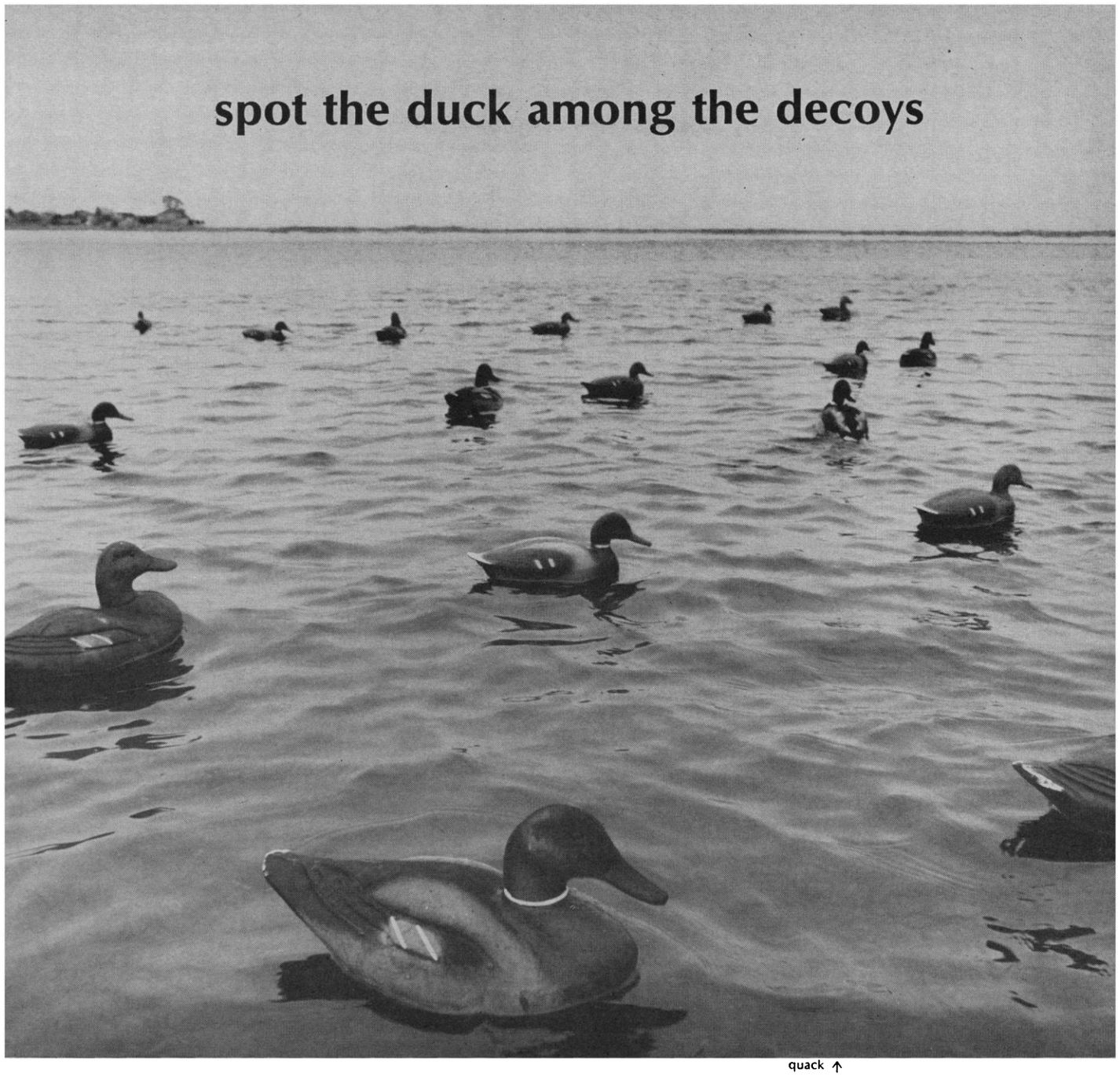
One automatic system for all:

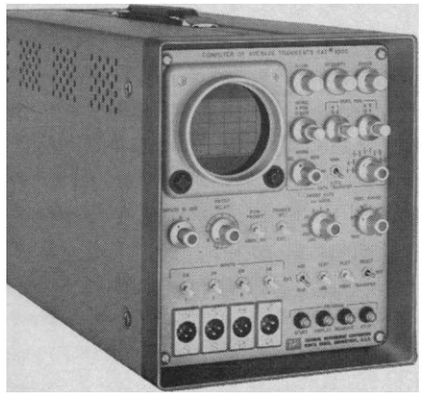
Amino acids • carbohydrates • peptides • enzymes in liquid chromatography.



■ Technicon's basic chromatography system is completely automated from indexed sample presentation to recorded peaks. Requires a simple change of reagent and resin to separate... ■ Amino Acids: 90 minutes. New unattended 40 sample sequential loading. ■ Peptides: 5 hr. analysis with in-system hydrolysis for complete peptide identification. Quantitates ninhydrin positives and negatives. ■ Carbohydrates: 15 peak chromatogram, 4½ hrs. Unmatched resolution and sensitivity. Samples down to 1 μg. ■ Enzymes: Only minute portions of the fraction to quantitate and assay. Automated method for a wide variety of enzymes. For details write Dept. A, Technicon Corporation, Ardsley, New York 10502.



with TMC's CAT, Computer of Average Transients



Investigating chemical, electric, electronic, geophysical or other phenomena? Chances are, you're having difficulty isolating response from background noise and extraneous signals. CAT has the answers to your problems.

CAT—Computer of Average Transients—is a digital computer which rapidly increases signal strength by accumulating and adding repetitive samples, while the random nature of background noise causes it to be accumulated at a much smaller rate.

CAT can give you results "on line"—without disturbing system operation—letting you adjust parameters and monitor effects at will on the oscilloscope screen, and keep a simultaneous record for presentation in virtually any desired digital or analog form.

CAT's many other capabilities include: histogram analysis, auto- and crosscorrelation computations, and power spectral density analysis.

For help in the solution of your problem, send us a brief description, or call your nearby TMC applications engineer. CAT will take it from there.

Write to Technical Measurement Corporation, 441 Washington Avenue, North Haven, Connecticut, or call collect: (203) 239-2501.

TMC TECHNICAL MEASUREMENT CORPORATION

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attack by fragmentation bombs. If such use of so-called "non-lethal" CB weapons becomes widely practiced and generally accepted, the way is paved for a chemical and biological arms race and progressive escalation in this or future wars to the use of the entire spectrum of CB weapons.

In this connection we would like to quote the strategic analyst T. C. Schelling [*Arms and Influence* (Yale Univ. Press, New Haven, 1966), p. 131] on possible agreements for preventing the use of gas in warfare:

> "Some gas" raises complicated questions of how much, where, under what circumstances; "no gas" is simple and unambiguous. Gas only on military personnel; gas used only by defending forces; gas only when carried by projectile; no gas without warning—a variety of limits is conceivable . . . But there is a simplicity to "no gas" that makes it almost uniquely a focus for agreement when each side can only conjecture at what alternative rules the other side would propose and when failure at coordination on the first try may spoil the chances for acquiescence in any limits at all.

JOHN T. EDSALL
MATTHEW MESELSON
Biological Laboratories,
Harvard University,
Cambridge, Massachusetts 02138

In Defense of Rachel Carson

Philip H. Marvin's complaint (Letters, 7 Apr.) that the "plague" of Rachel Carson's book continues to "infest" the minds of scientists demands comment. *The Silent Spring* has not only "infested" scientists, but also caused naturalists who look further than the results of a single crop to become acutely aware of the danger of pesticides. It is true that Carson's book contains overstatements, but it is also true that many forms of wildlife, particularly those at the end of a feeding hierarchy, such as hawks, terns, spoonbills, and many others, are unnecessarily decimated by the indiscriminate use of pesticides. In Holland several of these forms of wildlife are now at at the brink of extermination. The "plague" of pesticides forms a real danger, and the struggle to preserve nature, based both on Carson's warnings and on the newer investigations of the near extinction of wildlife, must continue.

