

SCIENCE

11 August 1967

Vol. 157, No. 3789

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

ESTUARY



We make house calls.

Have us demonstrate the new Ultek/EAI QUAD 150 residual gas analyzer under your roof. Whatever gas analysis jobs you have in-house (even ones a bit more exhaustive than the one suggested above), the QUAD 150 will no doubt fill the bill. For example, this quadrupole RGA has been proven in use for air pollution control studies; it is used with dry box systems

and in thin film work by the semiconductor industry; in vacuum tube exhaust analysis; in molecular beam studies and space satellite research; in biological and medical research for respiratory studies and breath analysis; and the QUAD 150 is used as a comprehensive leak detection system for all types of gases in a variety of high vacuum applications.

Let us know when you're ready for a house call. Your local Ultek office has a QUAD 150 RGA ready to go. You'll feel fine when you see what it can do.

QUAD is a trademark of Electronic Associates, Inc.

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ULTEK DIVISION / BOX 10920 PALO ALTO, CALIFORNIA 94303 / (415) 321-4117 / TWX 910-376-6442

Four new P's in the Mettler pod: some stay level, some weigh backwards, and some even weigh conventionally

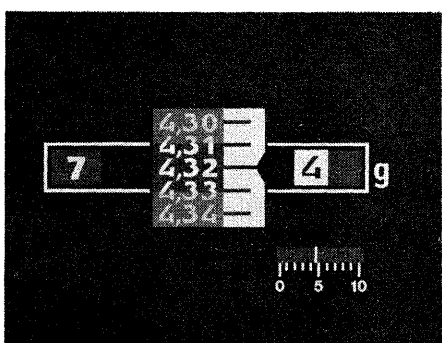
P160, P2000, P5 and P6 – these are the four new instruments we've added to our widely-accepted series of top-loading balances. They bring improved precision/capacity relationships while offering special advantages for particular applications.

WEIGH UP, WEIGH DOWN...

Perhaps the most unusual of the new group is the P160. It has the 160 g capacity of our finest analytical balances and the milligram precision of our best top-loader.

Its scale reads two ways. Operating conventionally, it tells you, with milligram precision, just how much weight you have on the pan.

A turn of a knob wipes out all traces of conventionality – your scale now tells you, in positive values and with milligram precision, just how much weight the object on the pan has **lost**. This reversible scale is important in all work in-



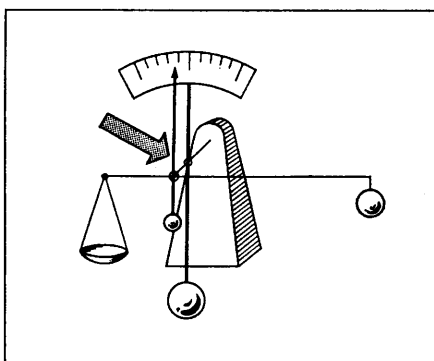
Digital or analog, up or down

volving weight loss studies such as drying and evaporation experiments and determination of residues. It makes possible, for the first time, gravimetric titration, in which titrant is dispensed directly by weight instead of indirectly by vol-

ume. We have done some homework on this subject.¹

...BUT NEVER SIDEWAYS

Some of the new P balances have the exclusive Mettler **level-matic** feature. This automatically compensates for slight changes in balance level which are due to work-



Secrets of level-matic

ing on a less-than-ideal balance table. Essentially a fail-safe system, it protects the unwary balance operator against himself. If tilt exceeds its compensation range, **level-matic** automatically covers the readout scale. Faulty readings are impossible.

Level-matic, available as an option on the P160 and P2000 instruments, is supplied as an integral feature on the larger P5 balance.

TWO KILOS IN A ONE-KILO CASE

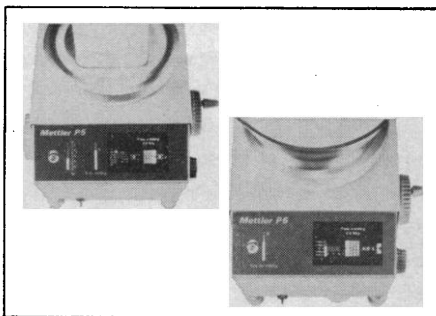
The model P2000 stands out by not really standing out. It is a remarkably compact unit that offers twice the capacity and 60% more

1) We've found 44 citations which suggest useful applications for, or advantages of, dispensing titrant by weight. If you'd like a copy, ask for Technical Information Bulletin 1014, "Gravimetric Titrimetry – a Review of the Literature."

taring than other instruments in its precision and size class. It has 2-kilo capacity with precision of ± 0.05 g and readability of 0.1 g.

