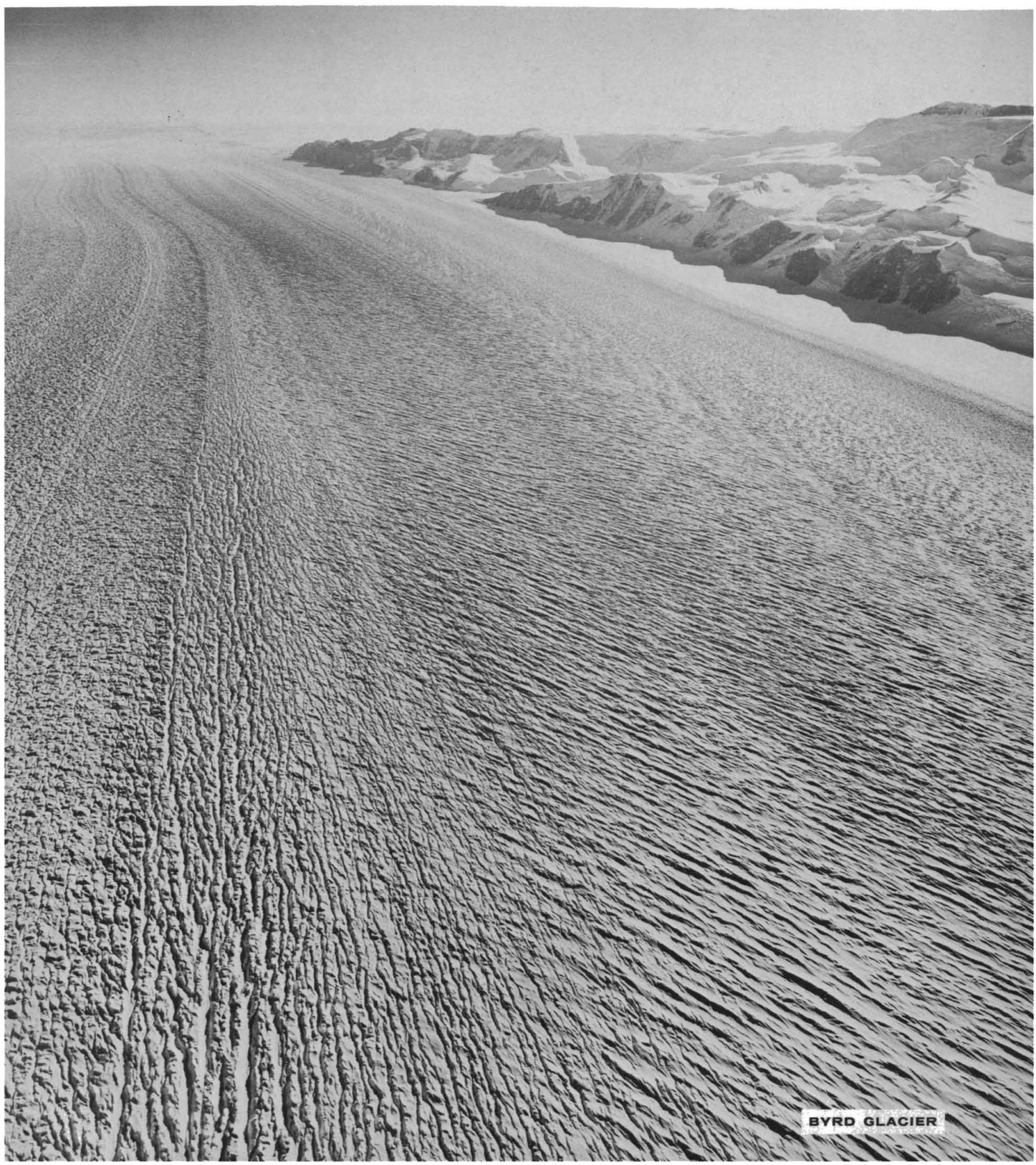
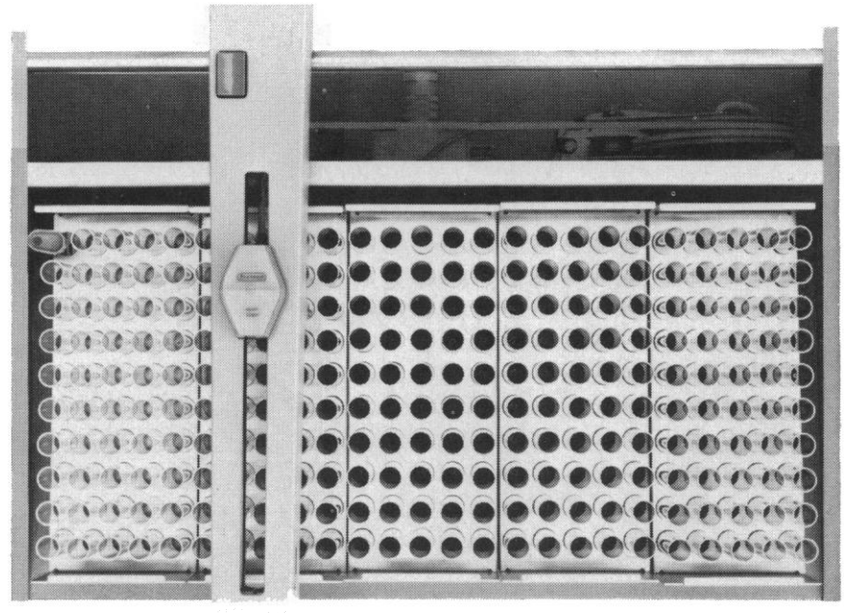
SCIENCE

9 August 1963

Vol. 141, No. 3580

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



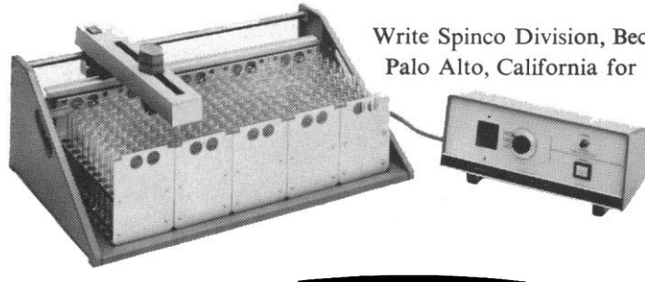


WE'VE SQUARED AWAY THE FRACTION COLLECTOR!

You're looking at the new shape in Fraction Collectors—a compact, practical rectangle that takes up only 26 inches of lab bench, yet provides a full 250 tubes. The controls have been designed into a separate transistorized unit which fits unobtrusively on the bench beside the collector, or on a shelf above.

The space problem isn't the only thing our Model 132 squares away. For example, identification of tubes is easier since the moving delivery head fills one row at a time in a logical front-to-back order. Cleaning is easier since each rack of 50 tubes can be washed without removing the tubes. Timed-flow and drop-counting delivery are available at the flick of a switch, and a simple accessory provides volumetric delivery.

If you're at all involved with column chromatography, send for a copy of our compact, rectangular Fraction Collector brochure.



Write Spinco Division, Beckman Instruments, Inc., Palo Alto, California for File 132-5.

Beckman INSTRUMENTS, INC.
SPINCO DIVISION
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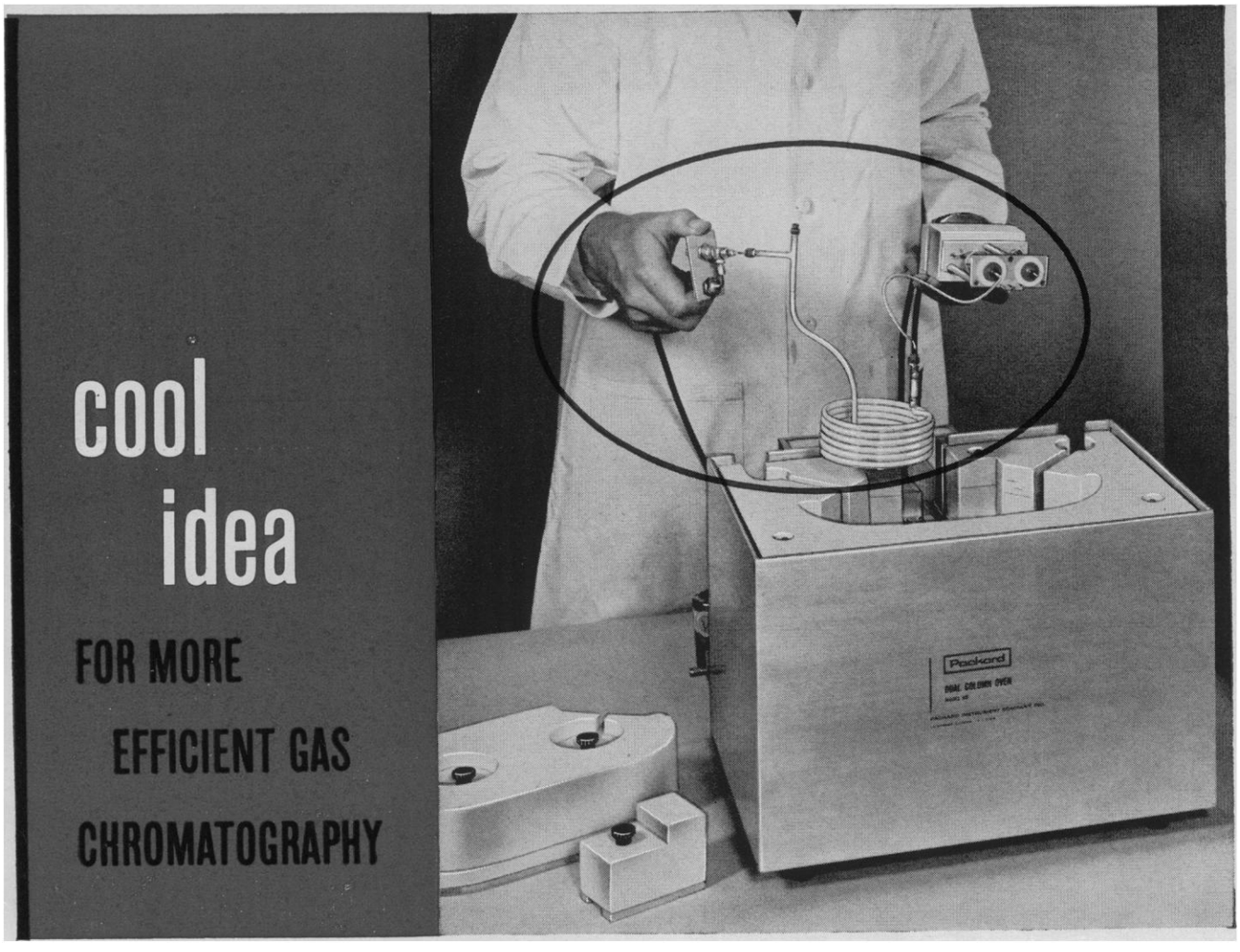
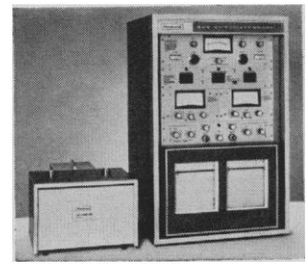


The new Packard Model 802 Dual Column Oven incorporates a unique feature of special interest to every research worker who has changed a column or made a connection in a hot oven: Lift-out column and detector assemblies.

This feature permits you to connect or change columns and detectors, replace septums and make system leak checks outside the heated oven area. A column and detector may be removed and replaced in less than one minute without touching heated oven surfaces. No tools are required. When installing or removing a column, it is not necessary to disconnect carrier gas lines. This eliminates the risk of contaminating the column and reducing sensitivity of the system.

Other features of the Model 802 Dual Column Oven: programmable or isothermal operation; separately controlled dual inlet and outlet heaters; thermally isolated and separately controlled detector capable of accepting dual plug-in argon ionization, flame ionization, electron capture, thermal conductivity and d.c. discharge detectors; rapid oven cooling by means of water circulation around oven wall; high mass construction; convenient access to column and detector ovens.



Model 802 Oven is designed for use with the interesting new Packard Model 7508 Gas Chromatograph which embodies many advanced concepts to meet most analytical or control requirements. Your Packard Sales Engineer can provide complete details and performance data. Write for Bulletins.

Packard

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SCIENCE

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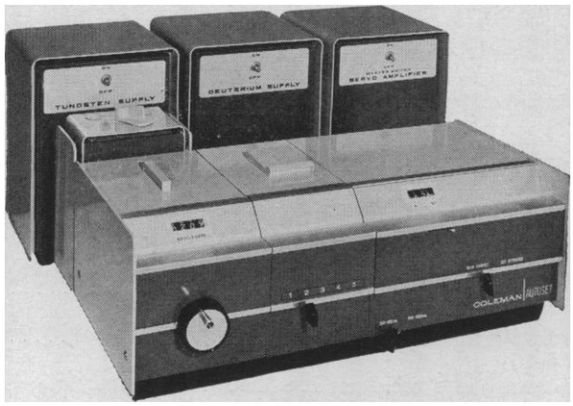
COVER

Byrd Glacier in Antarctica, one of the seven principal glaciers that flow into the Ross Ice Shelf. The glacier is 26.5 kilometers wide and flows at the rate of 2.14 meters per day. This picture was taken 3048 meters above sea level, looking upstream. Mount McClintock (right) is 3508 meters high. The furrows in the foreground are 9.2 meters deep. See page 523. [U.S. Navy]



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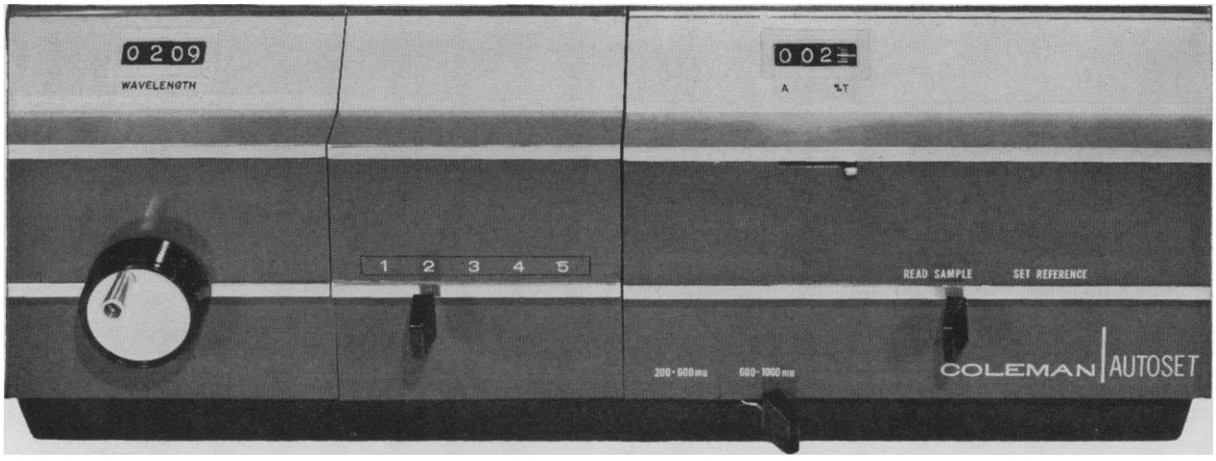

SIMPLE CONTROLS...NUMERICAL READOUT

This is the control panel of the AUTOSET Spectrophotometer, a new UV-Visible instrument featuring automatic reference setting, digital readout and simplified controls.

These are all the controls you need to perform fast, accurate spectrochemical analyses throughout the 200-1000 mμ spectrum.

SPEED and CONVENIENCE

Automated reference setting, the AUTOSET feature, ends the need for the multiple manipulations ordinarily required for making a spectrophotometer reference setting.

With AUTOSET, you can achieve the reference value in seconds by positioning a single control. Select the sample, place the control in "Read" position, and the sample value appears quickly in the readout window.

ERROR ELIMINATION

Reading analytical data from the AUTOSET's digital readout is twice as fast and three times as accurate as reading from a conventional dial.

In the AUTOSET Spectrophotometer, all data—wavelength, analytical results and sample identification—are presented in unmistakable numerical form.

SAMPLE VERSATILITY

The instrument's cuvette compartment is designed to accept a full range of cuvettes—ultramicro, long light path, test tube type and the highly-accurate 1-cm square cells.

The sample compartment has adequate room for such special equipment as mixers, thermostated components and 100-mm light path cells.

For additional information write for Bulletin SB-286.

CONDENSED SPECIFICATIONS

Monochromator
Bipartite reflection diffraction grating.
2 millimicron standard bandwidth; 1 and 5 millimicron bandwidths also available for special work.
Wavelength range 200-1000 millimicrons.

Photometer
Self-balancing null system.
Photometric accuracy: ±0.5% T, ±0.005A at 0.4A.

Sample Range
120 microliters to 25 milliliters.
1 to 100 millimeter light path.

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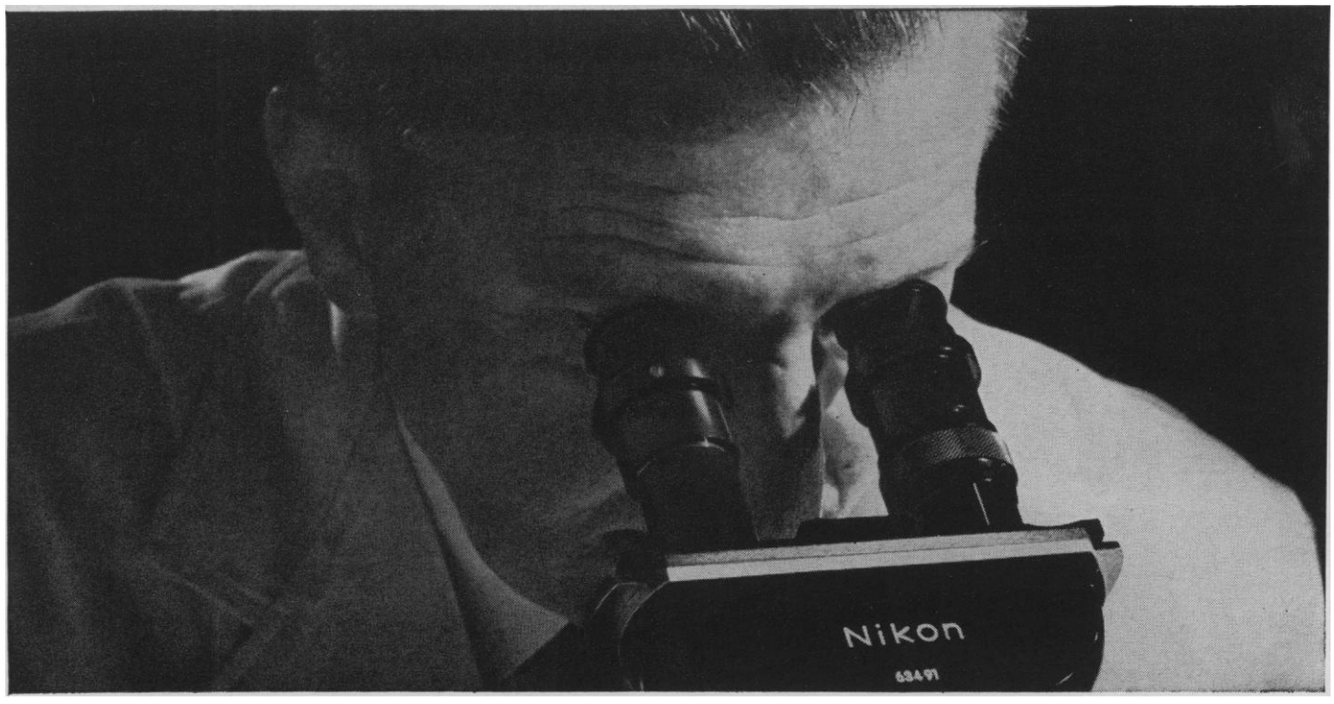
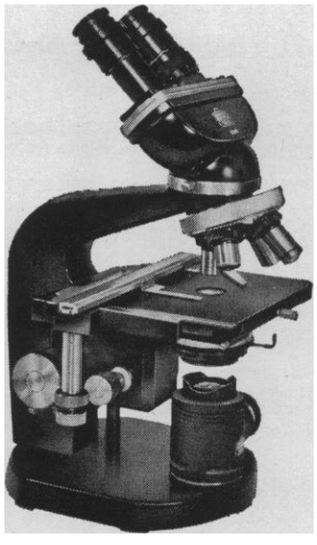


where ruggedness and reliability are as essential as optical quality

NIKON SBR laboratory microscope



The Nikon SBR is a solidly built, yet incredibly flexible laboratory instrument. A veritable workhorse for routine applications, its ready adaptability, whenever special problems arise, is no less astonishing.