MARTIN G. RUTTEN
Prinses Beatrix Str. 37,
Bunnik (4), Holland

Patriotic Emigrants

Although the brain drain is a complex sociological problem, it is unfair to blame it on those who do not partake of it (Byrne, Letters, 17 Mar.). Having spent some years researching in one of the bigger institutes in the U.S. or Britain, the returned scientist can hardly expect the fatted calf from his stay-at-home colleagues, who have continued to work in much less glamorous surroundings, with second-rate equipment and poor funding, with lower salaries and larger teaching duties, but still have managed to keep the home institution going during their colleague's absence. That valuable research experience abroad should be recognized by the home institution is without question; it is equally true that a university or college owes its lifeblood to those who, perhaps shortsightedly, stay with it through difficult times. The fact that so many returned emigrants eventually leave their native shores again is as much their own failure to come to terms with their home environment as it is of the home institution to appreciate their value. If such institutions, "which have been unchanged since St. Patrick," are to be changed, then it will come about through the efforts of those who return—and stay. Whether the motive is patriotism or the desire to help an underprivileged nation to better itself—surely either is big enough to withstand some petty, but inevitable, professional jealousy.

TREVOR C. WEEKES*
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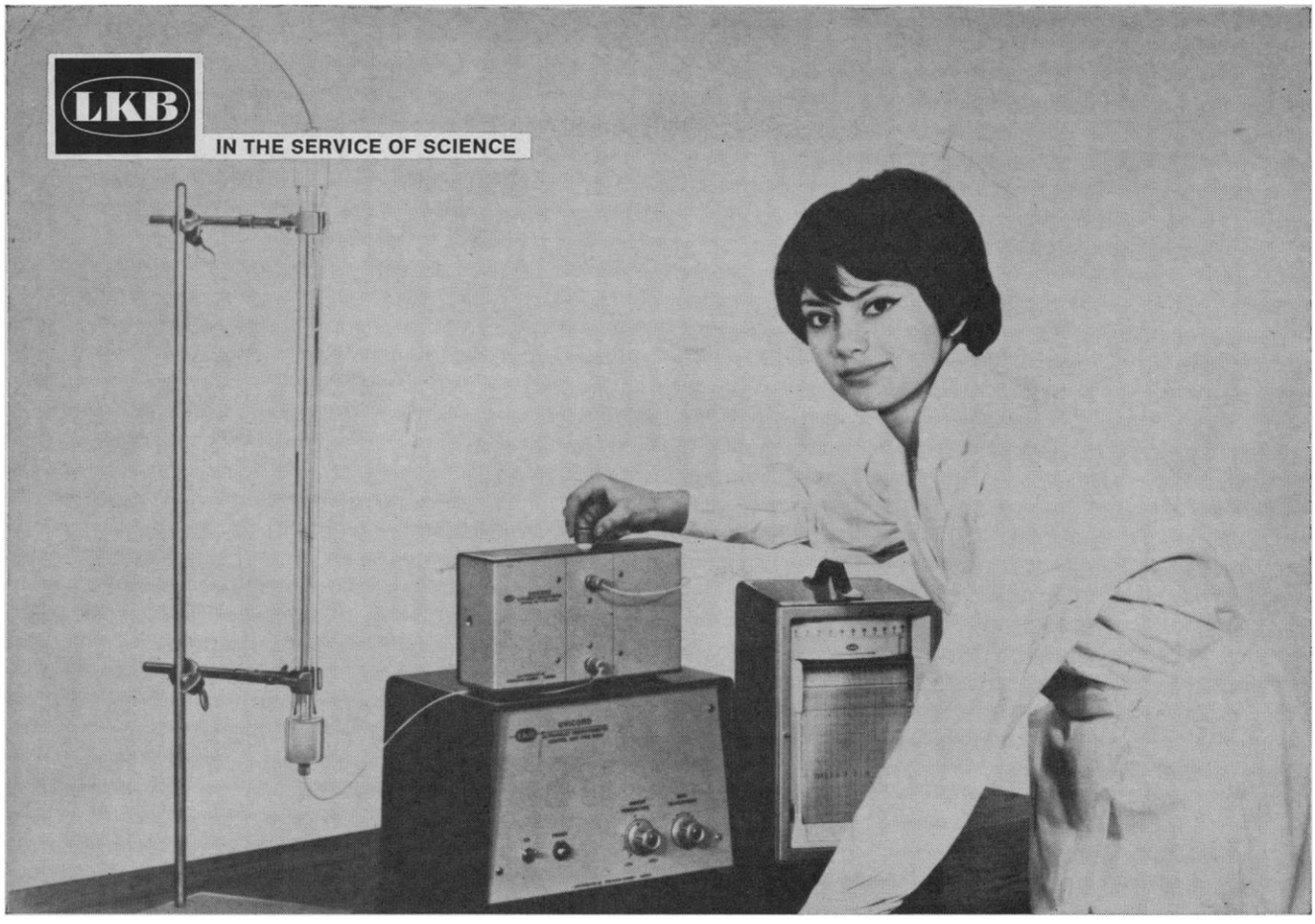
*On leave of absence from University College, Dublin, Ireland.

Byrne (Letters, 17 Mar.) would class me as a "returned Yank" and, indeed, for some time after I returned 12 years ago I shared some of his feelings toward Irish institutions. However, the change in attitude toward returning scientists which he calls for has been underway for some time.

In this University College, a majority of the senior teaching staff are "returned Yanks" or "Sassenachs," a development that is obviously being encouraged. The government-sponsored Commission on Higher Education recently recommended drastic changes in university administration, including replacing our archaic appointment system with one in which applicants for senior staff positions will



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be assessed by a small committee which will have among its members "two experts external to the institution, one at least of whom would be from outside the State." This committee would submit one name only to the appointing authority. The government, through its Department of Education, has just inaugurated postdoctoral fellowships in science and engineering which will be tenable in Irish universities and research institutes; preference will be given to applicants proposing to work in institutions other than those from which they apply. These measures demonstrate the widespread desire to reverse our brain drain.

It cannot be denied that tremendous efforts must be made in Ireland in the near future if it is to avoid a state of scientific and economic colonialism. According to a recent OECD-sponsored report "international comparisons show that Ireland is among the nations with the lowest rate of research expenditure in Europe." However, there is a feeling of optimism abroad and it is earnestly hoped that the establishment of the proposed National Science Council will inaugurate a new era in scientific studies in Ireland.

COLM Ó hEOCHA

Department of Biochemistry, University College, Galway, Ireland

Anthropologists Debate Ethics

Niehoff's objection (Letters, 3 Mar.) to the American Anthropological Association's Vietnam resolution and his fine distinction between condemning the barbaric behavior of the United States in Vietnam as an American, and condemning it as an anthropologist was a disturbing sophistic exercise.

It is one thing for an anthropologist to observe ritual killing and torture in another culture without expressing ethnocentric moral judgments, and quite another to maintain Olympian detachment while his *own* culture brutally and systematically decimates another. He argues that the anthropologist cannot judge the customs of other cultures according to his own morality. Few would disagree. He then says that the anthropologist is supposed to be "culture free," and presumably, since he no longer belongs to his own culture, he cannot, as a good anthropologist, subject it to moral judgment. These intel-

lectual gymnastics may serve for some as an escape from the responsibility of their active or passive participation in the uglier aspects of our own society. One is reminded of the astounding degree of objectivity displayed by the German doctor attached to a concentration camp, who rigidly maintained aseptic conditions when he performed a cesarean section with impeccable technique, and then placed mother and child on a stretcher and imperturbably sent them off to the gas chamber. Surely, this is the ultimate in cultural detachment, though few would aspire to it.