MEET THE BIG BOYS

The P5 and P6 are the higher-capacity members of the new breed of P's. With comparable capacities, 5000 g and 6000 g respectively, the two units distinguish themselves in terms of performance and precision.



P5 and P6 – top-loading balances

The P6 offers fully automatic operation – place the sample on the pan and read the result – across its full capacity. It provides precision of ± 0.25 g.

The P5, on the other hand, provides about another decimal precision – ± 0.05 g – with automatic operation over its 1000 g optical scale.

FOR PRODUCT LITERATURE...

All the new Mettler balances are described in a new 10-page booklet. Get your copy from your laboratory supply dealer or request it from Mettler Instrument Corporation, 20 Nassau Street, Princeton, New Jersey 08540.

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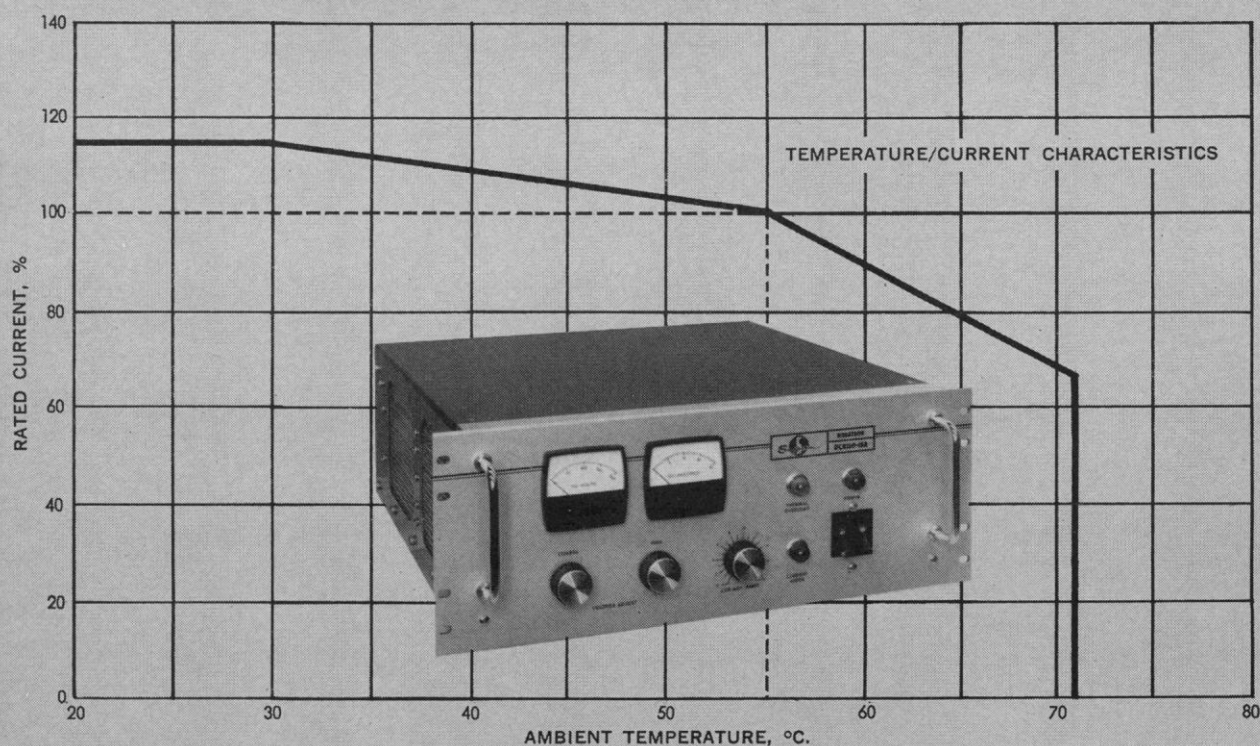
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COVER

Estuarine flow near Ocean City, Maryland. The tidal waters of Isle of Wight Bay (left, above) meet those of Chincoteague Bay (below, not shown) at Sinepuxet Bay and flow into the Atlantic Ocean (right) (scale of composite photograph, approximately 1:10,000). See review of *Estuaries*, page 672. [Reproduction of official photograph authorized, U.S. Department of Commerce, Environmental Science Services Administration, Coast and Geodetic Survey]

The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.