Essentially, the SBR consists of the basic Series S microscope body equipped with dust-proof, quadruple nosepiece, mounted in ball bearings; rotating binocular head; and rotating, rectangular graduated mechanical stage whose coaxial controls can be operated with either hand.

Tension-adjustable, focusing controls are located on both sides of the instrument. And a stage-stop lever can be preset to prevent accidental contact between the slide and objective. All controls are low-positioned.

Whether focusing, or manipulating other controls, the one thing that impresses you about the SBR is its rock-steady mechanical stability. There's nothing finicky about any of the adjustments. Once set, they stay put. There's no loss of time or temper having constantly to reset and readjust them.

But, apart from the ruggedness, versatility and smooth mechanical responsiveness of the Nikon SBR, the quality that commends it above all else is its optics. You will find it difficult to duplicate its performance with any other microscope — for uniformity and brightness of field, image resolution, and for the visual comfort and ease you enjoy even with prolonged use.

Building-block design readies the SBR for any number of special applications. It accepts dark-field and phase-contrast equipment, interference-phase and polarizing attachments, photomicrographic equipment, projection head, and a wide variety of eyepieces, objectives, illuminators, measuring reticles, and other accessories.

For complete details, write to Dept. S-8

NIKON Instrument Division of Ehrenreich Photo-Optical Industries, Inc. 111 Fifth Avenue New York 3, New York

The most versatile pH instrument any Hospital or Industrial laboratory can own.

- A pH Meter of high accuracy and zero drift.
- A Titrator for performing routine clinical or industrial titrations automatically.
- When used with the Radiometer Recorder — a pH Stat for recording long term titrations.
- When coupled to the Radiometer Recorder — a recording Titrigraph.
- As a highly stable pH Meter — the Radiometer TTT-1 features a large 160 mm. mirror scale with reading accuracies down to ± .02 pH; and a high degree of zero and amplifier stability. As an Automatic Titrator, complete and automatic control of the end point is assured for either up or down scale titrations, with control over the rate at which the end point is approached and shut off delay after the last addition of titrant.

With its complete freedom from zero drift, and its long term stability, it serves admirably — with the Radiometer SBR2/SBU1 Recording Microburette — as both a pH Stat for the study of the kinetics of reaction solutions, and as a Titrigraph for automatically drawing titration curves.

Special output terminals provide for the use of recorders, relays for process control, and a wide variety of useful accessories.

RADIOMETER Model TTT-1

Accessories Available:

ELS12: A master switch unit permitting the use of several titration stands for large volume routine titrations.

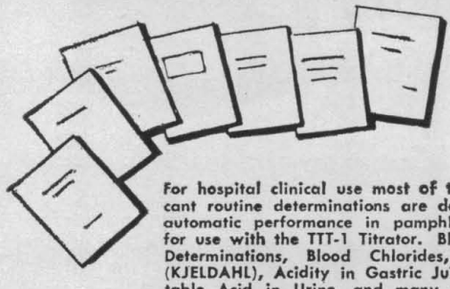
PHA622: External meter expanding to full scale the biological range of 6-8 pH.

PHA630T: External Scale Expander providing reading accuracy of .003 pH over the entire range 0-14 pH.

SBR2/SBU1: Recorder for use as a Titrigraph and pH Stat.

TTA1: Titration stands for automatic or manual titrations.

Electrodes: A complete catalogue of standard and special electrodes for all applications.



For hospital clinical use most of the significant routine determinations are detailed for automatic performance in pamphlet form — for use with the TTT-1 Titrator. Blood Sugar Determinations, Blood Chlorides, Nitrogen (KJELDAHL), Acidity in Gastric Juices, Titratable Acid in Urine, and many others are available. Both the determination of Acetylcholine Esterase in Serum, and the automatic recording of Choline Esterase activities are fully detailed.

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You'd find that regardless of the age of this unit, there would be no fewer than 30 heads available with innumerable accessories for a host of laboratory jobs including all the latest techniques such as a new angle blood bag head that permits blood separation in as little as five minutes at 5500 x G. In addition, the new Helixtractor, a continuous flow unit, increases separation efficiency up to 400%.

Yes, if you can locate a used PR-2 at a favorable price we sincerely recommend its purchase. However, since PR-2 owners rarely part with them you'll likely find it impossible to get one. So we recommend you investigate a **new** PR-2. You'll join a host of well satisfied users and won't want to part with yours, either. Write for a descriptive brochure.

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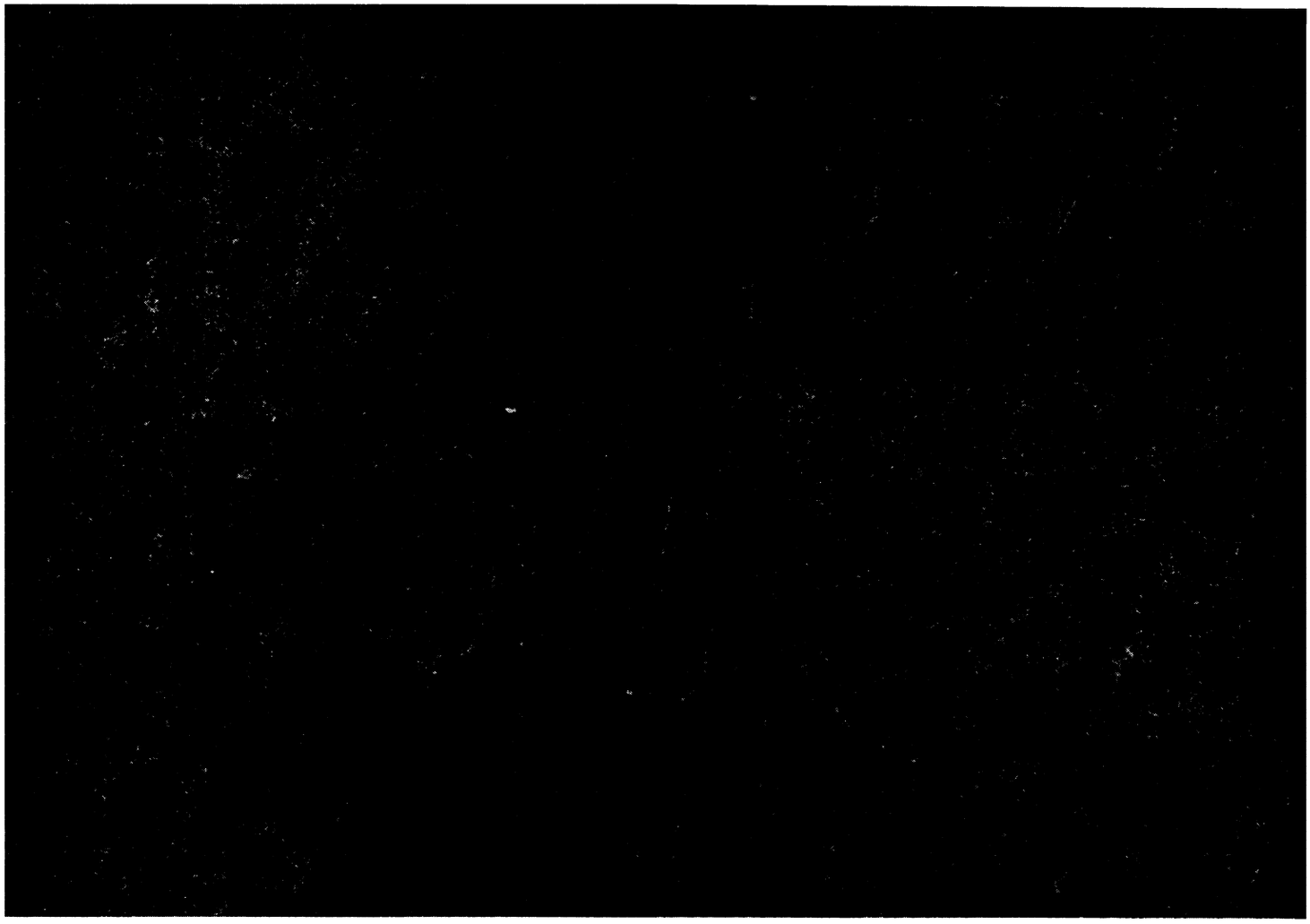

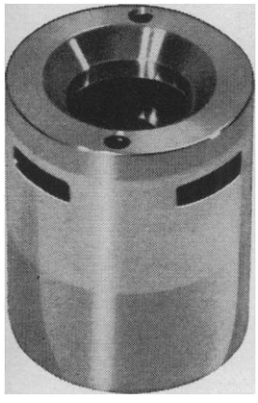

No. 1 in a Series:

ADVANCES IN ELECTRON MICROSCOPY

This is an objective lens pole piece for the Hitachi Perkin-Elmer HU-11A Electron Microscope. It represents the culmination of one half million scientist and engineer hours of research and development. It is one element in the remarkable imaging system of the HU-11A. The electron optics of this instrument are unmatched in performance and versatility. Introduced one year ago, the enormous potential of the HU-11A as a fundamental research tool is now being realized in nearly 100 laboratories throughout the world. Its guaranteed resolution is 7A.

The background electron micrograph on this page shows the (111) orientation of single crystal gold. The spacing of the vertical lines is 2.35A. It was taken by the tilted illumination method. The total magnification is 6,700,000.

This extraordinary micrograph was obtained with a standard Model HU-11A by an expert electron microscopist under controlled conditions at the Hitachi Central Research Laboratory in Kokubunji, Japan. It is by far the highest resolving power demonstrated to this time by any electron microscope.

Perkin-Elmer, as exclusive U.S. distributor, is proud to be associated with this milestone achievement in Electron Microscopy.

A print of this electron micrograph and complete information on the HU-11A can be obtained by writing to: The Perkin-Elmer Corporation, Distributor Products Department, 910 Main Avenue, Norwalk, Connecticut.

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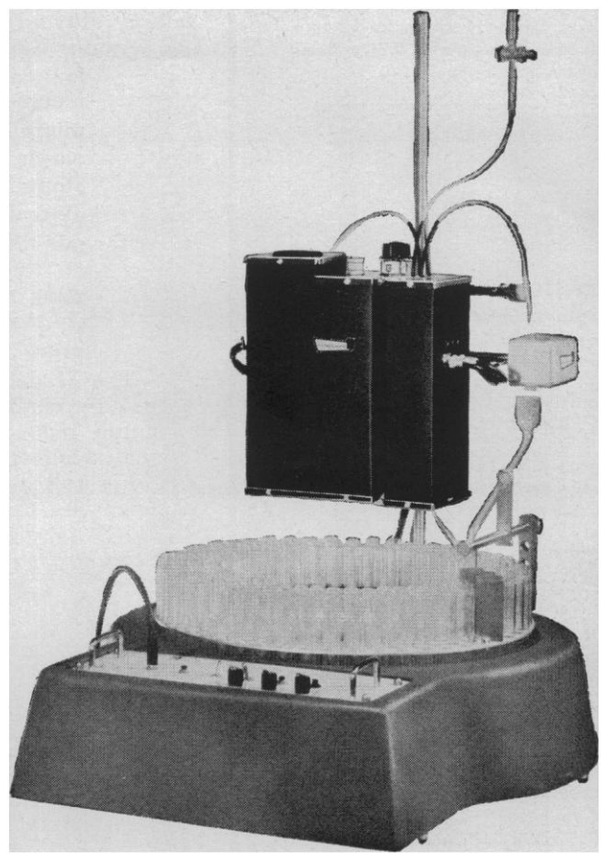
Now Vanguard introduces another innovation in instrumentation, offering the new model 1056-A, the most compact, space-saving, easy-to-operate UV Analyzer available today with variable wave length control. Monochrometer-coupled broad emission UV light source allows selection of any wave length from 200 to over 400 millimicrons with a turn of a dial. Dual-beam operation utilizing sample and reference cuvettes provides continuous base line compensation for gradient elutions and for other applications where the optical density of the eluent may change. The 1056-A operates with minimum supervision and is compatible with all fraction collectors. Automatic chart recorder marking system speeds location and identification of test tubes containing UV absorbing materials. Completely transistorized, for long, maintenance-free operation. Write for complete information.



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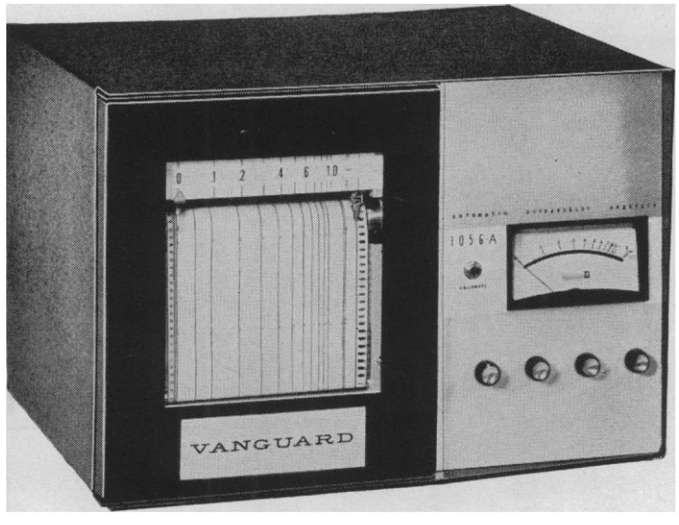

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new from F & M

model 180 carbon, hydrogen, nitrogen analyzer

The first commercial instrument capable of the rapid and simultaneous micro-determination of carbon, hydrogen and nitrogen in organic materials, the new F & M Model 180 is a significant advance in microchemical analysis. The Model 180 can be operated in any analytical laboratory by technicians possessing no special training in micro-analytical procedures. Accuracy and precision of results match or exceed those obtained by classical methods. Yet the Model 180 performs a complete microanalysis of C, H and N in less than 10 minutes.

The Model 180 is a highly specialized gas chromatograph every part and component of which was designed specifically for the job at hand, i. e. fast, accurate and reliable analysis of C, H and N.

Among the many outstanding features of the Model 180 are the following:

low cost of analysis . . . no special environment or highly trained technicians required

micro sample size . . . less than one milligram sample required

single sample for all three determinations

single weighing . . . no "weigh-in, weigh-out" procedure

extensive automation of analytical procedure

gas chromatographic determination of combustion products for fast, accurate and reliable results

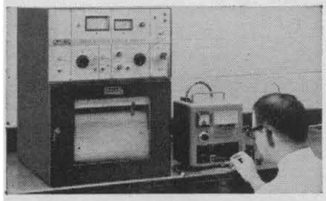
peak height readout and permanent record of analysis from strip chart recorder

price . . . approximately $4,000 including balance and recorder.

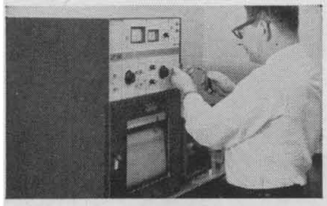
The Model 180 can handle solid or liquid materials and gas samples can also be analyzed with only minor instrument modifications. In addition, sulfur, halogens and nitriles will not adversely affect the accuracy of the analytical results.

For full information on the Model 180, write for Bulletin 1800. F & M Scientific Corporation, Route 41 and Starr Road, Avondale, Penna., 215-COlony 8-2281. *European subsidiary: F & M Scientific Europa N. V., Leidsestraat 67, Amsterdam, The Netherlands.*

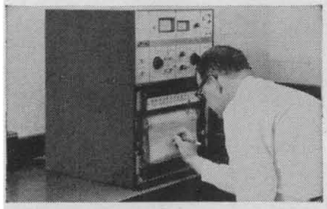
The Model 180 greatly simplifies the analytical procedure for the microdetermination of C, H and N. Here's how:



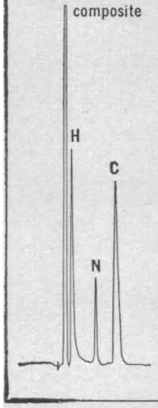
Using a low-capacity micro balance, the analyst weighs a 0.2 to 3 mg sample (solid or liquid) . . .



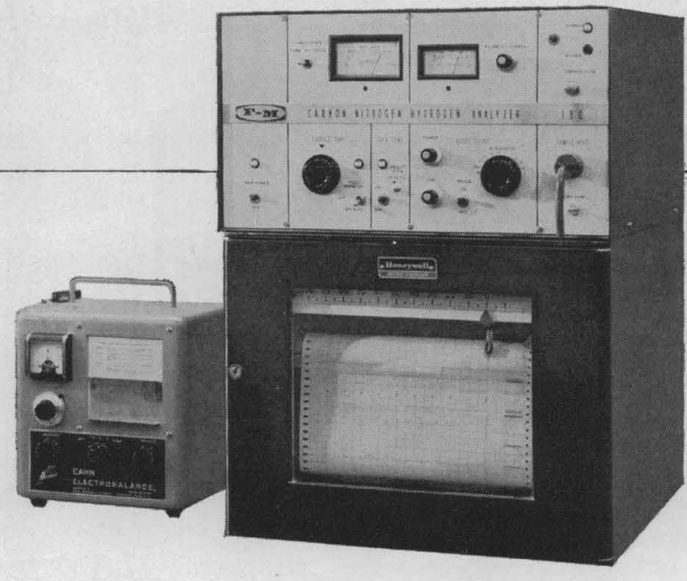
injects the sample into the instrument, purges the furnace by flipping a switch, further inserts the sample into the furnace. After 4 minutes . . .



the analyst introduces the products of combustion into the dual-column, dual-detector gas chromatograph, again by operating a switch. Soon, individual peaks appear on the recorder chart.



■ The first peak is the composite; the second is proportional to the amount of hydrogen in the sample; the third, to the amount of nitrogen; and the last to the amount of carbon. In each case, peak height readout yields quantitative results comparable to those obtained by classical methods.