The fact that we are scientists, regardless of speciality, neither "legislates" us out of our culture, nor out of the human race. As scientists, we bear the same responsibilities as any other citizen. Precisely because scientific research is being used for military applications against our fellow human beings, we must face these moral dilemmas without assigning ourselves to a class of acultural, amoral scientific automatons.

VICTORA BORDAZ
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JACQUES BORDAZ
Department of Anthropology, University of Montreal

The recent action of the anthropologists is most discouraging. . . . Could it be that they hope for the best of both worlds; that is, they will share all of the advantages of a free world and will yet have gained some measure of respectability in that shadow world where it is considered to be a morally courageous act to be absent from those who are willing to stand up and be counted.

KENNETH R. COBURN
100 Whitehorse Pike, Haddon Heights, New Jersey 08035

We wish to record our concern with the professional and scientific implications of the article, "Anthropologists' debate: Concern over future of foreign research" (23 Dec., p. 1525) and "Anthropologists' Vietnam resolution." In our opinion the articles do not reveal the full implications of the debate. At the November American Anthropological Association annual meeting at Pittsburgh, Ralph L. Beals reported on his activities as chairman of a committee in research problems and ethics. The remarks were diffuse, personalized and subjec-

tive, as was a politically oriented introduction of Beals by the newly appointed executive secretary of our association. Because of the lateness of the hour, and the fact that floor microphones were not working, subsequent discussion was brief. Controversial portions of the Beals report received front-page coverage in the New York *Times*.

When copies of the report were distributed, some Fellows sought to determine the intent and meaning of what they were being asked to approve, and others sought to revise the wording. Although the executive board's request for approval was cast as "approving the Beals report," the document to be voted upon, in the opinion of many Fellows, appeared to be a quasi-ethical manifesto, in which there were questionable statements of fact and of implication. Approval of the statement would, in effect, recommend separating American anthropologists from significant kinds of service to the government.

Beals admitted that allegations of "tainting" anthropology by CIA were based on hearsay. (Some of such hearsay has the ring of the apocryphal: Supposedly one anthropologist was asked "How would you go about poisoning the water supply of Guatemala City?") Questions that attempted to reach the facts seemed always to go back to Project Camelot, upon which Beals was not adequately informed. Project Camelot was not in any way related to the CIA, nor was it a classified project; distorted press discussions of Camelot have generated more heat than light. The Beals report was recommitted to the committee for revision by a vote of 155 to 104.

The so-called "Vietnam Resolution" offered by David Aberle for council action was markedly different from the one actually passed and published in *Science*. Initially the resolution was a relatively conventional indictment of U.S. policies in Vietnam. When first offered for discussion, it was refused by the presiding president-elect of the association, based upon an opinion that as a political document it was not appropriate to the scientific purpose of the association. The resolution was later revised from its original anti-U.S. government bias to a general condemnation of certain aspects of warfare by any participants.

More important were the implications of what was involved. If we understand correctly the clarifying state-

ments and intent of those concerned with the Beals report in its initial form, they would: (i) eliminate all classified government work from the universities, except in time of declared war; (ii) make it undesirable for anthropologists to work for the government on realistic administrative terms; and (iii) cast doubts upon the wisdom of young anthropologists working for either commercial firms or nonacademic, nonprofit groups that accept government contract work. The effect of approving the proposed "report" would be to put the association on record as believing that the federal government should support independent anthropological research, but should have no right to expect responsible loyal support from the anthropologists they otherwise subsidize.

We are disturbed by the naivety displayed by students of human behavior who would stipulate that war must be formally declared before a scientist can offer aid to his country. Can any informed adult, conscious of the dangers of nuclear warfare be unaware that today, more than ever, a declaration of war signifies the final failure of diplomacy—when it is far too late for a country to profit by overdue patriotic motives!

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Received 18 January 1967

Who Fights in Little Wars?

The discussion of selection of men for military service put forth by Dael Wolfle (Editorial, 24 Mar., p. 1499) seems most reasonable if the selection is made in anticipation of a major war. In that case, the optimal deployment of available manpower would appear to form a reasonable basis for selection.

However, there seem to be other considerations when it is a question of fighting "little wars" that do not greatly tax the nation as a whole. In these cases, it is perhaps less necessary to be "optimal" and more desirable to demand the direct exposure of a representative spectrum of citizens. Otherwise, it seems to be a case of our leaders being willing to give less than their best for a cause which they hold worth fighting for.

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Oil Pollution

Destruction of the Torrey Canyon and the associated pollution of parts of the English and French coasts dramatized a problem chronic in the United States. All too often major and minor releases of petroleum have destroyed marine life and fouled vacation beaches of the Great Lakes and of our seacoasts. Unless additional legislation is enacted, the intensity and frequency of fouling could increase. The tonnage of crude oil and its products moved in tankers is growing, and ships of unprecedented capacity are being built. Sooner or later, one of these huge tankers will be sunk off the United States. How will we meet such a disaster? Who will pay for the damages?

At the moment there is effectively little legal recourse. Included in the Clean Water Restoration Act of 1966 were amendments to the Oil Pollution Act of 1924. These amendments were intended to increase the law's penalties and authorize the government to remove spilled oil from the water or shorelines and then sue the responsible parties for the cost. The Senate version of the amendment included a definition of an oil discharge as "any accidental, negligent, or willful spilling." However, this version was changed in House-Senate Conference. The new definition of "discharge" became "any grossly negligent, or willful spilling." Proving gross negligence is almost impossible, or so Justice Department lawyers believe*, for no one has been prosecuted under the new law. Previously about 100 prosecutions a year were filed.

Some petroleum companies have exposed themselves to the charge of "public-be-damned" attitudes, through their practice of cleaning tankers near the coasts by rinsing them with sea water. However, other oil companies have been leaders in efforts to minimize nuisances associated with their activities. Progress in methods of treating refinery wastes is especially noteworthy.† For instance, some facilities are so designed and operated that phenols are almost entirely absent from waste effluents. Many refineries do a good job of removing other components of their effluents. In a typical instance most of the oil is separated mechanically, leaving water containing about 50 parts of oil per million. The oil content is reduced to about 7 parts per million by microbial attack in aerated ponds containing inorganic nutrients. Straight-chain hydrocarbons are readily destroyed. Chains with tertiary carbons are resistant. Also relatively resistant are tar-like complex asphaltenes of high molecular weight.

For years it has been difficult to identify those responsible for oil pollution. When large oil slicks recently were sighted off the Atlantic Coast, the source of the petroleum could not be fixed. Leakage of oil from sunken World War II tankers was blamed. But this facile explanation may not suffice much longer. With modern instrumentation it should be possible to catch the culprits. For instance, a combination of gas-liquid chromatography, controlled pyrolysis, mass spectrometry, and computer calculations probably could provide an identification as valuable as a fingerprint. Patterns obtained from oil slicks could be compared with samples obtained from tankers bound for, and unloading at, United States ports.

The oil industry has needlessly damaged its public image. The industry has adequate talent and resources to minimize its contribution to pollution, and it should proceed to do so.—PHILIP H. ABELSON

* *Congressional Record* (20 April 1967). † J. B. Davis, *Petroleum Microbiology* (Elsevier, New York, 1967).

area of interphase between two substances mixed in a specimen is $S_V = 2\bar{P}_L$, where $\bar{P}_L$ is the average number of intersections with a test line of length L. The volume fraction of a component is given by $V_V = P_P$. This simple formula means that the percentage of space occupied by a specific component of a specimen equals the number of points out of 100 points which "hit" the profiles of the component.

More difficult is the determination of size. Various algebraic and analytic procedures have been developed by which a particle size distribution curve can be derived from a frequency distribution curve of dimensions of profiles or intercepts of these particles on section. But all these methods for determination of size yield only approximations. Nevertheless, these approximations are good enough for practical purposes because the primary measurements of the profiles on section cannot be accurate themselves due to irregularities of the structures.

Measurements of axial ratios (quotients of length over width) of profiles and their classification yield information on the three-dimensional shape of the objects, cut or seen on photographic plates of celestial objects.