Sorensen DCR Series now with temperature capability to 71°C.

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Sorensen's wide range DCR Series has been up-dated and improved. What's new about the DCR's? They are now 100% silicon; ambient temperature capability is now to 71°C. • Four 3-phase models have been added extending power capability to 20 kW; 24 models are now available with ranges up to 300 volts. • Multiple mode programming—voltage/current/resistance. • Voltage regulation, line and load combined, is $\pm .075\%$ for most models • Constant current range 0 to rated current. • DCR's meet MIL-I-26600 and MIL-I-6181

specifications and conform to proposed NEMA standards. • Front panel indicator for voltage/current crossover. These features of the improved DCR (model numbers will have an "A" suffix) are offered at no increase in price. For DCR details, or for data on other standard/custom power supplies, AC line regulators or frequency changers, call your local Sorensen rep, or write: Raytheon Co., Sorensen Operation, Richards Avenue, Norwalk, Connecticut 06856. Tel: 203-838-6571.

MODEL SELECTION CHART

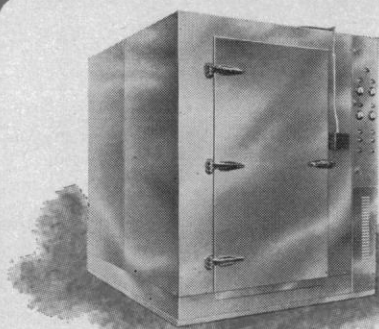
| Voltage | Amps. | Model | Price | Amps. | Model | Price | Amps. | Model | Price | Amps. | Model | Price |
|---------|-------|---------------|--------|-------|---------------|--------|-------|--------------|--------|-------|-------------|-------|
| 0- 20 | 125 | DCR 20- 125A | \$1180 | 250 | DCR 20- 250A | \$1550 | — | — | — | — | — | — |
| 0- 40 | 10 | DCR 40- 10A | 360 | 20 | DCR 40- 20A | 525 | 35 | DCR 40- 35A | \$ 750 | 60 | DCR 40-60A | \$925 |
| 0- 40 | 125 | DCR 40- 125A | 1390 | 250 | DCR 40 250A | 2100 | 500 | DCR 40-500A | 3050 | — | — | — |
| 0- 60 | 13 | DCR 60- 13A | 525 | 25 | DCR 60- 25A | 780 | 40 | DCR 60- 40A | 925 | — | — | — |
| 0- 80 | 5 | DCR 80- 5A | 360 | 10 | DCR 80- 10A | 580 | 18 | DCR 80- 18A | 780 | 30 | DCR 80-30A | 925 |
| 0-150 | 2.5 | DCR 150- 2.5A | 360 | 5 | DCR 150- 5A | 580 | 10 | DCR 150- 10A | 780 | 15 | DCR 150-15A | 910 |
| 0-300 | 1.25 | DCR 300-1.25A | 375 | 2.5 | DCR 300- 2.5A | 580 | 5 | DCR 300- 5A | 780 | 8 | DCR 300- 8A | 910 |