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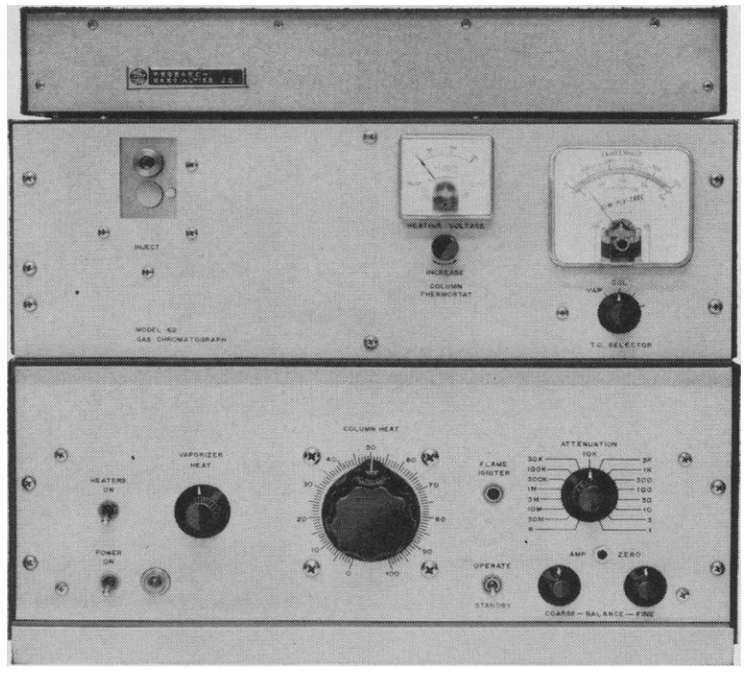
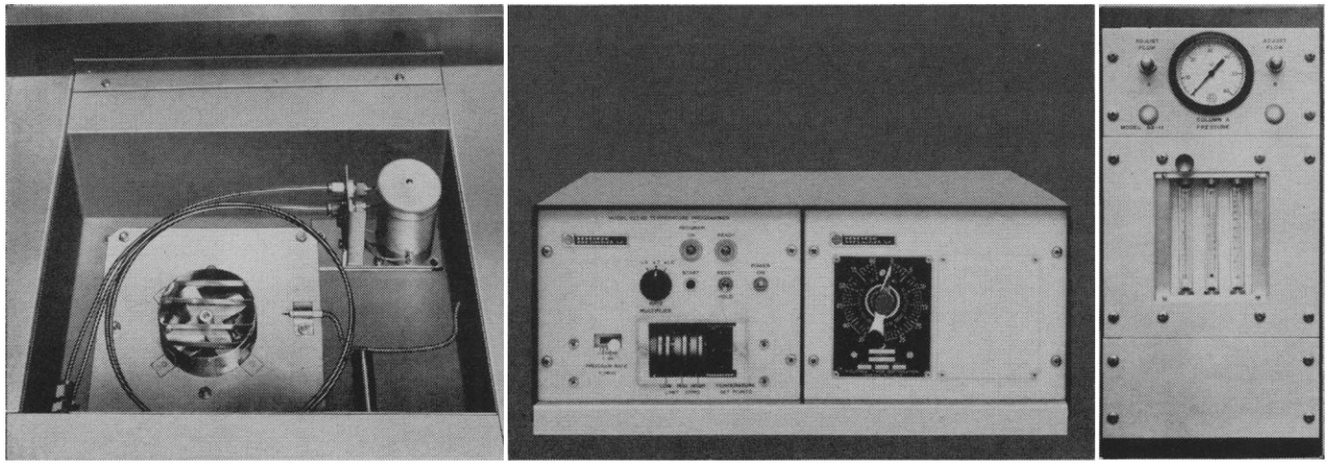


Here's a brand new low-priced gas chromatograph that gives you

single or dual flame operation, automatic programming, and more!



RSCo's new Model 62 is the only flame ionization gas chromatograph you can buy for $950. Add dual flame operation and automatic temperature programming and you have the most versatile, low-cost unit now available. The Model 62's wide range of accessories—separate detector ovens, sampling valves, input splitters, and flow meters—give it the versatility of a modular unit. □ Start with a basic model and add accessories as your needs expand. Good way to stretch a capital-expenditure budget? You bet. RSCo also makes the matchless 600 Series modular gas chromatography system. (It costs more, of course, but you can't buy a better one at any price.) Write us. We'd like to send you complete details.

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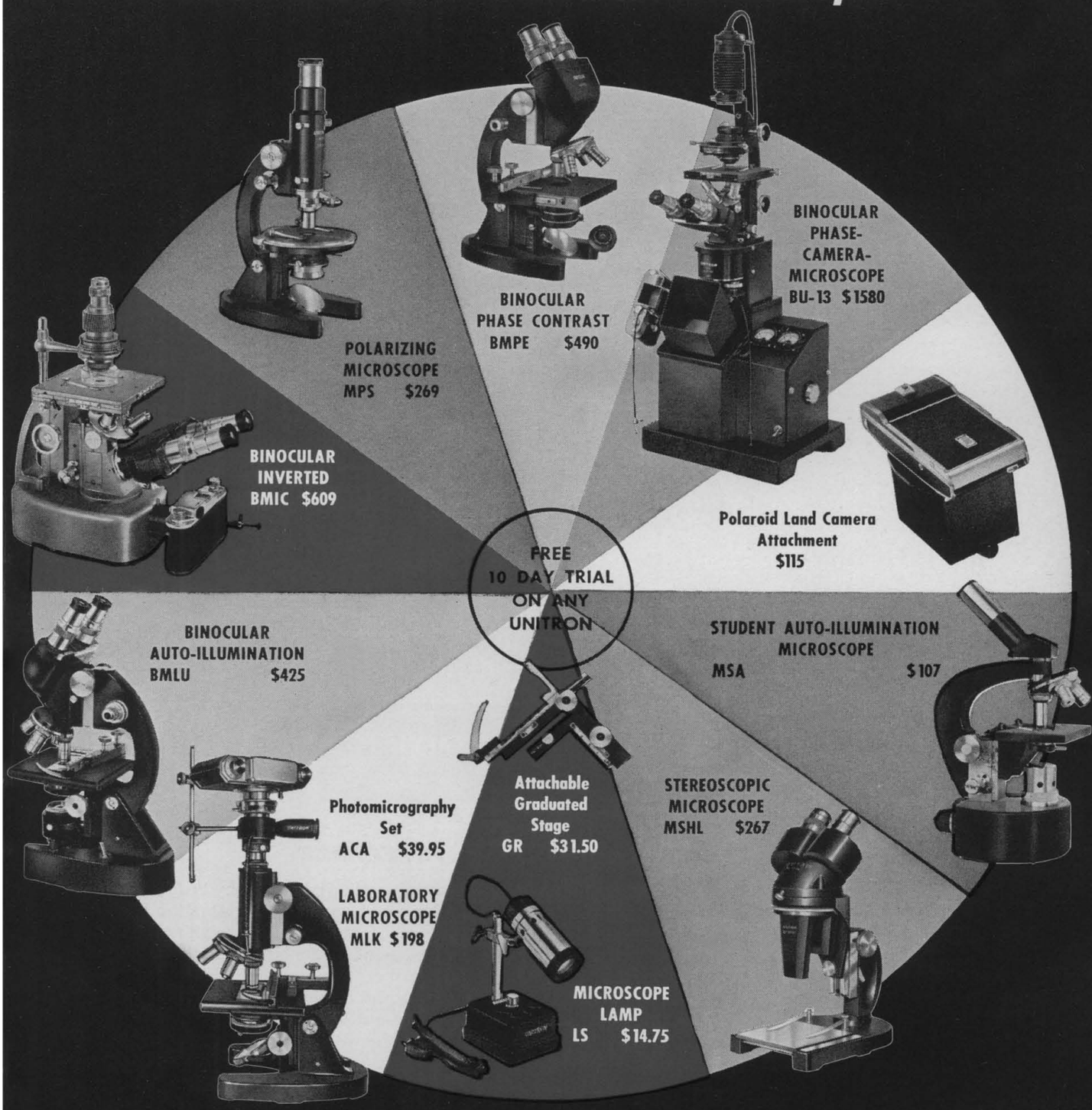

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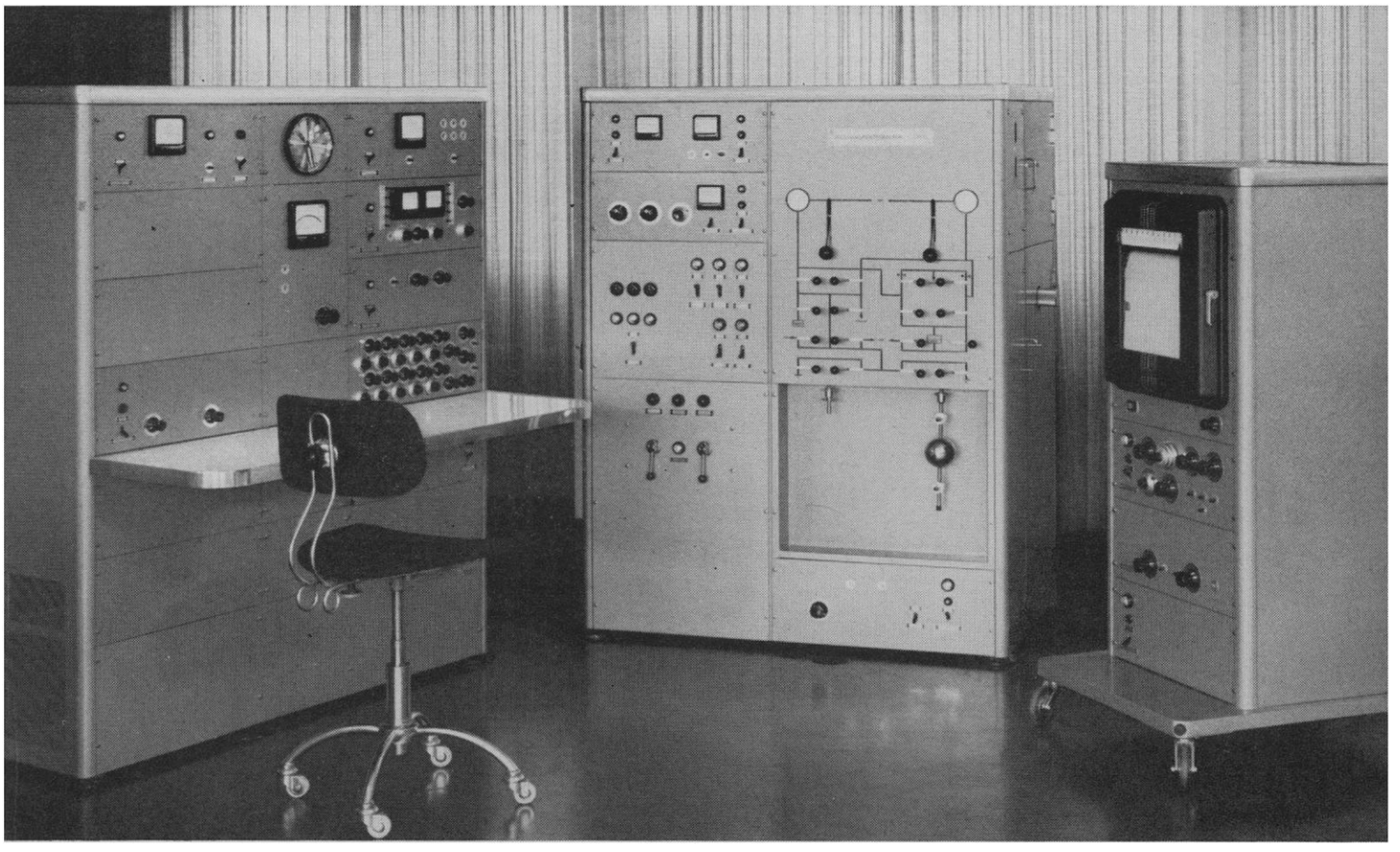

For data on the CH4 above, or other MAT instruments, send for Data File E 306-83

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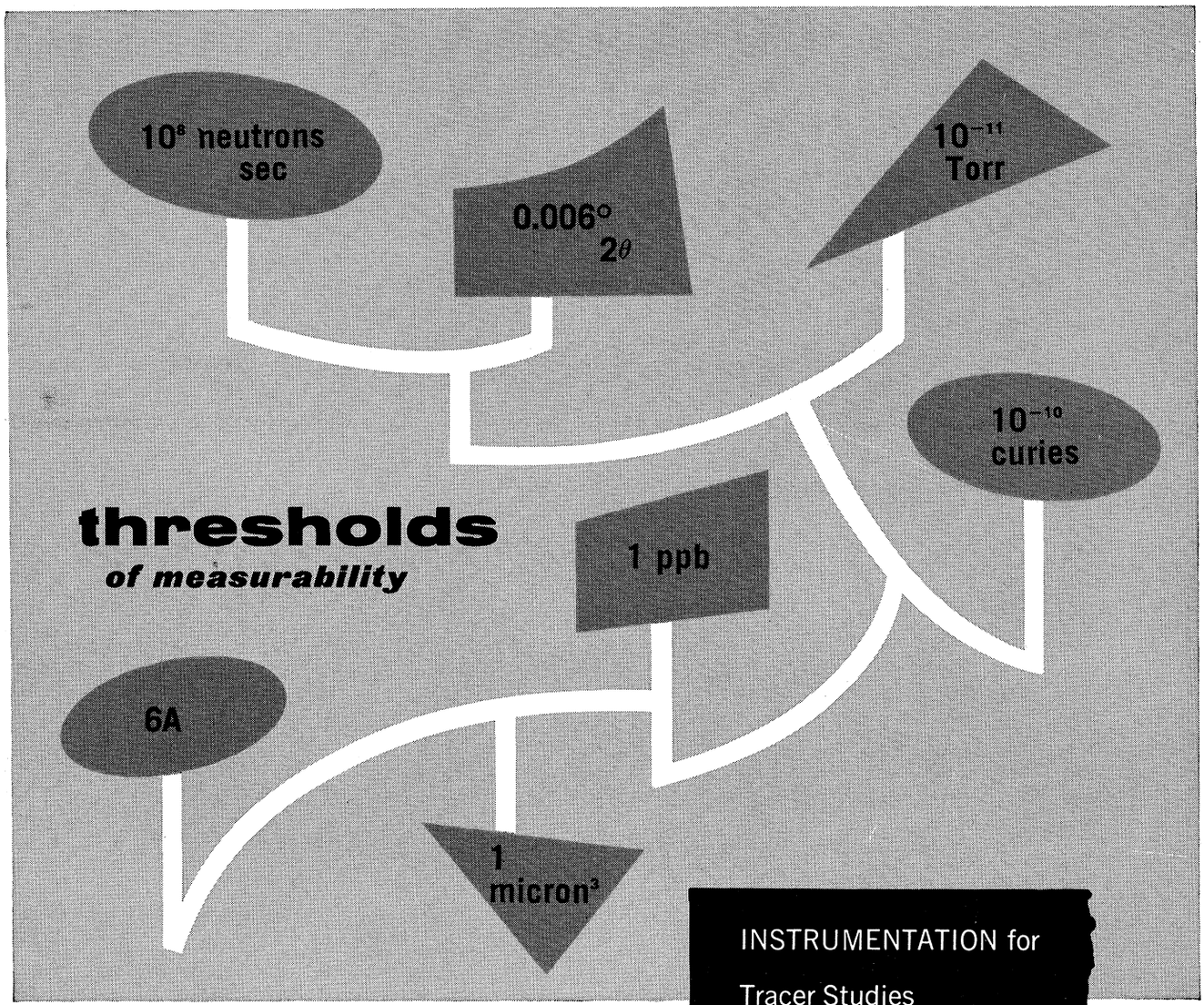

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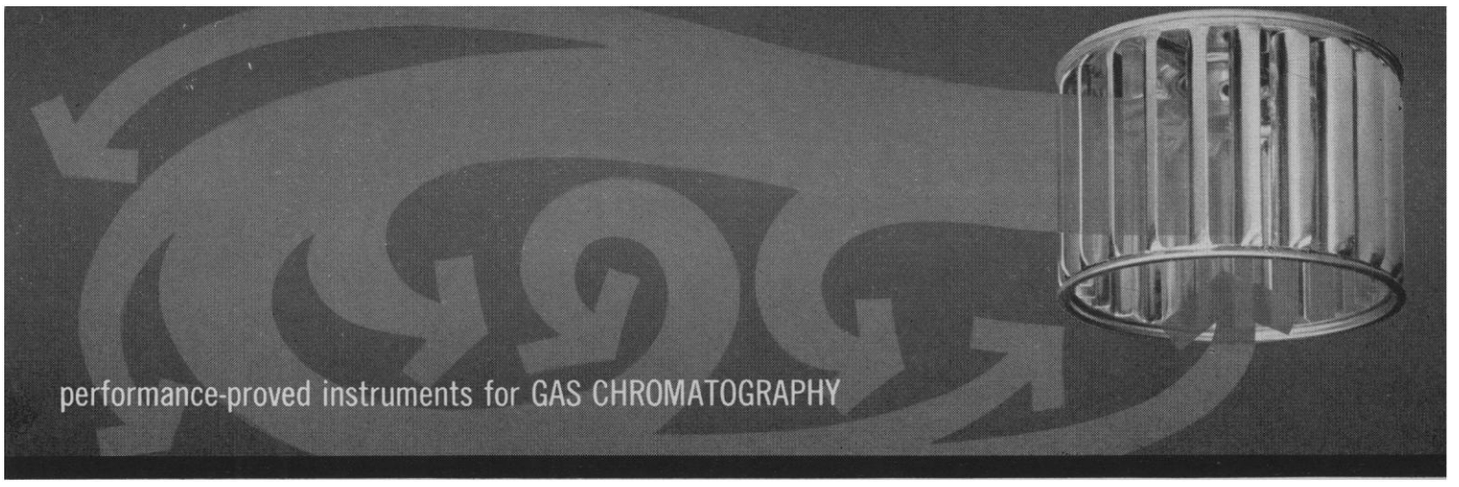

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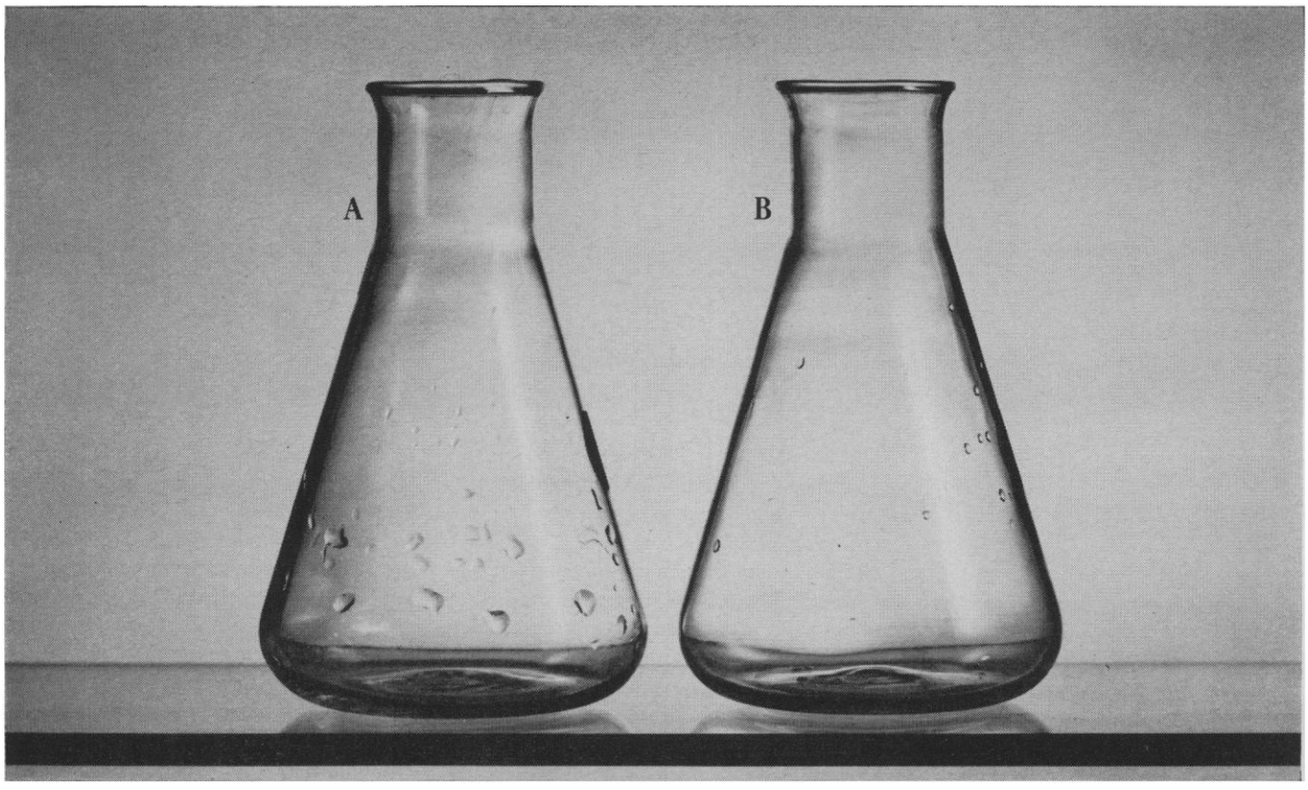

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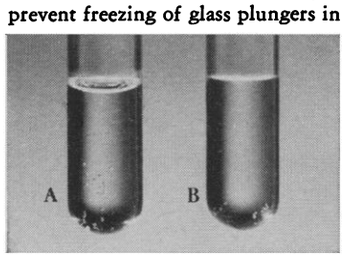

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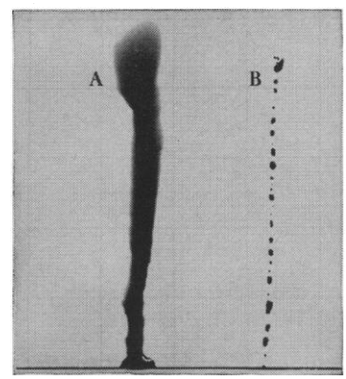

ACTUAL PHOTOGRAPH

Equal amounts of blood dropped simultaneously on glass plate at 90° angle.
A. Blood on untreated surface clings to glass, spreads slowly down glass, pools at bottom edge.
B. Blood on Siliclad-treated surface runs down glass plate immediately. Does not cling, stick, or pool at bottom edge of plate. Gentle tapping of glass plate removes few "beads" remaining.