The foregoing relations are valid under the assumption of random arrangement of objects in space. In cases of preferred orientation of parts in a sample, randomness can be produced by repeated random sectioning or by other methods of sampling.

The program included a few papers on stereoscopy and photogrammetry. This approach to the study of three-dimensional structure is based on biaxial viewing (parallax) and therefore is not really connected with stereology. Nevertheless the participants in the Congress, being concerned with every possible approach to the investigation of three-dimensional structure were equally interested in the papers on photogrammetry and stereoscopy.

Many representatives of the inorganic sciences became acquainted for the first time with various techniques of reconstruction from serial sections, so frequently used in the life sciences. They recognized that this method might be of advantage for the study of their own objects. Mathematical stereology as described previously is applicable only where many components of similar geometrical properties and of relatively simple shape are examined. But when a single object of complicated structure

is studied, geometricostatistical stereology is of no avail; serial sectioning is, at this time, the best known method of attack.

Another, extremely interesting approach to the study of three-dimensional structure of opaque objects is serial section cinematography. This process involves staining or etching the surface of the remaining block of a specimen, while the slices are discarded. The stained, exposed block surfaces are recorded on successive frames of a motion picture film. When projected, the film reveals the topological qualities of a specimen such as continuity, contiguity, connectivity, isolation, as well as the genus of a component of a specimen. Primarily, however, such films give very specific information on the arrangement of parts. Whenever a component has a shape other than that of a cylinder or pyramid oriented perpendicularly to the cutting plane, the film, when projected, gives the visual impression of change of shape or movement.

This chain of thought leads to "hyperstereology," the extrapolation from three- to four-dimensional space which might at a later time help in the clarification of certain cosmological phenomena.

The Congress was supported by a grant from the National Science Foundation. The complete program of the Congress with abstracts of all papers constitutes volume 6, No. 1, of *Stereologia*, the bulletin of the International Society for Stereology. The proceedings of the Congress, now in press, will be published by Springer-Verlag, New York and Heidelberg.

HANS ELIAS

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Calendar of Events

National Meetings

June

8–9. **Photographic Systems for Engineers**, seminar, Newton, Mass. (Soc. of Photographic Scientists and Engineers, 1330 Massachusetts Ave., NW, Washington, D.C. 20005)

8–9. **Post Irradiation Recovery Kinetics**, symp., Bethesda, Md. (M. F. Canning, Information Div., Technical Information and Services Dept., Armed Forces Radiobiology Research Inst., Defense Atomic Support Agency, Bethesda 20014)

8–10. Fourth Pacific Northwest **Plastics** Workshop, Spokane, Wash. (R. Raff, Re-

search Div., College of Engineering, Washington State Univ., Pullman 99163)

11–14. **Apollo and Beyond**, American Astronautical Soc., Huntsville, Ala. (S. S. Hu, Northrop Space Labs., P.O. Box 1484, Huntsville)

11–15. American **Nuclear** Soc., 12th annual, San Diego, Calif. (J. E. Wilkins, Jr., General Atomic, P.O. Box 608, San Diego 92112)

11–15. **Industrial Pharmaceutical Research**, 9th annual natl. conf., Land O' Lakes, Wis. (A. P. Lemberger, Extension Services in Pharmacy, 190 Pharmacy Bldg., Univ. of Wisconsin, Madison 53706)

11–16. **Air Pollution Control** Assoc., 60th annual mtg., Cleveland, Ohio. (Seward Covert & Associates, 1059 Leader Bldg., Cleveland 44114)

11–16. **Medical Library** Assoc., annual mtg., Miami, Fla. (The Association, 919 N. Michigan Ave., Chicago, Ill.)

12–14. American **Neurological** Assoc., 92nd annual mtg., Atlantic City, N.J. (M. D. Yahr, The Association, 710 W. 168 St., New York 10032)

12–15. Society for **Industrial and Applied Mathematics**, Washington, D.C. (W. J. Jameson, Jr., Collins Radio Co., 120-09. Cedar Rapids, Iowa 52406)

12–16. American **Osteopathic Academy of Orthopedics**, 7th annual instructional course, Vienna, Austria. (P. H. Lewis, 1930 Chestnut St., St. Joseph, Mo. 64501)

12–16. **Technical and Industrial Communication**, 10th annual inst., Fort Collins, Colo. (Director, The Institute, Colorado State Univ., Fort Collins 80521)

13–14. **Electroexplosive Devices**, 5th symp., Philadelphia, Pa. (G. Cohn, Senior Staff Engineer, Franklin Inst. Research Lab., Philadelphia 19103)

13–15. American **Astronomical** Soc., Yerkes Observatory, Williams Bay, Wis. (G. C. McVittie, Univ. of Illinois Observatory, Urbana 61803)

13–16. **Conjugate Point** Symp., Boulder, Colo. (Aeronomy Lab. 540.03, Environmental Science Services Administration, Inst. for Telecommunication Sciences and Aeronomy, Boulder 80302)

13–16. **Vacuum Metallurgical** Conf., 10th annual, New York, N.Y. (E. L. Foster, Materials Engineering Dept., Battelle Memorial Inst., 505 King Ave., Columbus, Ohio)

14–15. **Plastics for Tooling**, 9th seminar, Lafayette, Ind. (Soc. of Plastics Industry, 250 Park Ave., New York 10017)

14–16. **Densitometry**, seminar, Chicago, Ill. (B. Kettinger, News Service Office, P.O. Box 3404, Rochester Inst. of Technology, Rochester, N.Y. 14614)

14–17. Modern **Computer Analysis of Complex Social Science Data Bases**, Council of Social Science Data Archives, annual mtg., Los Angeles, Calif. (W. A. Glaser, Bureau of Applied Social Research, 605 W. 115 St., New York 10025)

14–17. **Speech-Analyzing Aids for the Deaf**, conf., Washington, D.C. (J. M. Pickett, Hearing and Speech Center, Gallaudet College, Washington, D.C.)

15–16. American **Rheumatism** Assoc., New York, N.Y. (Miss M. Walsh, The Association, 1212 Avenue of the Americas, New York)

15–16. **Soil, Water and Suburbia**, Dept.

of Agriculture and Dept. of Housing and Urban Development, Washington, D.C. (S. Kasper, Room 1201, Dept. of Housing and Urban Development, 1430 K St., NW, Washington, D.C.)

15–17. American Assoc. of **Physics Teachers**, summer mtg., Canton, N.Y. (A. B. Arons, Physics Dept., Amherst College, Amherst, Mass.)

15–17. Symposium on **High Energy Radiation Therapy Dosimetry**, American Assoc. of Physicists in Medicine, New York, N.Y. (L. H. Lanzl, Dept. of Radiology, Univ. of Chicago, 950 E. 59 St., Chicago, Ill. 60637)

15–18. American **Therapeutic** Soc., mtg., Atlantic City, N.J. (A. F. Kreglow, 1801 Eye St., NW, Washington, D.C.)

15–19. American College of **Chest Physicians**, Atlantic City, N.J. (M. Kornfeld, 112 E. Chestnut St., Chicago, Ill. 60611)

16–17. American **Geriatrics** Soc., Atlantic City, N.J. (E. Henderson, Executive Director, The Society, 10 Columbus Circle, Room 1495, New York 10019)

17. Academy of **Tuberculosis Physicians**, Atlantic City, N.J. (G. P. Bailey, 1295 Clermont, Denver, Colo.)

17–18. Academy of **Psychosomatic Medicine**, 4th symp. on anxiety and depression, Atlantic City, N.J. (E. Dunlop, 150 Emory St., Attleboro, Mass. 02703)

17–18. American **Diabetes** Assoc., Atlantic City, N.J. (J. R. Connelly, The Associaton, 18 E. 48 St., New York 10017)

17–18. Society for **Surgery of the Alimentary Tract**, Atlantic City, N.J. (J. Van Prohaska, The Society, 950 E. 59 St., Chicago, Ill. 60637)

17–19. **Reliability and Maintainability**, 6th annual conf., Cocoa Beach, Fla. (Meetings Dept., American Inst. of Aeronautics and Astronautics, 1290 Sixth Ave., New York 10019)

18–21. **Botanical** Soc. of America, Northeastern Section, summer field mtg., Tuxedo, N.Y. (R. K. Zuck, Dept. of Botany, Drew Univ., Madsion, N.J.)

18–22. American **Medical** Assoc., 116th annual conv., Atlantic City, N.J. (The Association, 535 N. Dearborn St., Chicago, Ill. 60610)

18–22. **Health Physics** Soc., 12th annual mtg., Washington, D.C. (J. C. Villforth, Radiological Health Lab., 1901 Chapman Blvd., Rockville, Md.)

18–22. Society for **Investigative Dermatology**, Atlantic City, N.J. (G. W. Hambrick, Jr., The Society, Johns Hopkins Hospital, 601 N. Broadway, Baltimore, Md. 21205)

18–23. American Soc. of **Ichthyologists and Herpetologists**, annual mtg., San Francisco, Calif. (W. I. Follett, California Acad. of Sciences, Golden Gate Park, San Francisco 94118)

18–30. **Electron Microscopy**, workshop, Northeastern Univ., Boston, Mass. (C. Youse, Continuing Education, Northeastern Univ., 360 Huntington Ave., Boston)

19. **Scombroid Phylogeny**: Ideas and Approaches, symp. of American Soc. of Ichthyologists and Herpetologists, San Francisco, Calif. (B. J. Rothschild, Tuna Ecology Program, Bureau of Commercial Fisheries, P.O. Box 3830, Honolulu, Hawaii 96812)

19–21. Automatic **Data Processing Systems in Local Government**, 3rd annual

conf., New York, N.Y. (H. Sellin, School of Continuing Education, New York Univ., New York 10003)

19–21. **Colloid**, 41st natl. symp., Buffalo, N.Y. (P. Becher, Chemical Research Dept., Atlas Chemical Industries, Wilmington, Del. 19899)

19–21. **Heat Transfer** and **Fluid Mechanics** Inst., La Jolla, Calif. (D. B. Olfe, Dept. of Aerospace and Mechanical Engineering Sciences, Univ. of California at San Diego, La Jolla)

19–21. **Microelectronics**, symp., St. Louis, Mo. (R. Pellin, Inorganic Chemicals Div., Monsanto Co., 800 N. Lindbergh Blvd., St. Louis 63166)

19–22. American Soc. for **Engineering Education**, 75th annual mtg., East Lansing, Mich. (L. Winner, 152 W. 42 St., New York 10036)

19–22. Western Soc. of **Soil Science**, annual mtg., Los Angeles, Calif. (J. L. Young, 100 Agricultural Hall, Oregon State Univ., Corvallis)

19–23. **Automating State and Local Records Making and Records Keeping**, American Univ., Washington, D.C. (P. W. Howerton, Director, Center for Technology and Administration Inst., 2000 G St., NW, Washington 20010)

21–23. **Modern Titrimetry**, 20th annual summer symp. on analytical chemistry, Claremont, Calif. (A. L. Beilby, Dept. of Chemistry, Pomona College, Claremont 91713)

21–25. Society of **Women Engineers**, 17th annual conv., Washington, D.C. (Mrs. J. R. Fisher, 12501 Connecticut Ave., Silver Spring, Md. 20906)

21–30. **Combustion-Generated Air Pollution**, mtg., Berkeley, Calif. (Engineering Extension, 2223 Fulton St., Berkeley 94720)

22–23. **Animal Reproduction**, 8th symp., Urbana, Ill. (Short Courses and Conferences, 116 Illini Hall, Champaign, Ill. 61820)

22–24. American Soc. of **Enologists**, annual mtg., Santa Barbara, Calif. (The Society, Box 411, Davis, Calif.)

22–25. American Assoc. of **Bioanalysts**, mtg., Detroit, Mich. (D. Birenbaum, The Association, 805 Ambassador Bldg., St. Louis, Mo. 63101)

25–27. **Mountain Meteorology**, symp., Fort Collins, Colo. (J. L. Rasmussen, Dept. of Atmospheric Science, Colorado State Univ., Fort Collins 80521)

25–28. American Soc. of **Agricultural Engineers**, annual mtg., Saskatoon, Sask., Canada. (O. L. Symes, Dept. of Agricultural Engineering, Univ. of Saskatchewan, Saskatoon)

25–28. American **Dairy Science** Assoc., Ithaca, N.Y. (C. Cruse, The Association, 903 Fairview Ave., Urbana, Ill. 61801)

25–28. American **Leather Chemists** Assoc., Lake Placid, N.Y. (W. T. Roddy, Executive Secretary, The Association, Univ. of Cincinnati, Cincinnati, Ohio 45221)

25–30. American Soc. for **Testing and Materials**, 70th annual mtg., Boston, Mass. (H. H. Hamilton, Public Relations, The Society, 1916 Race St., Philadelphia, Pa. 19103)

26–27. American Soc. of **Pharmacognosy**, annual mtg., Ann Arbor, Mich. (A. G. Paul, College of Pharmacy, Univ. of Michigan, Ann Arbor)

26–28. **Computer Workshop,** Columbia Univ., New York, N.Y. (Workshop Director, College of Pharmaceutical Sciences, Columbia Univ., 115 W. 68 St., New York 10023)

26–30. American Schools for the **Deaf,** conf. West Hartford, Conn. (E. W. Tillinghast, Arizona State School of Deaf and Blind, P.O. Box 5545, Tucson 85703)

26–30. **Computers in Chemistry,** conf., Univ. of California, San Diego. (P. James, Chancellor Office, Univ. of California at San Diego, La Jolla)

26–30. Workshop on Graduate Training in **Scientific Writing,** Rockefeller Univ., New York, N.Y. (F. P. Woodford, Rockefeller Univ., New York 10021)

26–8. **Immunology,** summer course. Lake Forest, Ill. (S. Dray, Univ. of Illinois at Medical Center, P.O. Box 6998, Chicago)

27–29. Western Soc. of **Crop Science,** University Park, N.M. (B. A. Melton, Jr., New Mexico State Univ., University Park 88001)

28–30. American Scientific **Glassblowers** Soc., 12th annual symp., Atlanta, Ga. (R. W. Poole, 100 Cedar Lane, Oak Ridge, Tenn. 37832)

28–30. Joint **Automatic Control** Conf., 8th annual mtg., Philadelphia, Pa. (L. Winner, 152 W. 42 St., New York 10036)

28–30. Society of **Protozoologists,** Toronto, Ont., Canada. (R. W. Hull, Dept. of Biological Sciences, Florida State Univ., Tallahassee, 32306)

29–1. **Navigation** in the Last Third of the 20th Century: Where Do We Stand; What Needs to be Done, Inst. of Navigation, 23rd annual mtg., Washington, D.C. (The Institute, 711 14th St., NW, Suite 912, Washington 20005)

International and Foreign Meetings

June

14–15. **Light and Vision,** intern. symp., Columbus, Ohio. (G. A. Fry, Ohio State Univ., Columbus 43210)

14–16. **Systematic Biology,** intern. conf., Ann Arbor, Mich. (A. G. Kluge, The Conference, Dept. of Zoology, Univ. of Michigan, Ann Arbor 48104)

14–17. Canadian **Psychiatric** Assoc., annual mtg., Quebec City, P.Q. (W. A. Blair, 225 Lisgar St., Ottawa, Ont.)

14–17. Mechanized **Information Storage, Retrieval and Dissemination,** conf., Rome, Italy. (British Computer Soc., 23 Dorset Sq., London, N.W.1, England)

16–18. Society of **Obstetricians and Gynecologists** of Canada, annual mtg., Murray Bay, P.Q. (J. L. Harkins, 537 Medical Arts Bldg., Toronto 5, Ont.)