References: (1) Levin, H. L.: Milit. Med. *121*:397 (Dec.) 1957. (2) Harkins, G. A.: J. Thoracic & Cardiovas. Surg. *40*:549 (Oct.) 1960. (3) Cantor, M. O.: Am. J. Surg. *100*:584 (Oct.) 1960.

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enlarged view of agglutinates being separated by decantation from the analytic stream. Reaction-produced agglutinated cells travel along with the stream: being heavier they drop to the bottom. On arriving at the "T" junction, the heavy agglutinates are drawn off: unreacted cells move on to hemolysis and colorimetry. Where hemolysis is to be measured the cells are decanted off and the hemolyzed material read out.

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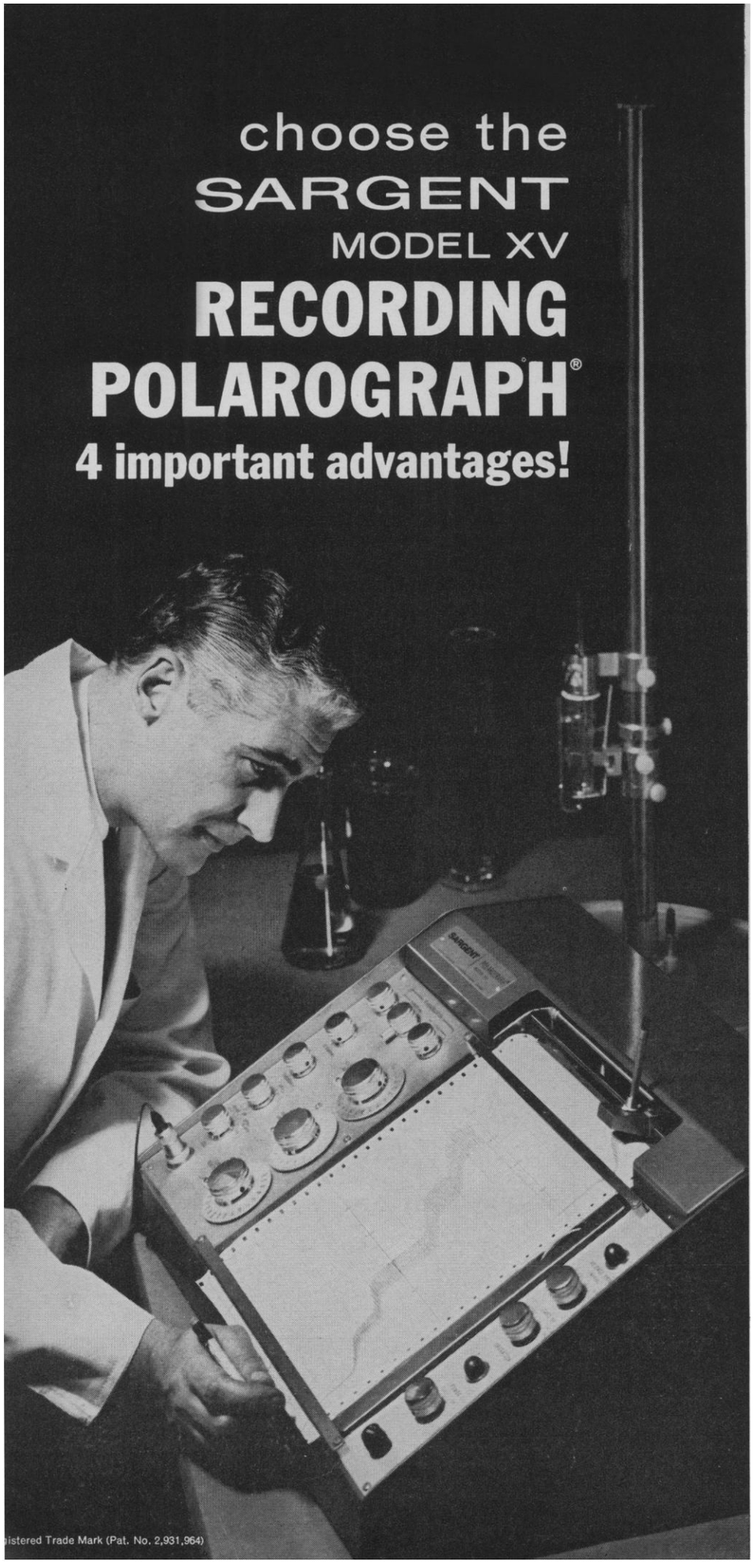

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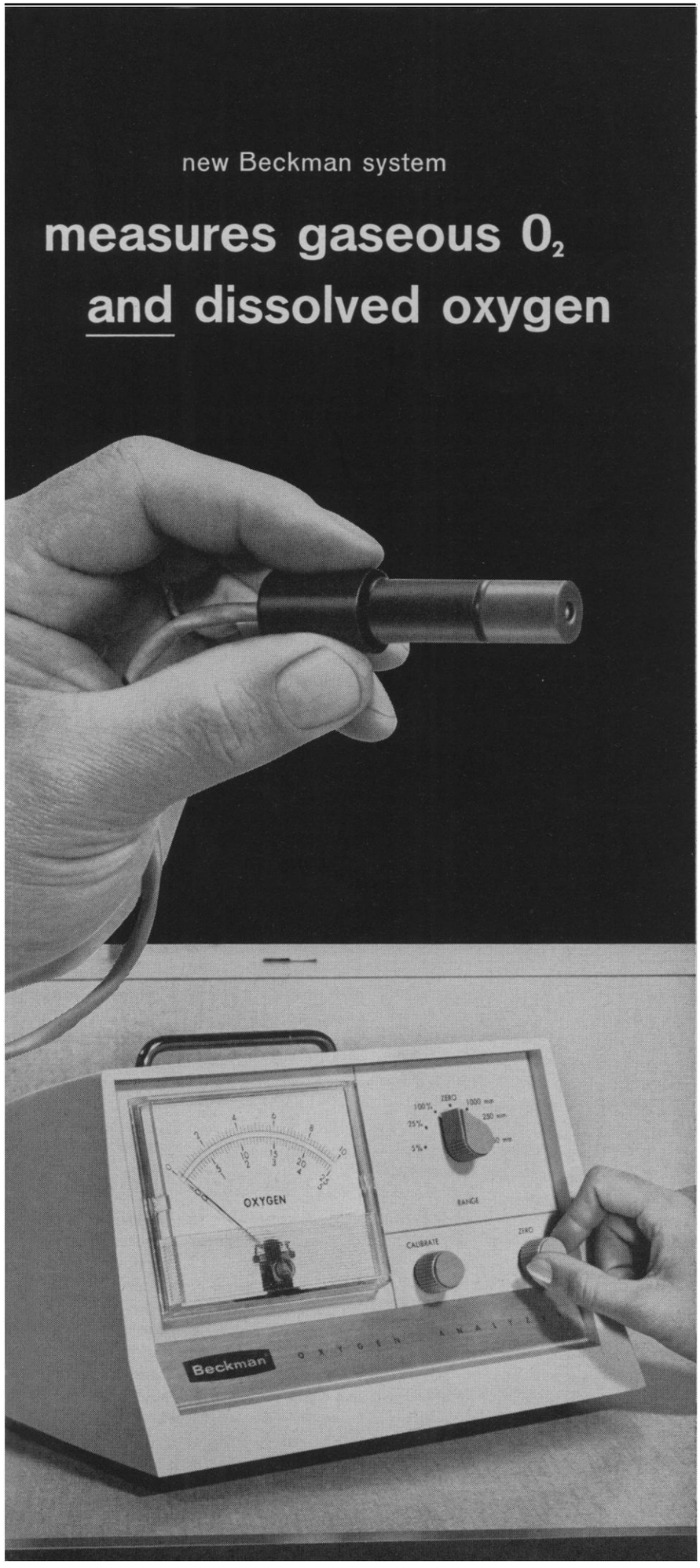
is a grant of monopoly, and the extension of copyright is an extension of monopoly. If a bill were now before Congress to extend patent protection from its present 17-year period by only 5 to 10 years, in order to "encourage and better reward the inventor," it would be quite apparent to all that the major beneficiaries would be large commercial interests, and that the public would suffer through higher prices and further extension of restrictive practices. Doesn't the same hold true for the monopolistic grant of copyright? In a hearing on the bill, the Department of Justice quite properly opposed this aspect of the bill, on the grounds that the bill was an extension of monopoly.

Unfortunately, the public is under the misapprehension that most copyrights are controlled by individual authors and composers who can be relied upon to do the right thing for the public (shades of the noble garret inventor!). This is not the case. By and large, copyrights are held and controlled by large music, book, and magazine publishers. Dominant forces such as Time-Life, Grolier, and Encyclopedia Britannica own and control the copyrights on everything they publish. Even when copyright is not owned by the publisher, it is usually controlled by him. Publishing is becoming bigger and more centralized. What we need now is legislation to slow down this trend. The public is not fully aware that a grant of copyright gives full and final control over material copyrighted. Since our law does not allow for compulsory licensing (as does the copyright law of many other countries), we grant this privilege to all copyright holders, not only in this country but in all other countries that are members of the International Copyright Convention. Isn't 56 years a long enough period for this privilege of unilateral restriction? Will it serve the national interest to further limit our use of foreign literature?

Censorship through copyright restriction is a common and serious problem. An unexpurgated English translation of *Mein Kampf* never appeared in the United States because the Hitler regime decided it would be better propaganda if Americans were given an abridged version, and American courts necessarily supported the Nazi position because the work was copyrighted. There have been, and there will be, other such cases. It is clearly against the public's interest to extend this



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privilege of censorial restriction beyond 56 years.

Copyright restriction can be a serious roadblock in scientific writing and research. Anyone who has attempted to obtain permission for reproducing work that is more than 30 years old knows how difficult and time-consuming it can be to locate the copyright holder, and how frequently the quest is unsuccessful. If scientists and educators are interested in disseminating knowledge, they certainly should not favor a law that makes such dissemination difficult, if not impossible.

Folsom presents a false picture of pricing methods in publishing—a not uncommon error of people who don't fully understand trade practice. Royalty is a cost which almost always increases the retail price by three times the amount of the royalty payable. If you take a book in the public domain that is usually priced at $2.25 and add a 10 percent royalty of 22½ cents per book, the retail price will have to be increased to $3, not to $2.50. This factor of 3 is necessary to take care of booksellers' discounts and overhead. In the same way, a saving of 25 cents in binding cost can lower the price of a book by $1.

Having a large body of literature in the public domain makes it possible to publish cheaper editions of this literature, and the availability of these cheap editions tends to limit the price for all books which are still protected by copyright. It is very difficult to price a paperback at $5 when others are available from 25 cents to $2. As the source of books in the public domain becomes smaller, the price of books protected by copyright will increase. There is no law or regulatory body which limits the pricing of copyrighted literature, even though the prices may be exorbitant and restrictive.

If the public is willing to pay considerably higher prices for thousands of books, records, and musical scores, it has the privilege of supporting the bill for copyright revision. However, I do object to statements that create the false impression that there will be little or no increase in price, and that these miniscule sums will aid hard-working, somewhat indigent authors. The increase in price will be substantial, and most of the money will go to a small group of publishers and authors who have already greatly profited from 56 years of copyright protection. I have never seen the present copyright law inflict a hardship on any long-lived author, and I challenge proponents of the bill to present more than an occasional and unusual case where it has done so. On the remote possibility that this legislation may benefit these very few individuals, isn't it rather foolish to support legislation that contributes to monopolistic growth, further limits the circulation of ideas, and asks the public to pay additional millions of dollars to private interests?

The bill for copyright revision may pass because, as in the case of so many special-interest bills, minority property interests are strongly represented and no one is speaking for the public—a public that does not realize that the proposed bill is not calling just for a longer copyright period for new works but is granting an additional 20 years for all works copyrighted during the past 56 years. Except for the Department of Justice and a very few private citizens such as myself, no one has made any effort to inform congressmen of the full implications of the bill. The bill can be defeated if there is some resistance to it by an informed citizenry. Congress does not generally give public property to private interests, but it may very well do so unless the public asserts its rights and indicates that it objects to this usurpation of public property. I hope that, as scientists and educators become aware of all the implications of the bill, they will speak out against it, and that Congress will then be less susceptible to the pressures and blandishments of the special-interest groups that are pressing for this unfortunate piece of legislation.

HAYWARD CIRKER

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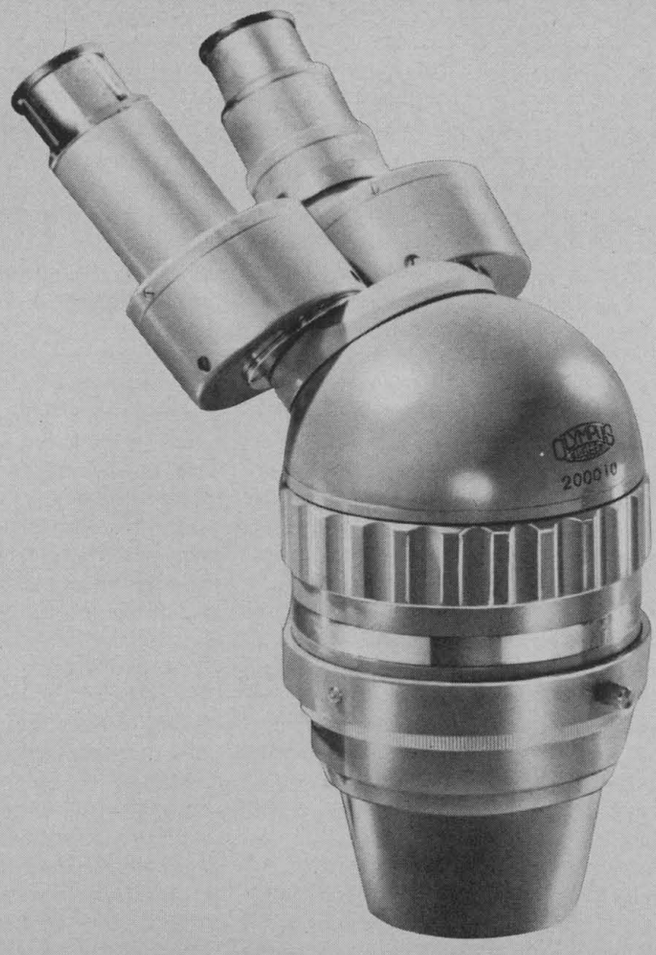
University Education and Applied Science

In approaching the subject of education in a university engineering department, I propose to take quite a broad view, for what I have to say is applicable to almost any university department and is not special to departments of engineering.

What is the objective of a university? As I see it, the preeminent objective of a university is developing students' minds: to take in good brains from high school and make them work as well as possible.



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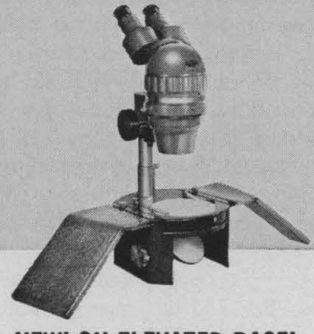

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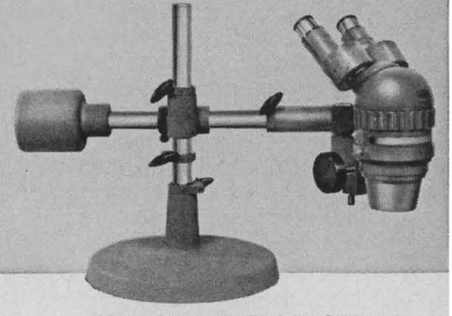

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What is the objective of a particular department of a university? A particular department is concerned with a particular field of knowledge, but the department is nevertheless pursuing the common university objective: to exploit the potentialities of a particular field of knowledge for the purpose of developing students' minds as well as possible. Notice that the objective has nothing directly to do with training the students for a particular job.

What is the objective of a particular university engineering department, such as the department of electrical engineering? It is not to train students for a particular job. It is to develop the students' minds. Thus, the objective of an electrical engineering department is to exploit the potentialities of electrical engineering for the purpose of developing students' minds as fully as possible. Notice that electrical engineering is only the means whereby this can be done.

Unfortunately, there are people in engineering departments, both faculty and students, who do not distinguish clearly between the means and the objective of the educational process in which they are involved. For example, it is not uncommon for someone in an engineering department to recommend a particular professional specialty in the following words: "Students should not graduate in such-and-such engineering from this university without knowing so-and-so."

Such an individual can usually be tagged as a man who has allowed a misguided loyalty to the profession of engineering to supersede his loyalty to the profession of education—a man who talks about the means available for the educational process as though they were themselves the objective of the educational process; a man who has forgotten that, even in an engineering department, the objective of the operation is mental development.

Many people in engineering departments have had the experience at some time or other of being looked down upon by someone in the humanities as a person involved in an inferior brand of intellectual activity. While there is no foundation for the assumed intellectual superiority of the humanist, it is nevertheless true that he does have a significant point. Put yourself in the position of a man engaged in teaching the classics. What does a professor of the classics regard as the objective of the educational process in which he is engaged? The classics professor is in the fortunate position of being almost unable to conceive any primary educational objective other than that of developing students' minds. He cannot be trapped into imagining that he is training "classicists" for industry! But he notices that many engineering educators do fall into just this type of trap, and he likes to poke fun at the consequences. However, it is not intellectual superiority that keeps the classics professor straight about educational objectives!

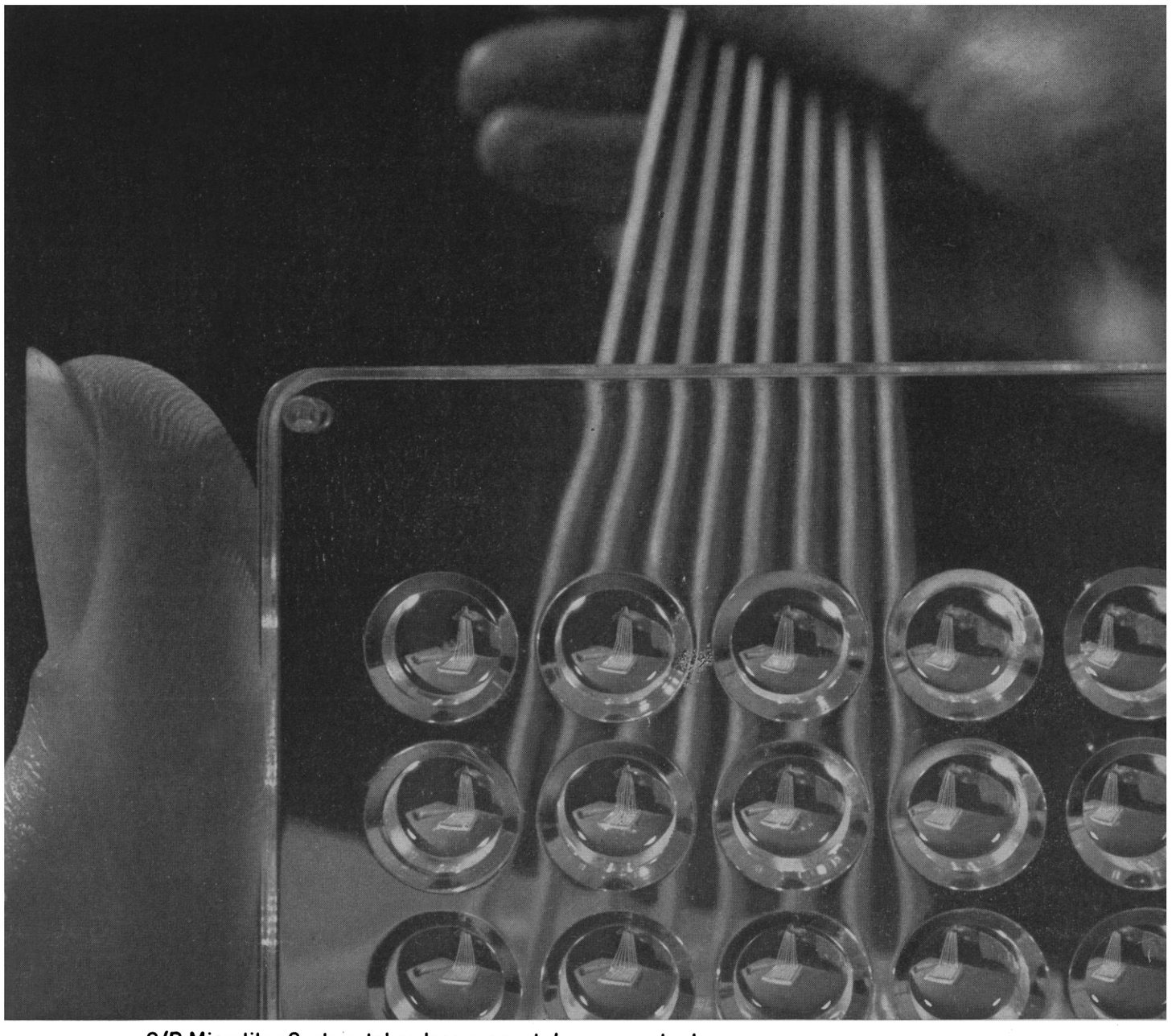
It is true that many students who have had their minds developed by mastering the physical concepts and mental skills upon which, say, the electrical engineering industry is based find it appropriate to pursue a subsequent career in electrical engineering. Unlike many university departments, engineering departments are aware of the probable future career of their students, at least on a short-term basis. Awareness of the probable future career of a student is, however, no basis for making a change in the fundamental objective of the educational process.

Most of the statements I have made concerning the objectives of the educational process are true for all university departments, and the same is true for most of the statements still to be made. Let us now begin to distinguish between the objectives of undergraduate and graduate education.

What is the objective of undergraduate education? Its characteristic feature is that it is principally concerned with what is well known. Its objective therefore, is to develop students' minds as fully as possible by having them study what is well known.

There is a common fallacy that brings out quite well the confusion between means and objectives in engineering education. The fallacy pertains to the exponential increase in knowledge. It is argued that students must be taught more now than they were 50 years ago, and that they will have to be taught much more 50 years from now. The fallacy is immediately seen as soon as we remember that the objective is mental development. Students' minds today are the same as they were 50 years ago, and they will be the same 50 years from now. What the exponential increase in knowledge does is this: it gives universities more material from which to choose in producing the same degree of mental development. Even this is less true than is sometimes supposed, because the advancing front of knowl-

(Continued on page 575)



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9 August 1963, Volume 141, Number 3580 **SCIENCE**

Seven Years of Progress

The tenure of Graham Phillips DuShane as editor of *Science* (1956–1962) was characterized by important innovations and by strong growth of the journal. Comparison of an issue from 1955 with one of the spring of 1962 tells the story. Earlier issues typically consisted of 40 or 48 pages. Content was of narrow interest. General appearance was not very attractive. There was little advertising, and the circulation totaled only 32,000, in contrast to a present-day total of 89,000. Some of the major departments were similar in name to those of 1962, but the content of all was changed for the better during DuShane's regime. When he became editor, the AAAS published two journals, *Science* and the *Scientific Monthly*, and members ordinarily received one of the two. This split the possible circulation, and the result was two only moderately good periodicals. With limited distribution, neither journal was an attractive advertising medium and neither could charge rates sufficient to bring in substantial revenue. Support for the magazines came largely from members' dues. Thus, limited funds were available for staff and additional editorial content.

The key to a drastic improvement was to combine the *Scientific Monthly* and *Science*. This possibility had already been advanced in a preliminary way by Dael Wolfle, executive officer of the AAAS. When DuShane became editor, he quickly saw the potential advantages of the merger and joined in advocating it. To effect the change required vision and courage, however, for no one could predict with certainty the outcome. The readers of the *Scientific Monthly* were loyal to the publication, and fears were expressed that many members might resign from AAAS if a merger were to occur. Working effectively together, Wolfle and DuShane considered all aspects of the matter and presented an effective case. The decision-making process was handled with such skill that the combination was effected with minimum dissension among Board, Council, and membership. The merger occurred in January 1958, and by the end of that year *Science* had a total circulation of 61,000. DuShane was alert to exploit the opportunities created by the new combination. When he left in July 1962 to become dean of graduate sciences at Vanderbilt University, *Science* had been changed and its status in the scientific community had been substantially altered for the better. Improvements in content and appearance had been well received. Circulation had risen to 76,000. Advertising revenue had become sufficient to provide for adequate staff and increased editorial content.

Perhaps the most significant innovation was the establishment of a News and Comment section. Staff reporters were assigned to cover all facets of the interaction of government with science and education. At a time when funds for research and development were beginning to constitute a substantial fraction of the federal budget, such news was important. Yet the material was covered inadequately in the metropolitan newspapers and almost not at all in other dailies. Many scientists came to consider *Science* much the best source of information concerning what was happening in Washington. This kind of news was of interest to all branches of learning and provided important topics for group discussion.

Graham DuShane has left us, but his contributions remain to affect the development of science and the community of scholars for a long time to come.—P.H.A.

TMC multiple-purpose 4096-Channel pulse analyzer systems

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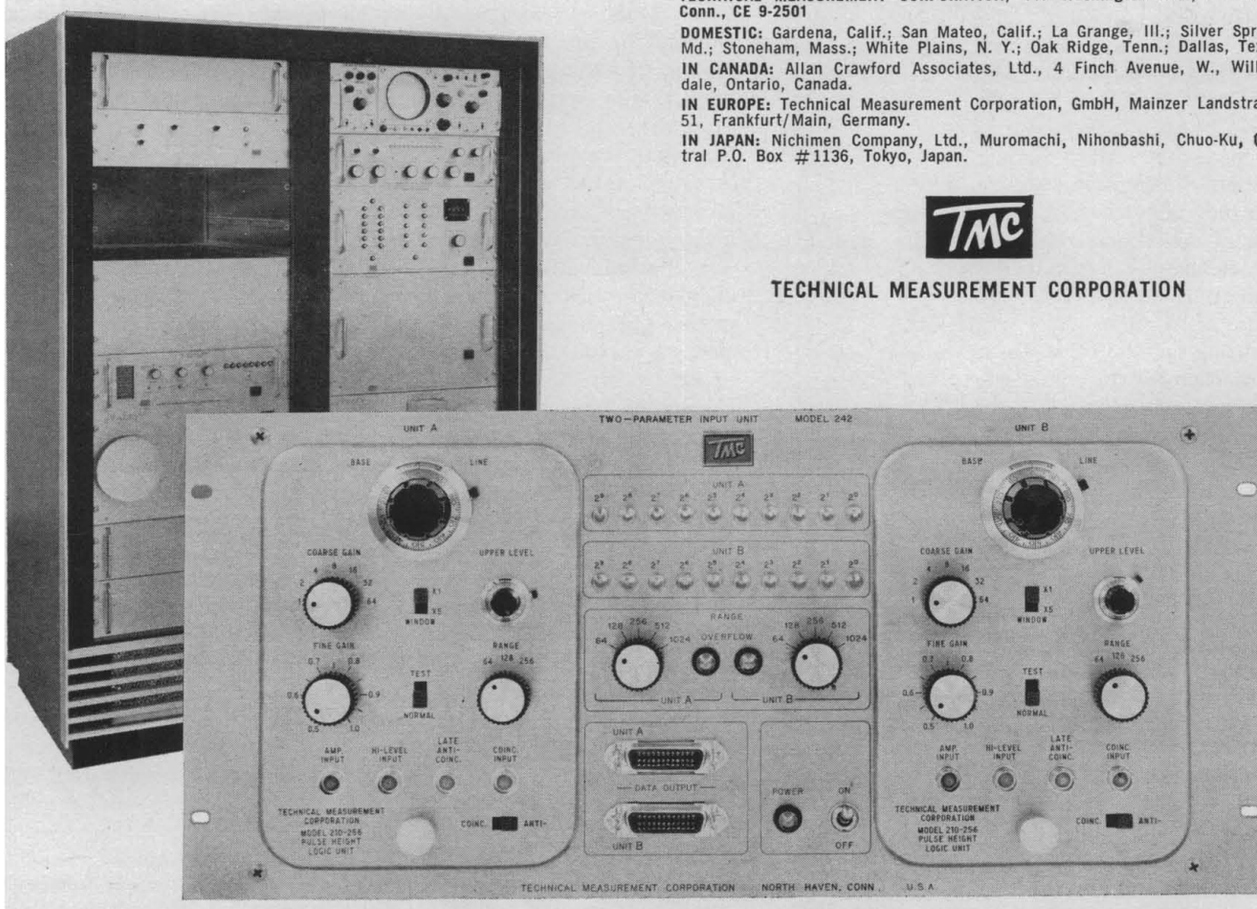

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phate bonds so that these are not produced. The cessation of flow of electrons in the high-energy phosphate system removes the normal feedback mechanism which controls the rate at which mitochondria utilize oxygen.

R. A. Cowley cited a publication which suggested that the ability of animals to survive shock was improved by the intravenous administration of mitochondria. This theory was received with interest and great skepticism.

Observations were made by G. G. Nahas on two groups of dogs which were bled to mean pressures of 50 mm of mercury and reinfused after 2½ hours. All animals breathed 100 percent oxygen by nasal catheter. The first group of 36 animals received an intravenous infusion of a buffer; the second group received an equal volume of isotonic salt solution. All animals secreted catecholamines, mainly epinephrine, during the period of hypotension and oligemia. The levels of catecholamines were nearly at control values 30 minutes after normovolemia had been reestablished. The animals that received salt solution instead of buffer secreted about twice the amount of catecholamines as those that did receive buffer. Only 37 percent of the control animals survived, while 70 percent of those receiving buffer survived. Administration of oxygen alone or of buffer alone did not improve the survival rate. These observations led to a discussion of the interrelationships among acidosis, the catecholamines, and oxidative metabolism.

The decrease in work performed by the heart while oxygen utilization is maintained near control levels results in lowered efficiency (D. B. Hackel). During oligemia and hypotension, about 20 percent of the cardiac output goes to the heart, as compared with the 4 or 5 percent under normal conditions. The normal myocardial pyruvate extraction is decreased during shock, and in severe shock the myocardium may actually contribute pyruvate to the blood flowing through it. "Excess lactate," as described by Huckabee for other organs, is not produced by the myocardium in shock.

There is some evidence that enzyme systems in the myocardium may become irreversibly changed or depleted after prolonged shock. Thus, if oligemia is corrected by transfusion within an hour after bleeding, extraction of myocardial pyruvate, lactate, and oxygen return to normal. But if the oligemia and hypotension are not

corrected until after 3 hours, the oxygen extraction is depressed to levels significantly below normal and the abnormalities in pyruvate and lactate extractions are no longer reversed by transfusion.

In hemorrhagic shock, tissues appear unable to phosphorylate thiamine and are low in cocarboxylase content. Myocardial metabolism of dogs deficient in thiamine resembles that of dogs in hemorrhagic shock. The administration of thiamine and cocarboxylase to dogs in hemorrhagic shock had no effect. According to F. A. Lipmann, although there may be a cocarboxylase deficiency in shock since ATP is needed to form thiamine pyrophosphate (cocarboxylase), cocarboxylase would not be expected to enter the cells.

Injury results in a rapid drop in the plasma level of ascorbic acid, its urinary excretion, and its "tissue saturation." Studies of wound healing in the experimental animal reveal that this biochemical scurvy indicates physiologic scurvy (S. M. Levenson).

As part of a series of experiments designed to determine the mechanisms of these changes, tests were performed to determine whether the microflora normally present in healthy animals influences ascorbic acid metabolism. For this, the response of germ-free and of normal guinea pigs to a scorbutigenic diet was followed. The germ-free guinea pig does develop scurvy, but at a much lower rate than in guinea pigs harboring the normal microflora. It is postulated that this is the result of utilization of ascorbic acid by the intestinal flora, a process which cannot occur in the germ-free guinea pig. Supporting evidence for this is provided by finding a more rapid decline of tissue ascorbic acid levels in the normal guinea pigs on a scorbutigenic diet than in their germ-free counterparts. The increased "requirement" for ascorbic acid brought about by serious clinical infections may be due in part to destruction of the vitamin by bacteria in the infected area. However, the increased "requirement" is more likely due to increased "utilization" (details not known) of ascorbic acid by the host as part of the overall metabolic response to serious infection, which is similar to that which follows severe injury.

The observations that the administration of vitamin C can influence the lethality of hemorrhagic shock were viewed with skepticism.

Levenson also noted that severe prolonged shock in animals is accompanied by an increase in the concentration of "total amino acids" in the plasma. This was not found in examinations of the blood of casualties during the Korean conflict when the individual amino acids were measured. This relative constancy of the concentration of total plasma amino acids was not the result of unvarying concentrations of the individual amino acids; some of these rose, while others fell or remained unchanged. The fluctuations in concentration of any of the amino acids were minimal in comparison with the changes of the other nonprotein nitrogen substances; the physiologic basis or consequence of the amino acid changes are not known.

A striking finding in patients who have been injured is an increase in what Levenson, Howard, and Rosen called "amino conjugates." This was found especially among those casualties with renal failure. The conjugate fraction increases remarkably in the plasma of such patients, and while normally it is composed of threonine, glutamic acid, and glycine, it contains a greater variety of amino acids after trauma. The exact nature, function, and significance of these compounds are not known; investigations of these problems should be fruitful.

On the assumption that "irreversible" shock produces decreased tissue perfusion and decreased utilization of oxygen, the employment of hypothermia is reasonable in so far as it would be expected to decrease the requirement for oxygen. R. A. Cowley reported encouraging results in man from the use of hypothermia in "septic" shock provided the body temperature was not brought below 32° C. In experimental septic shock in the dog, hypothermia did not improve survival, but prolonged the survival time from 3 to 4 hours to 10 or 18 hours.

W. R. Drucker noted that hemorrhagic shock causes a marked elevation in the blood concentrations of glucose, pyruvic and lactic acids, and serum inorganic phosphorus. These alterations are characteristic of anoxia and persist with increasing severity until the animal dies. If, however, the withdrawn blood is reinfused there is a rapid and progressive decline in the concentrations of these compounds, more than can be explained by dilution from the transfused blood. In those

animals that have a transient recovery of their mean arterial blood pressure and subsequently die in so-called normovolemic "irreversible" shock, there is no secondary rise in the concentrations of glucose, pyruvic and lactic acids, and inorganic phosphorus, concurrent with the terminal fall of blood pressure. Also the ratio of lactic to pyruvate, which is markedly elevated during hypovolemic hypotension and which declines following transfusion, does not rise again as the animal dies despite a prolonged period of hypotension prior to death. But if a hemorrhage is produced during the terminal phase of "normovolemic hypotension," all of the metabolic alterations characteristic of the initial period of hemorrhagic hypotension will reoccur.

These observations suggested that it is the decreased blood volume rather than the hypotension which reduces tissue perfusion with consequent anoxia and metabolic acidosis. Accordingly, it was postulated that any reduction in oxygen requirement during hypovolemia should lessen the severity of metabolic alteration and possibly promote an improved tolerance for hypovolemia.

To test this hypothesis, a series of animals were subjected to hypothermia at 30°C prior to hemorrhage. Preliminary studies had indicated that hypothermia of this order, produced in normovolemic dogs, caused a significant reduction in oxygen consumption with no metabolic acidosis. Thus, the reduction in oxygen consumption reflected a decrease in tissue need for oxygen rather than faulty oxygen transport. Hypothermia did promote the survival of animals subjected to hemorrhagic hypotension. The relation between this effect of hypothermia and the role of adrenal steroids, catecholamines, endotoxin, and other factors requires clarification.

This workshop was the 48th meeting of the Committee on Shock, Division of Medical Sciences, National Research Council. It was supported by the Department of Defense. Participants included F. A. Simeone (chairman), R. A. Cowley, W. R. Drucker, F. L. Engel, D. B. Hackel, W. E. Huckabee, J. M. Kinney, S. M. Levenson, F. A. Lipmann, G. G. Nahas, J. G. Strawitz, and M. G. Weidner.

F. A. SIMEONE

National Academy of Sciences–National Reseach Council, Washington 25, D.C.

Immunologic Phenomena: Cold-Blooded Vertebrates

The symposium on immunologic phenomena in cold-blooded vertebrates, held at the recent meeting of the Federation of the American Society for Experimental Microbiology, April 1963, included both reviews and new information on the behavior of fishes, amphibians, and reptiles. The major emphasis was centered on immunological comparisons and regulatory or reaction-controlling factors with references to phylogenetic development.

E. Edward Evans (University of Alabama Medical Center) described his long-range study on the antibody synthesis in reptiles and amphibians. Since the lower vertebrates are poikilothermic, the immune response is greatly influenced by ambient temperature. The reptiles *Sauromalus obesus* and *Dipsosauraus dorsalis* produced a good antibody response to the antigen *Salmonella typhosa* H at 35°C, but at 40°C titers were somewhat lower and not all animals survived. In groups maintained at 25°C, serum titers were very low or not detectable. The marine toad (*Bufo marinus*) responded well at 25° or 35°C, but not at 15°C.

Although the animals immunized at sub-optimal temperatures produced little or no detectable antibody, they acquired the potential for antibody synthesis and when warmed to an optimal temperature they produced antibodies without further immunization. Both synthesis and release of antibodies were inhibited at the sub-optimal temperatures used.

Antibody formation in response to injections of soluble proteins, such as bovine serum albumin and rabbit gamma globulin, was demonstrated by precipitation tests in fluid media or by immunodiffusion in agar. Through the use of fluorescein-labeled anti-bovine serum albumin, antibody-forming cells were shown within the spleen, liver, and kidney of *B. marinus* and the spleen and liver of *D. dorsalis*. These cells resembled plasmablasts. Parallel sections stained with methyl green-pyronin confirmed the presence of plasma cells and their increase in number during immunization.

Studies of antisera from *B. marinus*, *D. dorsalis*, and *S. obesus* by paper electrophoresis revealed that antibodies were located in the slowest migrating component at *p*H 8.6. Although electrophoretic patterns of these species may be quite different from those of

mammals, the fraction containing antibody seems to be analogous to γ-globulin of higher forms with respect to electrophoretic mobility. Immunoelectrophoretic patterns of antisera from reptiles and amphibians contain multiple lines resembling those seen with mammalian sera. Antibody activity appears to be associated with lines comparable to the 7*S* and 19*S* γ-globulins of man.

The critical role of temperature was also one of the major issues discussed by W. H. Hildemann (UCLA) in his paper entitled "Immunogenesis of homograft reactions in fishes and amphibians," co-authored by E. L. Cooper. The profound temperature effect on the rejection rates of skin homografts in goldfish was clearly illustrated in experiments at temperatures of 10°C and 25°C. At the lower temperature the median survival times for the first and second sets were 40.5 and 19.5 days, respectively, while at the higher temperatures the corresponding values were only 7.2 and 4.7 days. The authors studied the kinetics of this reaction as a function of temperature. They calculated the Q_{10} quotients over several temperature ranges and noted that the Q_{10} values decreased markedly with the increase in temperatures, that is, 20°C:10°C to 32°C:22°C. Furthermore, activation energies obtained from the Arrhenius equation were found to be 11 kcal/mole for 32°C:22°C and 23 kcal/mole for 20°C:10°C. The conclusion was that the Q_{10} and activation energy values decreased with increase in temperature for both 1st and 2nd set homografts. At lower temperatures the rejection process was reduced. The anamnestic responses to the second set grafts were less affected by temperature. Although homograft survival was greatly prolonged at 10°C, immunization occurred within 7 days. Transfer of the homografted hosts to a temperature of 25°C brought about acceleration in the completion of the rejection phenomenon. In the interpretation of these observations Hildemann stressed the need for consideration of factors other than the immune reaction which contributed to the rejection process. These factors include inflammation and wound healing, both of which are influenced by temperature.