18–21. Canadian **Opthalmological** Soc., 30th annual mtg., Ottawa, Ont. (Office of Secretary, 1948 Yonge St., Suite 902, Toronto 7, Ont.)

18–23. Canadian Soc. of **Laboratory Technologists,** Quebec City, P.Q. (The Society, 99 Wentworth St. S., Hamilton, Ont.)

18–23. **Kinetics of Reactions in Ionic Systems,** intern. symp., Alfred, N.Y. (T. J. Gray, College of Ceramics, State Univ. of New York, Alfred 14802)

18–24. **Oral Education of the Deaf,** intern. conf., Northampton, Mass. and New York, N.Y. (G. T. Pratt, Clark

School for Deaf, Northampton 01060)

18–30. **Algae, Man and the Environment**, intern. symp., Syracuse, N.Y. (D. F. Jackson, Dept. of Civil Engineering, Syracuse Univ., Syracuse 13210)

19–21. Federation of **European Biochemical** Societies, 4th mtg., Oslo, Norway. (W. J. Whelan, Dept. of Biochemistry, Royal Free Hospital School of Medicine, Univ. of London, 8 Hunter St., London, W.C.1)

19–23. **Electronics**, 14th intern. scientific congr., Rome, Italy. (Rassegna Internazionale Elettronica Nucleare e Teleradiocinematografica, Via Crescenzio 9, Rome)

19–23. **Spectroscopy**, 13th intern. colloquium, Ottawa, Ont., Canada. (Secretary, The Colloquium, Natl. Research Council, Ottawa 7)

19–28. International Commission on **Illumination**, Washington, D.C. (L. E. Barbrow, Secretary, USNC, c/o National Bureau of Standards, Washington, D.C.)

20–22. **Design Engineering**, conf. and exhibition, Melton Mowbray, England. (Conf. Organizer, Production Engineering Research Assoc., Melton Mowbray)

20–22. **Growth of the Nervous System**, symp., London, England. (Ciba Foundation, 41 Portland Pl., London)

20–23. British Assoc. of **Dermatology**, London, England. (S. Gold, 149 Harley St., London, W.1)

20–23. International **Data Processing**, conf. and business exhibition, Boston, Mass. (Data Processing Management Assoc., 524 Busse Hgwy., Park Ridge, Ill. 60068)

20–23. **Pathology and Microbiology**, 15th Scandinavian congr., Copenhagen, Denmark. (J. C. Siim, Statens Seruminstitutet, Amager Boul. 80, Copenhagen)

21–25. **Town Planning** Inst. of Canada, annual mtg., Montreal, P.Q. (The Institute, Board of Trade Bldg., 11 Adelaide St. W., Toronto 1, Ont.)

21–29. **ACHEMA** 1967, 15th chemical engineering congr. and exhibition, Frankfurt-am-Main, West Germany. (Deutsche Gesellschaft fur chemisches Apparatewesen, Postfach 7746, 6000 Frankfurt/Main, 7)

21–1. International **Plastics** Exhibition and Convention, London, England. (British Plastics, Interplas 67, Dorset House, Stamford St., London, S.E.1)

22–25. **Urology**, 32nd Belgian Congr., Liége, Belgium. (L. Timmermans, Hopital de Baviere, Clinique Urologique, 66, boulevard de la Constitution, Liége)

25–2. **Application of Mathematics in Engineering**, 4th intern. congr., Weimar, East Germany. (H. Matzke, Inst. of Mathematics and Scientific Computing Center, Weimar College of Architecture and Building, Karl Marx Platz, 2 Weimar)

25–2. **Chemotherapy**, 5th intern. congr., Vienna, Austria. (Sekretariat, Wiener Medizinische Akademie, Alser Strasse 4, 1090 Wienn, Austria)

26–30. **Carbonium Ions**, 1st intern. symp. on physical organic chemistry, Athens, Greece. (The Symposium, Dept. of Chemistry, Michigan State Univ., East Lansing 48823; or G. Gregoriou, Nuclear Research Center "Democritos," Aghia Paraskevi, Athens, Greece)

BOOKS RECEIVED

(Continued from page 1079)

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Cells and Energy. Richard A. Goldsby. Macmillan, New York, 1967. 127 pp. Illus. Paper, $1.95. Current Concepts in Biology Series.

The Central Nervous System of Vertebrates. vol. 1. *Propaedeutics to Comparative Neurology.* Hartwig Kuhlenbeck. Academic Press, New York, 1967. 320 pp. Illus. $17.50.

The Changing Concepts of Science. Hugh Grayson-Smith. Prentice-Hall, Englewood Cliffs, N.J., 1967. 640 pp. Illus. $9.50.

Chemistry and Technology of Fertilizers. A. V. Slack. Interscience (Wiley), New York, 1967. 148 pp. Illus. Paper, $4.95. Revised reprint from *Encyclopedia of Chemical Technology*, ed. 2, vol. 9, pp. 25–150.

The Chemistry of Boron and Its Compounds. Earl L. Muetterties, Ed. Wiley, New York, 1967. 715 pp. Illus. $27.50. Ten papers.

The Chemistry of Lignin. Irwin A. Pearl. Dekker, New York, 1967. 355 pp. Illus. $15.75.

The Chemistry of Organic Film Formers. D. H. Solomon. Wiley, New York, 1967. 381 pp. Illus. $14.95.

Chromatographic Methods. R. Stock and C. B. F. Rice. Chapman and Hall, London; Barnes and Noble, New York, ed. 2, 1967. 264 pp. Illus. Paper, $4; cloth, $7.50.

Clinical Dietetics and Nutrition: With Special Reference to Tropical Foods. F. P. Antia. Oxford Univ. Press, New York, 1966. 573 pp. Illus. $6.75.

The Cloak of Competence: Stigma in the Lives of the Mentally Retarded. Robert B. Edgerton. Univ. of California Press, Berkeley, 1967. 251 pp. $5.75.

The Collected Papers of David Rapaport. Merton M. Gill, Ed. Basic Books, New York, 1967. 953 pp. $17.50. There are 65 papers.

Color Science: Concepts and Methods, Quantitative Data and Formulas. Günter Wyszecki and W. S. Stiles. Wiley, New York, 1967. 644 pp. Illus. $27.50.

Compensatory Education for the Disadvantaged. Programs and practices: preschool through college. Edmund W. Gordon and Doxey A. Wilkerson. College Entrance Examination Board, New York, 1966. 309 pp. $4.50.

Completeness in Science. Richard Schlegel. Appleton, Century, Crofts (Meredith), New York, 1967. 296 pp. Illus. $7.50.

Concepts of Modern Physics. Arthur Beiser. McGraw-Hill, New York, ed. 2, 1967. 415 pp. Illus. $8.95.

A Contribution to the Classification of Snakes. Garth Underwood. British Museum (Natural History), London, 1967. 189 pp. Illus. £2 15s.

Contributions to Sensory Physiology. vol. 2. William D. Neff, Ed. Academic Press, New York, 1967. 277 pp. Illus. $9. Five papers.

Crystal Growth. Proceedings of an in-

ternational conference (Boston), June 1966. Sponsored by Air Force Cambridge Research Laboratories Solid State Commission and International Union of Pure and Applied Physics. H. Steffen Peiser, Ed. Pergamon, New York, 1967. 876 pp. Illus. $45. There are 136 papers.

Current Topics in Radiation Research. vol. 3. Michael Ebert and Alma Howard, Eds. North-Holland, Amsterdam; Interscience (Wiley), New York, 1967. 236 pp. Illus. $9.75. Five papers.

The Desegregation Era in Higher Education. Sam P. Wiggins. McCutchan, Berkeley, Calif., 1966. 120 pp. Illus. $4.95.

The Design and Analysis of Scientific Experiments. K. C. Peng. Addison-Wesley, Reading, Mass., 1967. 262 pp. Illus. $12.50.

A Dictionary of Civil Engineering. John S. Scott. Penguin Books, Baltimore, ed. 2, 1967. 348 pp. Illus. Paper, $1.65.

Dictionnaire Raisonné de Mathématiques. André Warusfel. Éditions du Seuil, Paris, 1966. 524 pp. Illus. Paper.

The Dynamics of Behavior Development: An Epigenetic View. Zing-Yang Kuo. Random House, New York, 1967. 254 pp. Paper, $2.45.

Electromagnetics. Robert S. Elliott. McGraw-Hill, New York, 1966. 653 pp. Illus. $15.50. McGraw-Hill Physical and Quantum Electronics Series.

The Electron Microscope in Molecular Biology. G. H. Haggis. Wiley, New York, 1967. 84 pp. Illus. Paper, $3.95.

Elementary Topology: A Combinatorial and Algebraic Approach. Donald W. Blackett. Academic Press, New York, 1967. 236 pp. Illus. $9.50.

The Encyclopedia of Biochemistry. Roger J. Williams and Edwin M. Lansford, Jr., Eds. Reinhold, New York, 1967. 894 pp. Illus. $25.

Entomologie: Appliquée à l'Agriculture. Pt. 2, *Lepidopteres.* vol. 1, *Hepialoidea—Stigmelloidea—Incurvarioidea—Cossoidea—Tineoidea—Tortricoidea.* A. S. Balachowsky, Ed. Masson, Paris, 1966. 1065 pp. Illus. F. 250.

Enzyme Cytology. D. B. Roodyn, Ed. Academic Press, New York, 1967. 607 pp. Illus. $25. Eight papers.

Essays on the Verbal and Visual Arts. Proceedings of the annual spring meeting (Philadelphia), April 1966. June Helm, Ed. Published for the American Ethnological Society. Univ. of Washington Press, Seattle, 1967. 221 pp. Illus. Paper, $4. Fifteen papers.

Fundamentals of Electronics. vols. 2 and 3. George E. Owen and P. W. Keaton. Harper and Row, New York, 1967. vol. 2, 303 pp., $14; vol. 3, 360 pp., $16.95. Illus.

Fundamentals of Vibrations. Roger A. Anderson. Macmillan, New York, 1967. 424 pp. Illus. $11.95. Macmillan Series in Mechanical Engineering.

General Chemistry. Martin A. Paul, Edward J. King, and Larkin H. Farinholt. Harcourt, Brace, and World, New York, 1967. 809 pp. Illus. $9.95.

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Handbook of Epoxy Resins. Henry Lee and Kris Neville. McGraw-Hill, New York, 1967. Unpaged. Illus. $32.50.

Handbook of Industrial Metrology. John W. Greve, Ed. Prentice-Hall, Englewood Cliffs, N.J., 1967. 508 pp. Illus. $15. American Society of Tool and Manufacturing Engineers Manufacturing Engineering Series.

Higher Education in the South. Sam P. Wiggins. McCutchan, Berkeley, Calif., 1966. 378 pp. Illus. $8.50.

The History and Geography of Diseases. Folke Henschen. Translated from the revised edition by Joan Tate. Delacorte Press, New York, 1967. 360 pp. Illus. $10.

Hydraulic Control Systems. Herbert E. Merritt. Wiley, New York, 1967. 368 pp. Illus. $14.95.

Infrared Spectra of Adsorbed Species. L. H. Little. Academic Press, New York, 1966. 440 pp. Illus. $16.50.

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Intermetallic Compounds. J. H. Westbrook, Ed. Wiley, New York, 1967. 681 pp. Illus. $29.75. Wiley Series on the Science and Technology of Materials. There are 29 papers.

International Study of Achievement in Mathematics: A Comparison of Twelve Countries. vols. 1 and 2. Torsten Husén, Ed. Almqvist and Wiksell, Stockholm; Wiley, New York, 1967. vol. 1, 304 pp.; vol. 2, 368 pp. Illus. $19.95 set.

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Kepler's Somnium. The dream, or posthumous work on lunar astronomy. Translated from the 1634 edition, with a commentary, by Edward Rosen. Univ. of Wisconsin. Press, Madison, 1967. 279 pp. Illus. $8.75.

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Light as an Ecological Factor. A symposium (Cambridge, England), March–April 1965. Richard Bainbridge, G. Clifford Evans, and Oliver Rackham, Eds. Wiley, New York, 1967. 464 pp. Illus. $13.50. The British Ecological Society Symposium, vol. 6. Twenty-two papers.

Lucrarile Institutului de Cercetari Veterinari si Biopreparate. vol. 4, Nos. 1–2, *1965*. Redactia Revistelor Agricole, Bucuresti, Roumania, 1966. 361 pp. Illus.

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G. Mendel Memorial Symposium, 1865–1965. Proceedings of a symposium (Brno), August 1965. Milan Sosna, Ed. Czechoslovak Academy of Sciences, Prague; Werner Flach, Frankfurt, Germany, 1966. 311 pp. Illus. There are 31 papers.

Mental Fitness. William B. McGrath. Arizona Foundation for Neurology and Psychiatry, Phoenix, 1967. 125 pp. $3.50.

Methods for Experimental Social Innovation. George W. Fairweather. Wiley, New York, 1967. 262 pp. Illus. $7.95.

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Mind: An Essay on Human Feeling. vol. 1. Susanne K. Langer. Johns Hopkins Press, Baltimore, 1967. 511 pp. Illus. $10.

The Modern Metropolis: Its Origins, Growth, Characteristics, and Planning. Selected essays by Hans Blumenfeld. Paul D. Spreiregen, Ed. M.I.T. Press, Cambridge, Mass., 1967. 393 pp. Illus. $12.50.

Molecular Insights into the Living Process. David E. Green and Robert F. Goldberger. Academic Press, New York, 1967. 432 pp. Illus. $9.75.

MOSFET in Circuit Design. Metal-oxide-semiconductor field-effect transistors for discrete and integrated-circuit technology. Robert H. Crawford. McGraw-Hill, New York, 1967. 150 pp. Illus. $10.

Movement of Water in Plants. G. E. Briggs. Davis, Philadelphia, 1967. 154 pp. $6.50.

The Myth of the Machine: Technics and Human Development. Lewis Mumford. Harcourt, Brace and World, New York, 1967. 352 pp. Illus. $8.95.

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The Nature of Biochemistry. Ernest Baldwin. Cambridge Univ. Press, New

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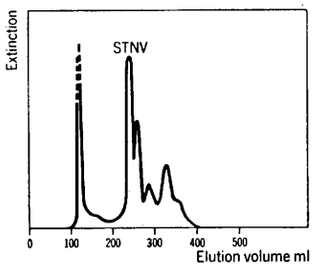
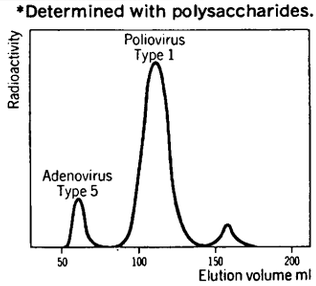
2B	60-250	2	$2x10^6$ to $25x10^6$*
4B	40-190	4	$3x10^5$ to $3x10^6$*

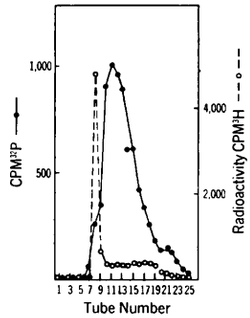
*Determined with polysaccharides.



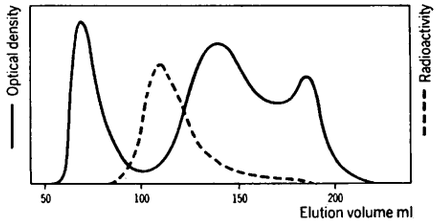
Chromatography of a crude preparation of satellite tobacco necrosis virus on Sepharose 4B.