X-irradiation prolonged survival of homografts in a teleost fish (*Fundulus heteroclitus*). At 28°C this fish would reject homografts after 3 to 4 days. Radiation at 500 roentgens was without significant effect, but at 1000 to 3000 r transplant survival was extended. Homografts were also enhanced in the fish by the injection of Cycloheximide (Acti-dione) and Stylomycin (Puromycin). While several nucleic acid analogues and steroids prolonged the survival time of the grafts, they also produced toxic effects. Methyl bis-(β chloroethyl)-amine (Mustargen) and triethylene melamine were also effective, but the highest effectiveness in suppressing the rejection mechanism was obtained with A-methopterin (Methotrexate) and aminopterin.

In studies of the development and maturation of the lymphomyeloid systems, bull frogs served as the most useful animal because they have a prolonged period of larval development associated with slow acquisition of immunologic competence. All types of definitive leukocytes other than small lymphocytes could be demonstrated during the period when larvae could still be made completely tolerant to homograft. Small lymphocytes increased about tenfold and mature eosinophils three to fourfold during the critical period of 40 to 50 days of age. It is at this time of development that the transition from homograft tolerance to the immune type of response occurs at 25°C. Among the most recent findings were some observations relevant to the role of the thymus of bullfrogs. The results indicated that thymus was not crucial to the immunologic competence of larvae during most of the period preceding the adult stage. However, the growth rate in thymectomized larvae decreased regularly, thus suggesting that the vertebrate thymus may have at least two distinct developmental roles; one may promote growth and one may govern lymphopoiesis.

L. W. Clem and M. Michael Sigel of the University of Miami School of Medicine and the Variety Children's Research Foundation reported on comparative immunochemical and immunological reactions in marine fishes with soluble, viral, and bacterial antigens. In order to obtain basic knowledge about the immune mechanism and immunological responsiveness of marine vertebrates, the authors used the lemon shark (*Negaparion brevirostris*) and the margate (*Haemulon albium*) to represent the elasmobranchs and teleosts, respectively. The subcutaneous inoculation of PR8 influenza virus into sharks caused a significant production of hemagglutination-inhibition antibodies, the levels of which, at times, exceeded those found in land animals. When tested against a variety of other

myxoviruses, the shark anti-PR8 sera displayed a high degree of specificity. The sharks responded poorly to poliovirus; only one of three animals produced an adequate amount of neutralizing antibodies and in this instance the shark had been given combined injections of poliovirus and influenza virus. After the injection of bovine serum albumin there was a relatively small induction of antibodies as shown by the agglutination of red blood cells treated with tannic acid and coated with bovine serum albumin; such antibodies were not detectable in the agar diffusion precipitation test. The immunization with polio and the bovine serum albumin antigen were carried out by the intraperitoneal route which was shown subsequently to be considerably less effective than the subcutaneous route for immunization with influenza virus. Therefore, it is possible that the lack of response was due to the suboptimal route of immunization.

The margates produced antibody to influenza, *Salmonella*, and bovine serum albumin antigens; the latter was detectable by the Ouchterlony technique. The response to influenza antigen was of lower magnitude than observed in the sharks and the degree of specificity was below that of the shark. While no complement-fixing activity could be detected in the sera of either group of animals, significant neutralizing activities were found. The antibody of fish was found to possess several physicochemical properties similar to those described for mammals. Immunochemical investigations of the serum protein showed, however, certain pertinent differences. The shark serum contained a component resembling the gamma 2 globulin of mammals. Such a component could not be demonstrated in the sera of margates; these sera contained proteins which behaved in a manner similar to the fast-moving gamma or slow-moving beta globulin.

Research by a group of investigators (B. W. Papermaster, R. A. Good, R. M. Condie, J. K. Finstad, and A. E. Gabrielsen of the University of Minnesota and Stanford) on the immunologic responsiveness and immunomorphologic characteristics of two cyclostomes, the hagfish and the lamprey, has illustrated the phylogenetic development of adaptive immunity. (These animals represent two of the lowest surviving vertebrate forms.) In the hagfish no antibodies were produced even when adjuvant was added to certain antigens; some of the antigens were found to

circulate in these animals for as long as 30 days. There was also some indication that the hagfish lacked homograft immunity. Adult lampreys were somewhat more capable of making antibody as judged by a limited primary response. The tests of the secondary response could only be carried out in a few animals because the spawning lamprey does not survive long enough to permit extended observation. The investigators also studied the response of the holostean fish, *Amia*, and the guitarfish, a primitive elasmobranch. Variable degrees of competence exist in these fishes and the secondary response was usually more vigorous than the primary. The hagfish appears to lack lymphocytopoietic tissue. Hagfish serum has no globulin of gamma mobility, but the lamprey serum contains a small amount of component comparable to mammalian gamma globulin. The thymus appears to be totally lacking in the hagfish and only an epithelial thymus is present in the larval lamprey. In sharp contrast, elasmobranchs and teleosts possess lymphopoietic tissue, circulating lymphocytes, gamma globulin, and a thymus. These fishes are also immunologically competent with respect to antibody production and homograft rejection. On the basis of these findings, it was concluded that adaptive immunity developed in parallel with phylogenetic development of the thymus and lymphoid system.

M. MICHAEL SIGEL
University of Miami School of Medicine, Coral Gables 34, Florida

Cell Life Cycle: Macromolecular Aspects

A symposium on the macromolecular aspects of the cell life cycle was the subject of the annual symposium sponsored by the Biology Division of the Oak Ridge National Laboratory and the Division of Biology and Medicine of the Atomic Energy Commission at Gatlinburg, Tennessee (8–11 April).

The major emphasis throughout the meeting was placed on mechanisms controlling the initiation and maintenance of DNA replication and the regulation of DNA function in relation to other events of the cell life cycle. The discussion of both DNA polymerase and the conversion of non-primer DNA to the primer state, with respect to the initiation of DNA synthesis, pointed up the current gap in information about

the biological control of this central event of the cell cycle. In the case of calf thymus DNA polymerase, no primer occurring naturally has yet been detected in cells, and the existence of such primer may be an extremely transient event in the cell. It is perhaps significant that hypotheses proposing control of DNA synthesis through regulation of precursor pools was not mentioned during the discussions.

Although the main emphasis was on the relation of DNA synthesis to the cycle, several speakers dealt in whole or in part with such problems as growth in dry mass during the cell cycle and the control of cell division by specific compounds. Papers dealing with proteins associated with chromosomes led to the generalized conclusion that all proteins of the chromosome, including histones, are normally turning over or being replaced continuously in the chromosome. The recent demonstrations of greater heterogeneity among histone molecules have produced more vigorous consideration of the question of control of genetic activity by these proteins. Histone heterogeneity so far demonstrated is still far short of the amount required by such a thesis. It was also pointed out that a stretch of DNA was insufficient information to specify the synthesis of its own histone and that these proteins must have their origin in a limited fraction of the genome.

D. M. PRESCOTT
Oak Ridge National Laboratory, Oak Ridge, Tennessee

Nucleon Structure

More than 400 physicists from twenty countries attended the recent international conference on nucleon structure at Stanford University, Stanford, California (24–27 June). Of principal interest was the present experimental evidence concerning the theory of elementary particles based on analyticity principles and Regge poles. The latest results on K-meson-proton scattering experiments at the Brookhaven Alternating Gradient Synchrotron, reported by Lindenbaum, are very similar to the π meson-proton scattering results previously reported and thus are quite different from the behavior of proton-proton scattering cross section as a function of energy. In the analyticity theories, all strongly interacting particles are taken as composites involving

all other strongly interacting particles; hence, at high energies, all should show the same scattering behavior. The conclusion is that simple Regge poles do not dominate the scattering process. This had already been suspected by some theorists. The Brookhaven proton-antiproton elastic scattering results are also quite different from the proton-proton scattering although the number of events reported was not large enough to be definitive. Further evidence against the simple Regge pole concept was provided by the Dubna (U.S.S.R.) report on proton-proton scattering at high energies but at angles small enough to show interference between the coulomb force and the nuclear force (V. Grishin).

An alternative way of characterizing the elementary particles, that of unitary symmetry, has become increasingly important (Y. Ne'eman). Of the various Lie algebras of rank two into which the elementary particles may be fitted, the SU (3) group is the only one which does not give predictions which are contradicted by experiment. Some particles predicted by the SU (3) group approach have not as yet been seen, but the unitary symmetry concept appears very promising. The extension of experiments to still higher energies is most desirable.

Investigations on the effects due to two-photon exchanges have been made with the Cambridge Electron Accelerator. The results, reported by J. K. Walker, are in agreement with the Rosenbluth one-photon exchange formula up to momentum transfers of 1.3 Bev/c. The Stanford experiments of Browman and Pine, while inconclusive because of the low counting rates, indicate little if any difference between electron-proton and positron-proton cross sections. A preliminary report by J. Perez y Jorba (Orsay) on a very difficult experiment measuring the polarization of the recoiling protons in elastic electron-proton scattering showed that a small polarization is indicated but the results are not yet firm enough to be significant.

Groups of researchers at Stanford, Cornell, Orsay, and Harvard have made measurements of nucleon electromagnetic form factors. The proton electric and magnetic form factors have been determined with increased precision at energies up to 1.3 Bev. Preliminary measurements by the Harvard group up to momentum transfers of 2 Bev/c can be fitted by a range of values but it is clear that the two form factors

cannot be equal and also be independent of momentum transfer at the higher momentum-transfer values. Studies of the neutron electromagnetic form factors from electron-deuteron scattering were reported by Stanford after using electron-proton coincidence techniques, and by Cornell with electron-neutron and electron-proton coincidence techniques.

Another possible approach to the determination of the neutron form factors was outlined by R. Hofstadter in his description of the Stanford electron-scattering experiments on tritium and helium-3. By using a simplified model by Schiff, the previously measured proton electric and magnetic form factors, and the neutron magnetic form factor, an electric form factor for the neutron can be derived which is in good agreement with that determined from electron-deutron experiments. The nuclear form factors of tritium and helium-3 are also determined. The radii associated with both tritium form factors and the helium-3 magnetic form factor are about 1.7 fermis while that of the helium-3 electric form factor is almost 2 fermis. A more exact theoretical treatment is needed before detailed information can be obtained from these measurements.

The Harvard group also reported on the beginnings of nucleon spectroscopy. Inelastic scattering of electrons on protons clearly shows the first two excited states of the pion-proton system.

C. S. Wu discussed her experiments testing the conserved-vector-current theory and weak-interaction form factors. The telegraphic report from CERN concerning the neutrino experiment, which announced a counting rate about 50 times that achieved in the Brookhaven-Columbia neutrino experiment indicated that weak-interaction form factors will be measurable in the not-too-distant future although still higher counting rates will be needed.

JEROME H. FREGEAU
Office of Naval Research, Washington 25, D.C.

Forthcoming Events

August

26–30. American **Mathematical** Soc., 68th summer, Boulder, Colo. (Mrs. R. Drew-Bear, Special Projects Dept., AMS, 190 Hope St., Providence 6, R.I.)

26–30. **Rheology**, 4th intern. congr., Providence, R.I. (R. S. Rivlin, Brown Univ., Providence 12)

26–30. **Solar Spectrum**, intern. symp., Utrecht, Netherlands. (C. de Jager, Theoretical Dept., Sterrewacht, Servaasbolwerk 13, Utrecht)

26–31. **Haematology**, European Soc., 9th congr. Lisbon, Portugal. (Secretary, Haematology Congr., Dept. of Haematology, Inst. of Tropical Medicine, Lisbon)

27–30. **Alaskan Science** Conf., Anchorage. (A. H. Mick, Alaska Agricultural Experiment Station, Palmer)

27–30. American **Physiological** Soc., Coral Gables, Fla. (M. Edwards, Physiology Dept., Univ. of Miami School of Medicine, Coral Gables 34)

27–30. **Computing Machinery** Assoc., natl. conf., Denver, Colo. (F. P. Venditti, Univ. of Denver, Denver 10)

27–31. American Inst. of **Biological Sciences**, Amherst, Mass. (R. A. Jester, Dept. of Floriculture, Univ. of Massachusetts, Amherst)

The following member societies will hold business meetings during the annual AIBS meeting in Amherst, Mass.

For further information, contact the secretary of the society in question.

American Bryological Soc., 26 Aug.

American Fern Soc., 27 Aug.

American Microscopical Soc., 28 Aug.

American Phytopathological Soc., 26 Aug.

American Soc. of Plant Taxonomists, 25 Aug.

Botanical Soc. of America, 25 Aug.
Ecological Soc. of America, 26 Aug.
Mycological Soc. of America, 26 Aug.
National Assoc. of Biology Teachers, 28 Aug.
Phycological Soc. of America, 28 Aug.
Society for the Study of Evolution, 30 Aug.
Society of Nematologists, 29 Aug.
Society of Protozoologists, 30 Aug.
Tomato Genetics Cooperative, 26 Aug.

27–4. **Automatic Control**, 2nd intern. congr., Basel, Switzerland. (A. von Schulthess, Wasserwerkstr. 53, Zurich 6, Switzerland)

28–31. **Electron Microscope** Soc. of America, 21st annual, Denver, Colo. (V. L. Van Breemen, Mercy Inst. for Biomedical Research, 2920 E. 16 Ave., Denver 6)

28–4. **British Assoc. for the Advancement of Science**, Aberdeen, Scotland. (Sir G. Allen, Burlington House, Piccadilly House, London, England)

29–30. **Solvation** Phenomena, symp., Calgary, Alberta, Canada. (P. J. Krueger, Dept. of Chemistry, Univ. of Alberta, Calgary)

29–31. **Pollen Physiology** and **Fertilization**, symp., Nijmegen, Netherlands. (H. F. Linskens, Dept. of Botany, Univ. of Nijmegen, Driehuizerweg 200, Nijmegen, Netherlands)

29–4. American **Psychological** Assoc., Philadelphia, Pa. (E. B. Newman, Memorial Hall, Harvard Univ., Cambridge 38, Mass.)

30–1. **Pancreatic Islets**, intern. symp., Uppsala, Sweden. (S. Brolin, Univ. of Uppsala, Uppsala)

30–2. Individual **Psychology**, intern. congr., Paris, France. (H. Schaffer, 28 rue des Archives, Paris 4)

September

1–5. Association of American **Geographers**, Denver, Colo. (A. C. Gerlach, 1785 Massachusetts Ave., NW, Washington 6)

1–5. European **Anatomical** meeting, 2nd, Brussels, Belgium. (P. Dustin, 97 rue aux Laines, Brussels 1)

1–5. **Hydraulic Research**, 10th intern. congr., London, England. (Inst. of Civil Engineers, Great George St., London, S.W.1)

1–5. **Speleology**, 4th intern. congr., Athens, Greece. (S. Lekkas, 9 Evripdon St., Athens)

1–6. Laurentian **Hormone** conf., Mont Tremblant, P.Q., Canada. (Committee on Arrangements, 222 Maple Ave., Shrewsbury, Mass.)

1–7. **Biometeorological** Congr., 3rd intern., Pau, France. (S. W. Tromp, Intern. Soc. of Biometeorology, Hofbrouckerlaan 54, Oestgeest, Leiden, Netherlands)

1–7. **Orthopedic Surgery and Traumatology**, intern. congr., Vienna, Austria. (Secretariat, Alserstr. 4, Vienna 9)

1–11. **Tropical Medicine** and Malaria, 7th intern. congr., Rio de Janeiro, Brazil. (F. N. Guimaraes, P.O. Box 1859, Rio de Janeiro)

2–4. **Quality Control** Congr., European Organization, 7th annual, Copenhagen, Denmark. (Dansk Forening for Industriel

Kvalitetskontrol, Birkevej 11, Langesø pr., Nordborg, Denmark)

2–4. **Psychometric** Soc., Philadelphia, Pa. (L. V. Jones, Dept. of Psychology, Univ. of North Carolina, Chapel Hill)

2–4. Fundamental Processes in **Radiation Chemistry**, Notre Dame, Ind. (M. Burton, Univ. of Notre Dame, Notre Dame)

2–6. British **Pharmaceutical** Conf., London, England. (Secretary, British Pharmaceutical Centenary Conf., 17 Bloomsbury Sq., London, W.C.1)

2–7. **History of Science**, first Mexican colloquium, Mexico City. (E. Beltran, Dr. Vertiz 724, Mexico 12, D.F.)

2–7. Dynamic **Meteorology**, intern. symp., Boulder, Colo. (W. L. Godson, Intern. Assoc. of Meteorology and Atmospheric Physics, 315 Bloor St. West, Toronto, Ont., Canada)

2–7. International **Phycological** Soc., Naples, Italy. (J. Th. Kosher, Rijksherbarmin, Nonnensteeg 1, Leiden, Netherlands)

2–7. **Space** Technology and Science, intern. symp., Tokyo, Japan. (I. Tani, Japanese Rocket Soc., 1-3 Ginza-Nishi, Tokyo)

2–12. **Genetics**, 11th intern. congr., The Hague-Scheveningen, Netherlands. (S. J. Geerts, Genetisch Laboaraorium, Driehuizerweg 200, Nijmegen, Netherlands)

2–13. Epidemiology and Biometeorology of **Fungal Diseases of Plants**, symp. (by invitation only), Pau, France. (R. D. Schein, Dept. of Plant Pathology, 113 Buckhout Laboratory, Pennsylvania State Univ., University Park)

3–6. **Entomology**, Canadian centennial, Ottawa, Ont., Canada. (Executive Committee, K. W. Neatby Bldg., Carling Ave., Ottawa)

3–8. **Anesthetics**, 1st European congr., Vienna, Austria. (K. Steinbereithner, Medizinische Akademie, Alserstrasse 4, Vienna 9)

4–5. **Industrial Design**, 1st intern. technical conf., Leipzig, Germany. (Sekretariat der Tagungskommission, Kammer der Technik, Hauptausschuss, Abt. Technischer Fortschritt, Klara-Zetkin-Str. 115-117, Berlin W.8, Germany)

4–6. Inorganic **Fluorine Chemistry**, symp., Argonne, Ill. (L. Stein, Chemistry Div., Argonne Natl. Laboratory, 9700 S. Cass Ave., Argonne)

4–6. **Proteins** and Their Reactions, symp., Corvallis, Ore. (A. F. Anglemier, Dept. of Food Science and Technology, Oregon State Univ., Corvallis)

4–7. **Biometric Soc.**, Eastern North American region, Cleveland, Ohio. (E. L. LeClerg, Biometrical Services, U.S. Dept. of Agriculture, Plant Industry Station, Beltsville, Md.)

4–7. **Production Engineering** Research, intern. inst., 13th general assembly, Pittsburgh, Pa. (E. Merchant, Cincinnati Milling Machine Co., Cincinnati 9, Ohio)

4–7. **Mössbauer Effect**, 3rd intern. conf., Ithaca, N.Y. (A. J. Bearden, Dept. of Physics, Cornell Univ., Ithaca)

4–7. American **Statistical** Assoc., Cleveland, Ohio. (R. T. Bowman, Office of Statistical Standards, Bureau of the Budget, Executive Office Bldg., Washington 25)

5–6. **Ellipsometer**—Measurement of Surfaces and Thin Films, Washington,

5–7. American Assoc. of **Obstetricians and Gynecologists**, Hot Springs, Va. (C. T. Beecham, 3911 Vaux St., Philadelphia 29, Pa.)

5–7. **Parapsychological** Assoc., New York, N.Y. (J. C. Pratt, 2744 McDowell St., Durham, N.C.)

6–7. **Plant Phenolics** Group of North America., 3rd, Toronto, Ont., Canada. (V. C. Runeckles, Imperial Tobacco Co. of Canada, P.O. Box 6500, Montreal, Quebec, Canada)

8–11. **High-temperature Technology**, intern. symp., Asilomar, Calif. (Dept. 493, Stanford Research Inst., Menlo Park, Calif.)

8–11. **Petroleum** Industry Conf., St. Louis, Mo. (R. G. Knaus, General Electric Co., 818 Olive St., St. Louis)

8–13. American **Chemical** Soc., 145th natl., New York, N.Y. (ACS, 1155 16th St., NW, Washington, D.C.)

8–13. **Illuminating Engineering** Soc., Detroit, Mich. (W. P. Lowell, Jr., Sylvania Electric Products, 60 Boston St., Salem, Mass.)

8–15. Function of **Esterases** in Animals and Plants, intern. symp., Pernambuco, Brazil. (S. L. Allen, Dept. of Zoology, Univ. of Michigan, Ann Arbor)

8–15 **Soil** Mechanics and Foundation Engineering, 6th intern. conf., Montreal, P.Q., Canada. (C. B. Crawford, Natl. Research Council, Ottawa, Ont., Canada)

8–15. **Thin-Film Optics**, Marseilles, France. (P. Rouard, Faculté de Sciences de Marseilles, Laboratoire de Physique Générale, P. Victor Hugo, Marseilles 3)

8–22. Brno Intern. **Trade Fair**, Brno, Czechoslovakia. (Czechoslovak Scientific and Technical Soc., Siroka C 5, Prague 1, Czechoslovakia)

9–10. Transport of **Radioactive Materials**, problems symp., Harwell, England. (Authority Health and Safety Branch, U.K. Atomic Energy Agency, 11 Charles II St., London S.W.1)

9–11. **Military Electronics**, 7th natl., Washington, D.C. (Inst. of Electrical and Electronics Engineers, Box A, Lenox Hill Station, New York 21)

9–11. **Weak Interactions**, intern. conf., Brookhaven, N.Y. (G. C. Wick, Brookhaven Natl. Laboratory, Long Island, N.Y.)

9–11. **Soils**, Laboratory Shear Testing, Ottawa, Ont., Canada. (American Soc. for Testing and Materials, 1916 Race St., Philadelphia 3, Pa.)

9–12. **Production Engineering** Research, intern. conf., Pittsburgh, Pa. (Carnegie Inst. of Technology, Pittsburgh)

9–12. **Instrument-Automation** conf., exhibit, Chicago, Ill. (Instrument Soc. of America, T. A. Abbott, American Oil Co., 2400 New York Ave., Whiting, Ind.)

9–13. International Union against **Cancer**, conf., Amsterdam, Netherlands. (H. G. Kwa, UICC Cancer Conf., c/o Congresdienst Gemeente Amsterdam 4, St. Agnietenstraat, Amsterdam-C)

9–14. **Biometrics**, 5th intern. conf., Cambridge, England. (R. C. Campbell, School of Agriculture, Cambridge)

9–14. **Pharmaceutical** Sciences, 23rd intern. congr., Münster, Germany. (K. E. Schulte, Institut für Pharmazie und Lebensmittelchemie, Piusalle 7, 44 Münster)

New Products

Radioactive paper chromatogram scanner (model SC-525T) is designed for both quantitative and qualitative detection and assay of all low-energy beta rays being emitted from a chromatogram strip. The Four-Pi scanner consists of two high-efficiency radiation detectors similar to those used in the low-background counting systems, a dual rotating collimator, ratemeter, high-voltage power supply, and strip-chart recorder. In operation, the chromatogram strip is automatically advanced between the two detectors. Output pulses are electronically integrated for a preselected time and fed to the recorder. As movement of both chromatogram strip and recorder chart are synchronized, an immediate, visual comparison can be made of activity, intensity, and relative position of radioactive material found on the strip. Specifications for the scanner include: background, approximately 15 count/min; gas consumption, less than 350 cc^3/min; chart speed, variable from 0.75 to 12 in./min or per hour; ratemeter, eight counting ranges are 25, 100, 250, 1000, 2500, 10,000 25,000, and 100,000 count/min; time constants, 0.5, 2.5, 10, 40, and 150 seconds. Slot widths for the dual rotating collimator are: 0.050, 0.125, 0.250, and 0.5 inch; a closed position for loading; and a 0.25-inch-wide slot covered with an aluminized mylar window having a density of 0.9 mg/cm^2. Paper rolls up to 100 ft long and 1.5 to 4 cm wide may be accommodated. Additional specifications are: circuit accuracy, ± 1 percent of reading; high-voltage power supply, variable from 800 to 1600 volts; line voltage, 100 to 130 volts, 50 to 60 cy, or 220 to 250 volts, 50 to 60 cy; size, 23 inches wide by 13 inches high by 18 inches deep.—R.L.B. (Tracerlab, 1601 Trapelo Rd., Waltham 54, Mass.)

Circle 1 on Readers' Service card

Digital printer (model MC 10-40) for data-logging applications is capable of printing at the rate of 1040 lines per minute. Impressions are made by permanently timed hammers striking through a ribbon against a constantly revolving character drum. A drive cam simultaneously impacts all selected hammers, imparting the same velocity to each to assume equal color weight. Column capacity may be 4, 8, 12, or 16 columns, and printable characters per column include 15 printing positions and blank. Standard arrangement is 0 through 9 plus five special characters. Character pitch is ten per inch and six printed lines per inch. The last line printed is available for viewing within 1 sec. The printer uses 2½-inch-wide paper in either roll or folded form. In operation, characters accompanied by a print command are presented in bit-parallel, column-parallel form to the printer. Upon receipt of the print command, a 5- to 20-volt negative-going pulse, the printer will indicate that the characters have been received and are to be held. Upon completion of printing, the printer will indicate that the characters may be dropped and that it is ready for the next input. If the next input is obtained within 14 msec, printing will be synchronous. If more than 14 msec elapses before the next input, printing will be asynchronous and speed will be less than maximum.—J.S. (Monroe Calculating Machine Co., 60 Main St., San Francisco, Calif.)

Circle 2 on Readers' Service card

Surface-measuring microscope is said to be capable of measuring surface roughness nondestructively with accuracy of 40×10^{-6} inch (1 μ). The instrument can also measure the thickness of transparent films and foils, depth of etching, and small parts such as suspension wedges and pans of balances that cannot be measured by the usual projection or silhouette methods. Measurements are made without contact with the surface of the object. In the instrument, a thin band of light is projected at a 45-deg angle upon the surface to be observed. This band of light that traces out the profile of the surface is viewed at a 90-deg angle through the microscope. Roughness is measured by moving a reticle to the peaks and valleys of the profile. The difference is read in microns on a micrometer drum. In measuring transparent films, the light band is reflected from the surfaces of both the film and the underlying material. Thickness can be determined by computation if the refractive index of the film is known. Contour photographs can be made with a 35-mm camera that is attached to the microscope. The microscope is equipped with magnification of 200 and 400 providing a measuring range from 0.0040 to 0.000040 inch (1000 to 1 μ). A mechanical stage, V-block, and center cradle are available and a ball-and-socket stage permits measurement of parts with nonparallel sides.—J.S. (Carl Zeiss Inc., 444 Fifth Ave., New York 18)

Circle 3 on Readers' Service card

Force and displacement transducers, using a strain gage as the sensing element, have been developed for use in research into certain mechanical characteristics of animal heart muscle. The transducers consist of two sensing elements with attached electrical leads cemented to a bronze plate. The assembly, including a portion of the insulation on the leads, is encapsulated in epoxy resin, which results in a transducer small in size and weight, providing electrical insulation from conductive fluids and low-temperature sensitivity over the range 5° to 45°C. One version of the transducer is that for myocardial force configurations for recording the mechanical activity of the ventricle *in situ* either in the acute or chronic preparation. The standard size, 35 mm long by 2.5 mm wide, is suitable for use on dogs. A smaller size, 23 mm long by 5 mm wide, is available for use on cats. These

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The material in this section is prepared by the following contributing writers:

Robert L. Bowman (R.L.B.), with the assistance of Denis J. Prager (D.J.P.), Laboratory of Technical Development, National Heart Institute, Bethesda 14, Md. (medical electronics and biomedical laboratory equipment).

Joshua Stern (J.S.), Basic Instrumentation Section, National Bureau of Standards, Washington 25, D.C. (physics, computing, electronics, and nuclear equipment).

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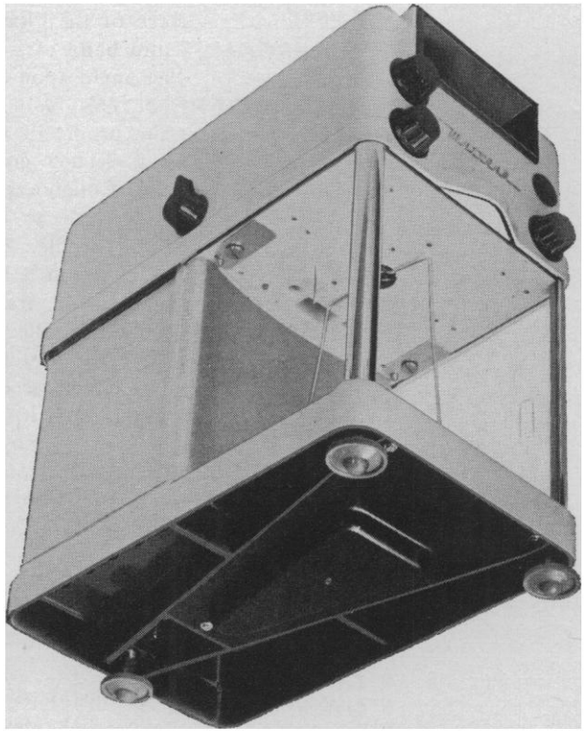

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transducers are supplied with integral 3-ft leads and connector and a patch cable consisting of connector, a 6-ft shielded cable, and matching bridge resistors mounted on an "AN" connector. A second configuration is that for force/displacement. This consists of a basic heart contractile force transducer mounted in a stainless-steel tube. A common laboratory ring stand with right-angle clamp is used as the mounting fixture and two mounting holes in the free end of the transducer serve as the coupling medium. For force or small displacement, the transducer size is ⅜ inch outside diameter by 6 inches long. Its output and stability are adequate to provide good resolution of forces of less than 100 mg and displacement of less than 1×10^{-3} inch. Addition of an extension arm to the force configuration converts the transducer into a large displacement device. A displacement of 0.5 inch requires a restoring force of less than 3 g. This force or displacement transducer is supplied with a 10-ft integral cable, matching bridge resistors mounted on an "AN" connector, and an extension arm.—D.J.P. (Honeywell, Denver Division, 4800 E. Dry Creek Rd., Denver 10, Colo.)

Circle 4 on Readers' Service card

Plastic centrifuge tubes, capable of withstanding over 75,000*g*, may be used for both low- and high-speed centrifugation and were developed particularly for use in ultracentrifuges. The tubes are moulded from crystal-clear polycarbonate plastic and combine many of the advantages of glassware with the strength and economy of plastic. Autoclear tubes will withstand repeated autoclaving and are resistant to most laboratory chemicals. They have extreme tensile strength and will not shatter if dropped. The new tubes are currently available in five sizes: 50, 25, 15, 12, and 7 ml.—D.J.P. (International Equipment Co., 300 Second Ave., Needham Heights 94, Mass.)

Circle 5 on Readers' Service card

Serum protein refractometer measures serum protein concentration and index of refraction simultaneously on two calibrated scales. One scale reads directly to 0.2 g protein per 100 ml with a range from 0 to 12 percent. The other scale indicates refractive index in steps of 0.0005 over a range from 1.333 to 1.365. The instrument provides a simple means for making ac-

curate serum protein analysis. To use, the technician merely places a drop of distilled water on the prism and "zeros" the instrument. The prism is then dried and a drop or two of the serum sample is placed on the prism. The serum protein in grams per 100 ml and the refractive index are then indicated on calibrated scales. The Protometer is ruggedly constructed of corrosion-resistant materials. Exposed metal parts are satin chrome plated. A rotating eyepiece permits proper focus adjustment for the user. The instrument is furnished in a durable felt-lined case.—R.L.B. (National Instrument Co., 4119 Fordleigh Road, Baltimore 15, Md.)

Circle 6 on Readers' Service card

X-ray image retaining panel is said to be capable of re-use at least 10,000 times. The panel uses a phosphor coated on a metal-ceramic panel. The phosphor, based on zinc-cadmium sulfide, glows in a d-c field when triggered by an external source of radiant energy. When the panel is energized in darkness, no light is emitted and the leakage current through the panel is extremely small. When light or other radiation triggers the electroluminescent mechanism, a yellowish glow appears. The panel retains the image when the triggering radiation is removed and the image is said to remain sharp for about 30 min. By removing the d-c field temporarily, the image is made to disappear and the panel is readied for use again. Panels measuring 3 by 3 inches or 6 by 4 inches are available at present and larger panels can be made.—J.S. (Thorne Electrical Industries, Ltd., Upper St. Martin's Lane, London, W.C.2, England)

Circle 7 on Readers' Service card

Thermoelectric immersion cooler is a 2⅓-lb thermal pump, 12 inches long, 2¾ inches wide, and 1⅛ inches thick, whose primary use will be as an "inside-out" refrigerator to cool a small tank or beaker of chemicals. Tap water from a faucet is passed through the central part of the unit at a rate of at least ½ gal/hr and is discarded into a drain. When the thermocouples located between the central part and the nickel-plated metal outer shell are energized by application of 3 volts, 25 amp of direct current, this immersion cooler will initially pump 52 thermal watts (175 Btu/hr) when the chemical solution against the shell is at the same temperature as the tap water. When the chemicals outside the shell

have been cooled to a temperature 80°F colder than the tap water, thermal pumping rate is 17 thermal watts (60 Btu/hr). By means of a thermoregulator in the a-c line to the direct-current power supply which energizes the unit, the chemicals in which the cooler is immersed may be held at very precise temperatures below room ambient, even below ice temperature. While this unit is called an immersion cooler, it of course becomes an immersion heater when polarity of the direct electric current through its Peltier thermal pumps is reversed.—R.L.B. (Whirlpool Corp. Research Laboratories, 300 Broad St., St. Joseph, Mich.)

Circle 8 on Readers' Service card

Micropotentiometer calibrator (model MPC) is a self-contained d-c calibration and RF readout system for micropotentiometers such as the manufacturer's model MPT. The Lindbeck microvolt source in the calibrator is adjusted to the desired setting as shown by the microvolt output meter. A stable source of direct current is applied to the thermoelement and adjusted to null on a self-contained galvanometer. The Lindbeck microvolt output meter is then switched into a millivoltmeter to read the corresponding thermojunction output. The switching network is dummy-loaded to avoid unbalancing the circuits. Overall accuracy of the meter is said to be better than ± 1 percent of full scale on all ranges above 100 μv using the internal galvanometer. An external galvanometer of higher sensitivity can be connected to provide greater accuracy and resolution on ranges of 100 μv and lower. The millivoltmeter is provided with an r.m.s. scale drawn to the typical output characteristics of a thermoelement. The thermo-junction output can be read to a nominal ± 3 percent accuracy. Adjustment is provided for the full-scale sensitivity of the indicator to fit any thermoelement.—J.S. (Singer Manufacturing Co., 915 Pembroke St., Bridgeport, Conn.)

Circle 9 on Readers' Service card

Constriction pipette is specifically suited for prothrombin tests, and gives 5-percent reproducibility even when used by untrained personnel. Within the pipette, a square shoulder constriction enables a liquid to be drawn to the same level each time. The liquid is drawn up to the constriction and into the capillary bore where it is held until blown out. If, through excess suction, the liquid column is

drawn above the square shoulder, it may be blown down or allowed to fall to the desired level. The pipettes eliminate the necessity for continuous mouth suction until discharge of the liquid is desired. They are available in two sizes: 0.1 and 0.2 ml.—D.J.P. (Scientific Industries, Inc., 220-05 97th Ave., Queens Village 29, N.Y.)

Circle 10 on Readers' Service card

Liquid-helium transfer tube (model FHT) is a flexible tube designed for use where limitations of space prohibit the use of storage-Dewar lifts. The light-weight tube is constructed of flexible tubing with a choice of either straight or right-angle 24-inch stainless-steel legs. The flexible section is 5 ft long and 1 inch in diameter. The tube is completely vacuum insulated. The manufacturer guarantees that bending the tube to its minimum mechanical radius of 5 inches will not cause thermal short circuiting. An evacuation valve is an integral part of the tube body. Replaceable threaded tips may be cut to accommodate any size Dewar.—J.S. (Janis Research Co., 21 Spencer St., Stoneham, Mass.)

Circle 11 on Readers' Service card

Temperature-stabilized polyesters for use as stationary phases in the gas chromatographic analysis of fatty acids include the following: ethylene glycol adipate; ethylene glycol sebacate; diethylene glycol adipate; diethylene glycol succinate; diethylene glycol sebacate. The phases are capable of operating efficiently at temperatures up to 250° to 270°C. These new stabilized materials make it possible to significantly speed up analysis time and permit efficient analysis of higher boiling materials. Extensive studies have shown the new phases to have an unusually low bleed rate. In many cases, column life has been doubled or tripled as compared to columns using unstabilized forms of the same polyesters. Tests also have indicated that there is no interaction of the stabilizing agent with the solid support or fatty acid samples. The phases are said to be very well suited for temperature programming and for preparative work where low bleed rate is essential to prevent contamination. The new phases are available in their pure form, or may be obtained coated on a support of the purchaser's choice. The current issue of the "Analabs Newsletter" discusses these temperature-stabilized polyesters in detail. Their characteristics and per-

formances are illustrated with graphs and typical chromatograms. Newsletter copies may be obtained.—R.L.B. (Analytical Engineering Laboratories, Inc., P.O. Box 5215, Hamden 18, Conn.)

Circle 12 on Readers' Service card

High-speed recording paper (Lino Writ 7) is designed for oscillographic recorders equipped with high-intensity incandescent light sources. The exposed image, blue on a pink background, becomes visible by photolysis in fluorescent light in less than 30 sec. Intensity of the image continues to increase for 30 min. Traces developed to maximum density by photolysis will remain stable indefinitely if protected from light or will withstand 8 to 24 hours' exposure to average artificial illumination. Nonphotolyzed records can be made permanent by chemical processing. The paper is available in thicknesses of 0.0045 and 0.0025 inch and can be supplied in sizes and winding specifications for all direct-writing photorecording instruments. Photographic reproductions of photolyzed oscillograms can be made in flow-type cameras with Micro-Writ photocopy paper or they can be photographed with an orthochromatic or panchromatic microfilm.—J.S. (E. I. du Pont de Nemours & Co., Wilmington 98, Del.)

Circle 13 on Readers' Service card

Ultraviolet cabinet for observation of fluorescence of chromatographs is a portable table-top cabinet containing long-wave ultraviolet source (maximum at 366 mμ) and short-wave ultraviolet source (maximum at 254 mμ), and a white light. The 24-inch long by 15-inch wide by 12¾-inch high unit has double curtains across the front and a urethane foam viewing port to exclude room light while one is observing chromatograms placed inside the cabinet. High-efficiency lamps can be adjusted inside the cabinet for optimum illumination and white light may be switched on for marking the records. An ultraviolet absorbing glass is provided over the viewing port for eye protection.—R.L.B. (Ultra-Violet Products, Inc., San Gabriel, Calif.)

Circle 14 on Readers' Service card

Paper chromatogram spotter or striper greatly reduces the time-consuming work of "spotting" or "striping" paper chromatograms. As many as eight spots or stripes can be applied at one time, automatically, on the same or separate papers. All the operator

need do is insert the paper, fill the pipettes, and adjust the speed. The instrument uses any solvent; volume and rate of application are adjustable. Spots and stripes are uniform. Stripes can be varied from 1 to 8 cm long; spots can be as small as 4 mm in diameter. From one to eight spotting heads can be used at the same time; any head can be stopped and the pipette refilled while the others continue to operate. Gentle heating and adjustable air circulation afford rapid evaporation of solvent, with minimal heating of the sample.—R.L.B. (Technilab Instruments, 2231 S. Carmelina Ave., Los Angeles 64, Calif.)