Separation of ^{32}P-labeled adenovirus and poliovirus on Sepharose 2B.



Separation of the replicative RNA intermediate (first peak) synthesized in RNA phage-infected cells from single stranded cellular RNA (second peak) on Sepharose 4B. Erikson and Gordon, Biochem. Biophys. Res. Commun. *23* (1966) 422-428.



Separation of a mixture of KB-cell nucleic acids and ^{32}P-labeled poliovirus RNA on Sepharose 2B. The first peak contains KB-cell DNA, followed by poliovirus RNA, KB-cell r-RNA and KB-cell s-RNA.

For additional technical information on SEPHAROSE, write to

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800 Centennial Avenue, Piscataway, N. J. 08854
Pharmacia (Canada) Ltd., 110 Place Crémazie, Suite 412, Montreal 11, P. Q.

(Inquiries outside U.S.A. and Canada should be directed to PHARMACIA FINE CHEMICALS, Uppsala, Sweden.)

York, ed. 2, 1967. 127 pp. Illus. Paper, $1.65; cloth, $3.50.

La Navigation par Inertie. Jean-Claude Radix. Presses Universitaires de France, Paris, 1967. 127 pp. Illus. Paper, F. 3.

The New Microbiology. John E. Flynn, Ed. McGraw-Hill, New York, 1966. 332 pp. Illus. Paper, $4.50; cloth, $6.50. Eighteen papers.

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Organic Chemistry of Synthetic High Polymers. Robert W. Lenz. Interscience (Wiley), New York, 1967. 853 pp. Illus. $15.

Organic Photochemistry. vol. 1. Orville L. Chapman, Ed. Dekker, New York, 1967. 351 pp. Illus. $15.75. Seven papers.

Persistence and Change: Bennington College and Its Students After Twenty-five Years. Theodore M. Newcomb, Kathryn E. Koenig, Richard Flacks, and Donald P. Warwick. Wiley, New York, 1967. 302 pp. Illus. $9.95.

Philosophy of Science Today. Sidney Morgenbesser, Ed. Basic Books, New York, 1967. 224 pp. $4.95.

Physical Geodesy. Weikko A. Heiskanen and Helmut Moritz. Freeman, San Francisco, 1967. 376 pp. Illus. $12.50. A Series of Books in Geology.

Physical Science: A Study of Matter and Energy. Verne H. Booth. Macmillan, New York, ed. 2, 1967. 760 pp. Illus. $8.95.

The Physical Sciences: From Atoms to Stars. Theodore Askounes Ashford. Holt, Rinehart, and Winston, New York, ed. 2, 1967. 748 pp. Illus. $10.95.

Physique des Dislocations. A colloquium (Toulouse), March 1966. P. Coulomb and G. Saada, Eds. Presses Universitaires de France, Paris. 1967. 243 pp. Illus. Paper, F. 35. There are 31 papers in English or French with an abstract of each in English and French.

The Plastids: Their Chemistry, Structure, Growth and Inheritance. John T. O. Kirk and Richard A. E. Tilney-Bassett. Freeman, San Francisco, 1967. 624 pp. Illus. $17.50.

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The Population of Urban Populations. Abraham Bernstein. Random House, New York, 1967. 414 pp. Paper, $3.95.

Power-Generation Systems: Energy Systems Engineering. Editors of *Power*. McGraw-Hill, New York, 1967. 404 pp. Illus. $15.

Pre-Calculus Mathematics: A Programmed Text. Books 1 to 3. Book 1, *Algebra* (575 pp.); Book 2, *Functions and Relations* (687 pp.); Book 3, *Analytic Trigonometry* (628 pp.). Vernon E. Howes. Wiley, New York, 1967. Illus. Paper, $4.95 per book.

Principles of Field Crop Production. John H. Martin and Warren H. Leonard. Macmillan, New York, ed. 2, 1967. 1054 pp. Illus. $11.95.

Process-Control Systems: Application, Design, Adjustment. F. G. Shinskey. McGraw-Hill, New York, 1967. 381 pp. Illus. $16.50.

Programmed Physics. Pts. 4 and 5. Pt. 4, *Kinetic Theory and Thermodynamics* (169 pp.); pt. 5, *Topics in Modern Physics*. (218 pp.); Alexander Joseph and Daniel J. Leahy. Wiley, New York, 1967. Illus. Paper, $4.95 per volume.

Progress in Nuclear Techniques and Instrumentation. vol. 2. F. J. M. Farley, Ed. North-Holland, Amsterdam; Interscience (Wiley), New York, 1967. 348 pp. Illus. $16. Four papers.

Progress in Physiological Psychology. vol. 1. Eliot Stellar and James M. Sprague, Eds. Academic Press, New York, 1966. 299 pp. Illus. $9.50. Six papers.

Pseudocholinesterasen: Pharmakogenetik, Biochemie, Klinik. H. W. Goedde, A. Doenicke, and K. Altland. Springer-Verlag, New York, 1967. 287 pp. Illus. $14.50.

Pulse Radiolysis of Water and Aqueous Solutions. A. K. Pikaev. Translated from the Russian edition (Moscow, 1965) by Scripta Technica. Edwin J. Hart, Translation Ed. Indiana Univ. Press, Bloomington, 1967. 313 pp. Illus. $10.

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Readings in Linguistics. vol. 2. Eric P. Hamp, Fred W. Householder, and Robert Austerlitz, Eds. Univ. of Chicago Press, Chicago, 1967. 407 pp. Illus. $8.50.

Regiomontanus On Triangles. *De triangulis omnimodis* by Johann Müller. Translated from the Latin (1533) by Barnabas Hughes. Univ. of Wisconsin Press, Madison, 1967. 308 pp. Illus. $10.

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Rock Mechanics and the Design of Structures in Rock. Leonard Obert and Wilbur I. Duvall. Wiley, New York, 1967. 670 pp. Illus. $21.95.

Russian Drug Index. Stanley Jablonski. U.S. Department of Health, Education, and Welfare, ed. 2, Washington, D.C., 1967 (order from Superintendent of Documents, Washington, D.C.). 388 pp. Illus. Paper, $2.25.

A Sand County Almanac: With Other Essays on Conservation from Round River. Aldo Leopold. Oxford Univ. Press, New York, 1966. 285 pp. Illus. $6.50.

Science in Switzerland. James Murray Luck. Columbia Univ. Press, New York, 1967. 437 pp. Illus. $10.

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Scott of the Antarctic. Reginald Pound. Coward-McCann, New York, 1967. 339 pp. Illus. $5.95.

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and 2. Raymond E. Borton, Agricultural Development Council, New York, 1966. vol. 1, 536 pp.; vol. 2, 607 pp. Illus. Paper, $5 per set. There are 136 papers.

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Charles Scott Sherrington: An Appraisal. Ragnar Granit. Doubleday, Garden City, N.Y., 1967. 200 pp. Illus. $6.

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Sources for History of Quantum Physics: An Inventory and Report. Thomas S. Kuhn, John L. Heilbron, Paul Forman, and Lini Allen. American Philosophical Soc., Philadelphia, 1967. 190 pp. $5.

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A System for Analyzing Lessons. John Herbert. Teachers College Press, New York, 1967. 143 pp. Illus. $3.50.

Strategy for Labor: A Radical Proposal. André Gorz. Translated from the French edition by Martin A. Nicolaus and Victoria Ortiz. Beacon Press, Boston, 1967. 213 pp. $5.95.

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Technology and Change: The New Heraclitus. Donald A. Schon. Delacorte Press, New York, 1967. 270 pp. Illus. $7.95.

Technology in Western Civilization. vol. 1, *The Emergence of Modern Industrial Society–Earliest Times to 1900*. Melvin Kranzberg and Carroll W. Pursell, Jr., Eds. Oxford Univ. Press, New York. 1967. 814 pp. Illus. $8.50. Forty-five papers.

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