Circle 15 on Readers' Service card

Micro-sized radiation dosimeter is composed of a volume of as little as 0.06 cm^3 of lithium fluoride phosphor. Upon exposure to radiation, the radiation energy is absorbed and stored in the crystal in the form of trapped electrons. Automatic heating in the readout instrument for 15 sec at 300°C provides the trapped electrons with sufficient energy to be released and light is emitted proportional to the total dose of radiation absorbed. The released light is precisely measured, and the dose in rads is indicated digitally on the readout panel. These detectors will measure doses of beta, gamma, or x-rays, fast neutrons, or protons, and in pairs they will discriminate between the fast neutron and gamma dose in mixed fields, such as those encountered in reactor irradiations or in weapons testing. The dosimeters can be fabricated in an unlimited variety of forms because the fine crystals can be packaged in plastic capsules or tubing in practically any shape or form desired. Since the cost of the dosimeters is low, many can be employed for simultaneous measurements at multiple points. The lithium fluoride dosimeter has a precision of ± 2 percent over a range of 100 mr to 10^5r. The radiation response of the dosimeter practically duplicates that of body tissue; in addition, the dosimeter response is nearly independent of radiation energy even down in the very soft x-ray energy levels. Dose determination is not affected by a delay in readout up to at least 3 months after exposure. No evidence has been found that shock, friction, vibration, humidity, light, or other factors produced deviation in measurement. Since the lithium fluoride is de-energized during readout, the phosphor can be again packaged for re-use. These new dosimeters have many applications, including source calibration and dose determinations, beam dose distribution, high-energy particle studies, in vivo dose measurements during radiobiology studies, radiation effects on materials, radiation sterilization, and radiation chemical processing. Encapsulated dosimeters, in standard or custom shapes, and the associated readout instrument, are now available.—D.J.P. (Controls for Radiation, 130 Alewife Brook Parkway, Cambridge 40, Mass.)

Circle 16 on Readers' Service card

Motor-driven timer (model 20225-A), powered by a continuous-duty synchronous motor, is designed to measure precisely short periods of time of from 0 to 60 sec. The elapsed time is displayed by two dials on the face of the timer. The first dial completes one revolution per second and is calibrated in hundredths of seconds. Each revolution of this dial is accumulated on the second dial which is calibrated in seconds and can accumulate up to 60

seconds. A lever on the front of the timer resets the hands after each timing period or after an accumulation of periods.—D.J.P. (C. H. Stoelting Co., 424 N. Homan Ave., Chicago 24, Ill.)

Circle 17 on Readers' Service card

A bench model **space simulator** is a compact mechanically refrigerated vacuum chamber. The equipment will provide vacuum equivalent to an altitude of 500,000 ft, approximately 3×10^{-6} torr, and temperatures controlled within $\pm 2°F$ in the $-100°$ to $+350°F$ range. The aluminum test cylinder measures about 35.6 cm in diameter and 30.5 cm deep. The interior wall is anodized in a black hard coat to permit high radiant energy transfer. The entire equipment measures about 137 by 66 by 53 cm and is completely self-contained with its own vacuum system consisting of a mechanical pump and high-speed, air-cooled diffusion pump and a hermetically sealed cascade refrigeration system. Reduction of temperatures requires approximately 1 hr for $-65°F$; 2 hr for $-85°F$, and 3 hr for $-100°F$. Heating from ambient to $+240°F$ requires approximately 30 min, to $+350°F$ approximately 60 min. Vacuum equivalent to 500,000 ft is reached in approximately 2 hr.—J.S. (Tenney Engineering, Inc., 1090 Springfield Rd., Union, N.J.)

Circle 18 on Readers' Service card

"Sontrifuge," a novel **centrifugal/sonic** machine combines low-acceleration centrifugal force with sonic energy produced by compressed-air-operated transducers to reduce foams to liquid. Constructed of stainless steel, with output capacities of 10 to 500 gal/min of defoamed, deaerated liquid reduced from foam and/or aerated liquid input, the new machines are said to be the answer to many defoaming and deaeration problems that have thus far resisted all efforts. Four Sontrifuge models are available, having output capacities of up to 10, 40, 60, and 500 gal/min, respectively, depending upon liquid viscosity. The Sontrifuge defoams and deaerates latex, milk, cream, and ice cream mix, fruit juice, detergents, petroleum products, paper coatings, black liquor foam, and chemicals with viscosity up to 500 cp. Output in nearly all cases contains less than 0.5 percent of included air by volume and less than 100 parts per million by weight. Applicable to processes as widely different as antibiotic fermentation, tank car filling, kraft

sulfate pulp manufacture, paper and adhesive coating, and deaeration of the output of conventional centrifuges and mixing equipment, the Sontrifuge is a new kind of unit process. It includes its own pumping mechanism and automatic controls so that it is readily incorporated and installed with a minimum of modification to existing processes.—R.L.B. (Teknika, Inc., 634 Asylum Ave., Hartford, Conn.)

Circle 19 on Readers' Service card

Random access projector (model 132) locates any frame in a 35-mm, 100-frame, closed-loop strip film in 3 sec or less. Accuracy of location at the film plane is said to be within ± 0.01 inch. The projector may be operated directly from command input devices such as a keyboard, telephone-type dial, or rotary switch. In locating any given frame, the device selects and searches the shortest direction to that frame so that transport is never more than half the length of the film. The film moves completely free from contact with the film gate during transport; a pressure plate moves out of the way at the beginning of the search and returns to press the film into position for projection at the end of the search. Models are available with light sources up to 500 watts and lenses of focal length from 2.5 to 3 inches. With custom adaptations, it is said to be possible to achieve greater speeds, location accuracies of ± 0.0005 inch at the film plane, and higher total count cycles. The total count cycle of the digital servomechanism used is expandable to any power of its number base without calling for increased resolution in the measurement of shaft rotation. The system can be operated from a computer binary output by adding a binary-to-octal converter and using an octal form of the digital servomechanism. Modification to handle open-end strips is also possible. The digital servo is separately available.—J.S. (Mast Development Co., 2212 E. 12 St., Davenport, Iowa)

Circle 20 on Readers' Service card

Metabolism cage, designed for accurate metabolic balance studies, separates the urine and feces of a test rat. It is a transparent, acrylic plastic, cylindrical cage provided with air holes, a drinking tube, and a stainless-steel grille floor. A polyethylene funnel beneath the grill conducts excreta to a glass separator that deflects solids into a 250-ml beaker and allows fluids to drain

into a 50-ml conical flask inside the beaker. The apparatus dismantles easily so that the grille, funnel, flask, beaker, and separator may be cleaned and sterilized.—D.J.P. (Science House, Inc., 1294 Raven Dr., Pittsburgh, Pa.)

Circle 21 on Readers' Service card

Dry-box gloves incorporate one of the newer synthetic elastomer materials used in combination with neoprene, with butyl rubber, and with lead-loaded neoprene rubber. Gloves made by this process offer an outside working surface with substantially improved resistance to abrasion and snag, to ozone attack, and to highly oxidizing chemical exposures such as red fuming nitric acid. "Dura-Sol" gloves are available in the standard "Neo-Sol," "Buta-Sol," and "Rad-Bar" types. Combining a film of the selected synthetic elastomers with butyl rubber, for example, offers a glove with high resistance to abrasion and with improved tensile strength, while still retaining the very low permeability characteristics of a butyl glove. Another feature of all "Dura-Sol" gloves is the ease of identification when there is any damage to the surface of the glove. The outer polmer film is compounded in a contrasting color and when this outer film is damaged by abrasion, snagging, or by other means, the black neoprene or butyl rubber film can be seen through the break. This provides the user with a built-in warning feature to make such damage easily detected by visual examination.—R.L.B. (Charleston Rubber Co., Charleston, S.C.)

Circle 22 on Readers' Service card

Teflon cementable sleeves are available in a full range of sizes for both standard taper and spherical joints. They may be used "loose" in place of grease for nonvacuum applications. An epoxy and a series of slightly undercut glass inner members are offered for perfect fit with these sleeves. Outer members feature a polished surface which fits better, and does not wear the Teflon.—D.J.P. (Ace Glass Inc., Vineland, N.J.)

Circle 23 on Readers' Service card

High-pressure transducer weighing less than 8.5 g is available with ranges from 0–50 to 0–5000 lb/in.^{2} absolute. The transducer uses semi-conductor solid-state elements bonded to the back of a pressure-sensing diaphragm and wired to a full bridge circuit to convert

pressure-induced strains to electrical output. The instrument will operate over an ambient temperature range of −65°F to +300°F and will withstand overpressure of 150 percent without recalibration and an overpressure of 300 percent without bursting the diaphragm. Specifications stated by the manufacturer include: input or output bridge resistance of 1000 ohms, maximum; accuracy ±1 percent of full scale; high natural frequency (90 kcy/sec at 1000 lb/in.^{2}); acceleration response 0.002 percent of full scale per gram in any plane; zero balance within ±5 percent of full scale. A transducer driver allows operation from an unregulated 28-volt d-c source and provides compensation for temperature. The latter may be located as much as 500 ft from the transducer. Full scale output at 78°F is 0.5 volt d-c.—J.S. (Micro Systems, Inc., 170 N. Daisy Ave., Pasadena, Calif.)

Circle 24 on Readers' Service card

Twelve-channel liquid pump, capable of precision-metered flow from zero to 4000 ml/hr per channel, provides for a continuous stepless flow control on each of 12 self-priming channels independently of all the others. Flow rate can be changed while the pump is running. Material being handled is entirely contained within plug-connected resilient tubing, externally valved, and mechanically compressed by the pump action—which is linear and positive. Any desired resilient tubing, such as Tygon, silicone rubber, neoprene, Buna N, gum rubber, and so forth, can be used, so that a wide range of chemicals can be handled and sterility can be established and maintained if desired. Mechanically, the Dial-A-Pump is based on a precision mechanism with sealed self-lubricated bearings and a Bodine gear-motor drive. Fittings are stainless-steel, and other pump parts have corrosion-resistant anodized or epoxy finishes. Frictional drag and the resulting "walking" of individual tubes have been eliminated. The 12 channels are externally numbered for convenience in record keeping and each of the flow dials has a set of six nominal calibration marks for establishing preliminary flow rates. Fittings and connecting plumbing components are available separately so that users can make up internal and external tubing units from materials and to specifications as desired. Pump operates from 115-volt, 50- to 60-cy/sec power and the unit weighs 13 lb. Applications include such

functions as mixing fluids in precision ratios, feeding liquids in continuous automated chemical analyses, perfusion, continuous dialysis, multiple chromatographic-column separations, precision reagent feeding, and gradient generation for electrophoresis.—D.J.P. (Durrum Instrument Corp., 841 Woodside Rd., Redwood City 2, Calif.)

Circle 25 on Readers' Service card

Optical curve generator (model D5) has a capacity of 12-inch diameter and 6-inch thickness. It can generate both concave and convex curves; the cross-slide travel is 18 inches with 12 inches right of center and 6-inch travel left of center. The machine consists of a vertically mounted work spindle with rapid traverse and controlled feed range of 1 inch. The grinding spindle is arranged on the cross slide for side-to-side motion and small front-to-back adjustment. Four inches of vertical adjustment are provided and an angular adjustment from 0 to 80 deg left of vertical. Standard speed on the work spindle is 350 rev/min and on the grinding spindle 3600 rev/min. The grinding spindle is hollow to provide for coolant delivery to the work. Accessories include motorized cross feed, variable speed work spindle, and vacuum system to hold work.—J.S. (SETCO Industries Inc., 5829 Hillside Ave., Cincinnati 33, Ohio)

Circle 26 on Readers' Service card

Temperature control thermometer maintains temperature to within 0.01°C of setting and is capable of up to 50 switching actions per minute. The calibrated scale is divided into two parts. The upper portion comprises the temperature selector; the lower part, the control thermometer with mercury reservoir and stem. A molded bakelite cap encloses the terminals and carries a rotary setting magnet. A steel spindle is rigidly connected to the core and carries a threaded setting bar. Clockwise or anticlockwise rotation of the magnet causes this bar to move up or down to the desired temperature setting. A thumb screw locks the magnet in place. Regulation is effected by means of a contact wire attached to the setting bar. The end of the wire extends through a sliding contact into the control thermometer where it makes contact with the mercury as it rises in the capillary.—D.J.P. (Standard Scientific Supply Corp., 808 Broadway, New York 3)

Circle 27 on Readers' Service card

Letters

(Continued from page 488)

edge is followed by a less-well-defined advancing front of oblivion.

What sets a limit to the undergraduate educational process? In a qualitative way this can be specified for an individual student, and if desired, one can take the risk of extending the statement to a hypothetical average student. The mental development of an individual proceeds rapidly through the years of early childhood and those of elementary and high school education. When a student becomes an undergraduate, his mind is still developing rapidly. Indeed, in countries with weak school systems, the rate of mental development may even increase at this time. As the undergraduate continues to develop his mind by studying what is well known, he reaches a point of diminishing returns. There is still a great deal that he does not know, some of which he may subsequently need to know. But the undergraduate educational process comes to an end when it is no longer worth the student's while to study what is well known merely for the purpose of developing his mind. In many universities the limit of undergraduate education defined in this way is not at the level of the bachelor's degree but somewhat above the level of the master's degree.

What is the objective of graduate education? At the conclusion of an ideal undergraduate education, a man's brain works well. He is convinced, not that he knows everything or even that he knows everything in a particular field, but that he stands a reasonable chance of understanding anything that someone else has already understood. Any subject that he can look up in a book he feels that he too can probably understand. On the other hand, if he cannot look it up in a book, he is uncertain what to do next. This is where graduate education comes in. Unlike the recipient of a bachelor's degree, the recipient of a doctor's degree should have reasonable confidence in his ability to face what is novel and to continue doing so throughout life.

There is a need to have the most intelligent members of society capable of facing novel situations with confidence. I do not mean only in the technical fields of science and engineering. The successful business man must continually face such situations with confidence and correctly evaluate them. So must the politician. The two K's are constantly confronted with novel situations upon which our very future depends. We can all point to major blunders that have been made in world affairs because a politician, or group of politicians, met with such a situation and bungled it. We are still keenly aware of the one that had to be faced in the 1962 Cuban crisis. Facing novel situations and mastering them is one of the most challenging tasks with which mankind is confronted.

There are, of course, many ways of learning to face such situations with confidence. If this is done in a university, what is the principal technique available? The answer, of course, is research. There is a contrast between research in a university and research in industry or government. In industry or government, research is itself the objective, or is the immediate objective in a series of objectives. On a university campus, research is the principal means for developing the minds of doctoral students.

Members of university departments associated with professional engineering activities sometimes try to claim exemptions from the general university educational objectives that I have outlined. The argument is that engineers have to take responsibility for the construction of reliable equipment, products, and installations for the benefit of mankind; that this requires practical training and experience that is not incorporated in university education aimed at developing students' minds; and that the engineering departments must therefore be permitted to depart from the broad educational objectives of the university in order to provide the necessary practical training for a professional career. As a civil engineer put it to me recently: "I will take any bet that you will refuse to have an appendectomy performed on you by a Ph.D. in medical science, no matter how well his mind has been developed."

It is interesting to compare the means of acquiring practical training and experience in engineering and in medicine. A man intending to practice medicine obtains practical training and experience by working in teaching hospitals which are frequently located on university campuses. The procedure is highly effective and yet can be made to fit in with academic life. Doctors-in-training assist with real operations on real people who can die (and sometimes do!). There is nothing artificial about a teaching hospital. It is genuine doctor-

ing business, and yet it can be conducted on a university campus.

To use a corresponding technique in engineering, it would be necessary to conduct genuine engineering business on university campuses. Real bridges would have to be designed, their erection would be supervised from university campuses, and real people would risk their necks crossing them. Imagine the howl that would go up from the local automobile dealers if, in order to provide practical experience for engineering students, the department of mechanical engineering went into a full-scale business of automobile servicing! The plain fact is that practical training corresponding to that in the teaching hospital is impractical in engineering.

An engineer receives his practical training and experience in industry after obtaining a university education, or sometimes concurrently with it. The vast business activity involved in the practical training of engineers has to be conducted within industry; no other arrangement is feasible or, probably, even desirable. Important, therefore, as the practical training of engineers is to mankind, it is not achieved by exempting university engineering departments from the preeminent educational objective of a university—the development of students' minds (*1*).

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Note

1. This material was presented during a symposium at the University of California, Berkeley, May 1963, and was based on a paper presented before the International Conference on Electrical Engineering Education, Syracuse University, September 1961. The author is IBM Professor of Engineering and Applied Mathematics at Cornell University, Ithaca, N.Y. He is temporarily at the Stanford Research Institute, Menlo Park, California.

Research in China

As agricultural research workers in mainland China several years before 1948, we can hardly agree with the statement made by Cheng in the first paragraph of his article "Insect control in mainland China" [*Science* **140**, 269 (19 April 1963)] that ". . . Before 1948, no organized research . . . in any field of science existed [in mainland China]. Insect control was practically unknown to the average farmer, who in his lifetime never saw a sprayer or a duster . . .".

Universities (for example, the University of Nanking since 1888) and

research institutes (for example, the National Agricultural Research Bureau since 1935) made significant contributions through organized scientific research long before 1948. Many average farmers not only *saw* but *used* sprayers and dusters before 1948; in fact, one of us (R. C. Liu) worked in China for the NARB supplying such tools to farmers.

Either the author left mainland China too early to know the organization and achievement of scientific research in China before 1948, or he has a different definition of "organized scientific research."

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I left China in November 1947, after having served as a university professor, a senior technical adviser to the Chinese National Relief and Rehabilitation Administration, and an officer of the United Nations Economic Commission for Asia and the Far East. My professional duties brought me to agricultural centers in all provinces south of the Yangtze River. Before leaving China, I devoted six months to collecting technical information from different ministries, government agencies, and research institutions in Nanking and Shanghai. In short, I am not unfamiliar with pre-Communist conditions as Liu, Tso, and Chang have suggested.

My statement that prior to 1948 the *average* Chinese farmer never saw a sprayer or duster in his lifetime is based on my talks with farmers in the provinces I toured, on my inspection of production facilities of the factories in which the equipment (mostly small hand sprayers and dusters) was manufactured, and on the size of the farming population in China. I would like to remind Liu *et al.* that over 75 percent of China's pre-Communist population, estimated to be 400-500 million, were engaged in agriculture. To equip only a small fraction of the nation's peasantry would have required millions of such hand sprayers and dusters; this huge quantity was far beyond the production capacity of the hastily equipped factories, which were medium-sized production shops by American standards.

Since it has been mentioned that Liu played a part in supplying such tools to farmers, I wonder if he could

tell how many of those units shipped to, say, Kwangtung and Fukien provinces actually reached the hands of "average farmers." I maintain that my statement is based on facts, part of which better remain untold. To say that a limited number of *fortunate farmers*, rather than "many average farmers," had access to sprayers and dusters is closer to actual conditions before 1948.

I am well aware of the work done at the University of Nanking and in the National Agricutural Research Bureau. Again, may I remind the gentlemen that from the outbreak of the Sino-Japanese war in 1937 to the end of World War II, the University of Nanking and major universities in north, east, and central China had to operate on improvised wartime campuses in west China. Those of us who have lived through the baptism of fire in China know what it was like trying to hold body and soul together and carry on teaching, with some research in addition. It is unfortunate, but true, that Chinese scientists barely had made a good start in the mid-1930's, when their research activities were interrupted by war.

As to my definition of "organized research," since my article deals with mainland China in its entirety, the term refers to the nation as a whole and not to a few isolated instances. It follows that by "organized research" is meant well-planned, administered, and coordinated research activities; it involves cooperation among related disciplines, and participation by various scientific institutions with national leadership and support, *in fact as well as in name*. I believe that those familiar with the history of scientific development in China will agree that no such organized research existed in any field of science prior to 1948. Instead, most of the pioneering work in science on the mainland was the fruit of tenacious efforts made by a small number of struggling scientists with or without outside help. Some research projects, like those in the University of Nanking, were supported in part by the China Foundation for the Promotion of Education and Culture, an independent organization administered jointly by Chinese and American educators; and others, like those in Lingnan University, were subsidized by religious and other organizations in America. Even in national universities, support from government funds was less than generous. As could be ex-