RAYTHEON

SEE US AT WESCON—BOOTH 2422, 2423

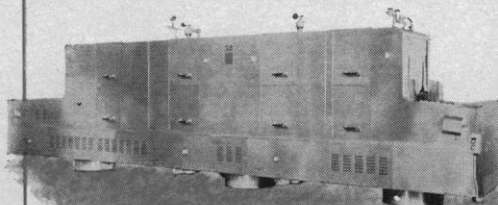
AMSCO-Specialty SERIES

ANIMAL CARE EQUIPMENT



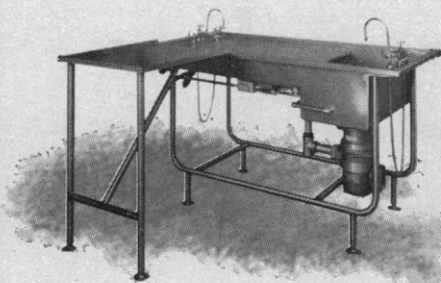
CAGE & RACK WASHERS

Modern design for highly efficient washing ... no exposed piping and pumps. 125-gallon integral screened detergent tank. Double stainless steel walls with styrofoam insulation contain heat. Controls are readily accessible. Stainless steel wash manifolds, spray pipes, high-velocity nozzles. Models for mounting in a pit or at floor level.



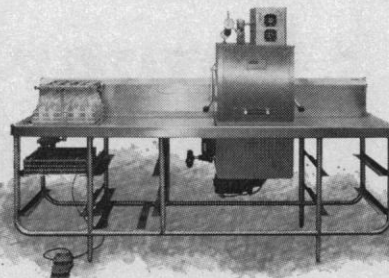
TUNNEL-TYPE CAGE WASHERS

Models available with 2, 3 or 4 tanks. Engineered for continuous production processing. All stainless steel conveyor. Integral motor/pump units have stainless steel motor shafts. Stainless steel hood, tanks and doors.



ANIMAL OPERATING-AUTOPSY TABLES

Convenient and easy to maintain. Rugged, all-welded stainless steel construction is highly corrosion resistant. Three standard models: 26½" W by 60" L, 31" W by 72" L and 36" W by 84" L. Working height 37¾". Integral sink and sump are pitched for efficient drainage.



BOTTLE WASHING & FILLING STATIONS

Durable stainless steel construction. Extremely simple to operate. Washes as many as 20 racks of bottles per hour. Generous counter space for racking bottles and sliding the racks directly into the washing chamber. Racks removed at opposite end (following processing) are then inverted and placed under bottle filler. Bottles are filled simultaneously, ready for return to animal rooms.

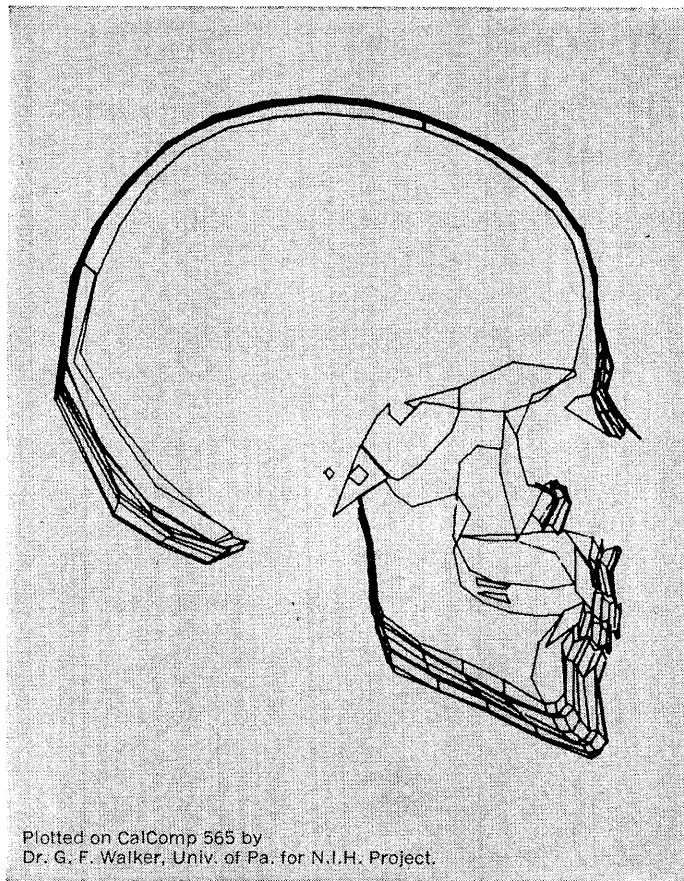
- Write for descriptive literature on any of the above products.

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Skull practice for creative programmers

This CalComp/Computer portrait of a growing boy is extremely helpful to anthropologists. Drawn from X-rays, it graphically reveals changes in bone structure in a normal child over a period of years.

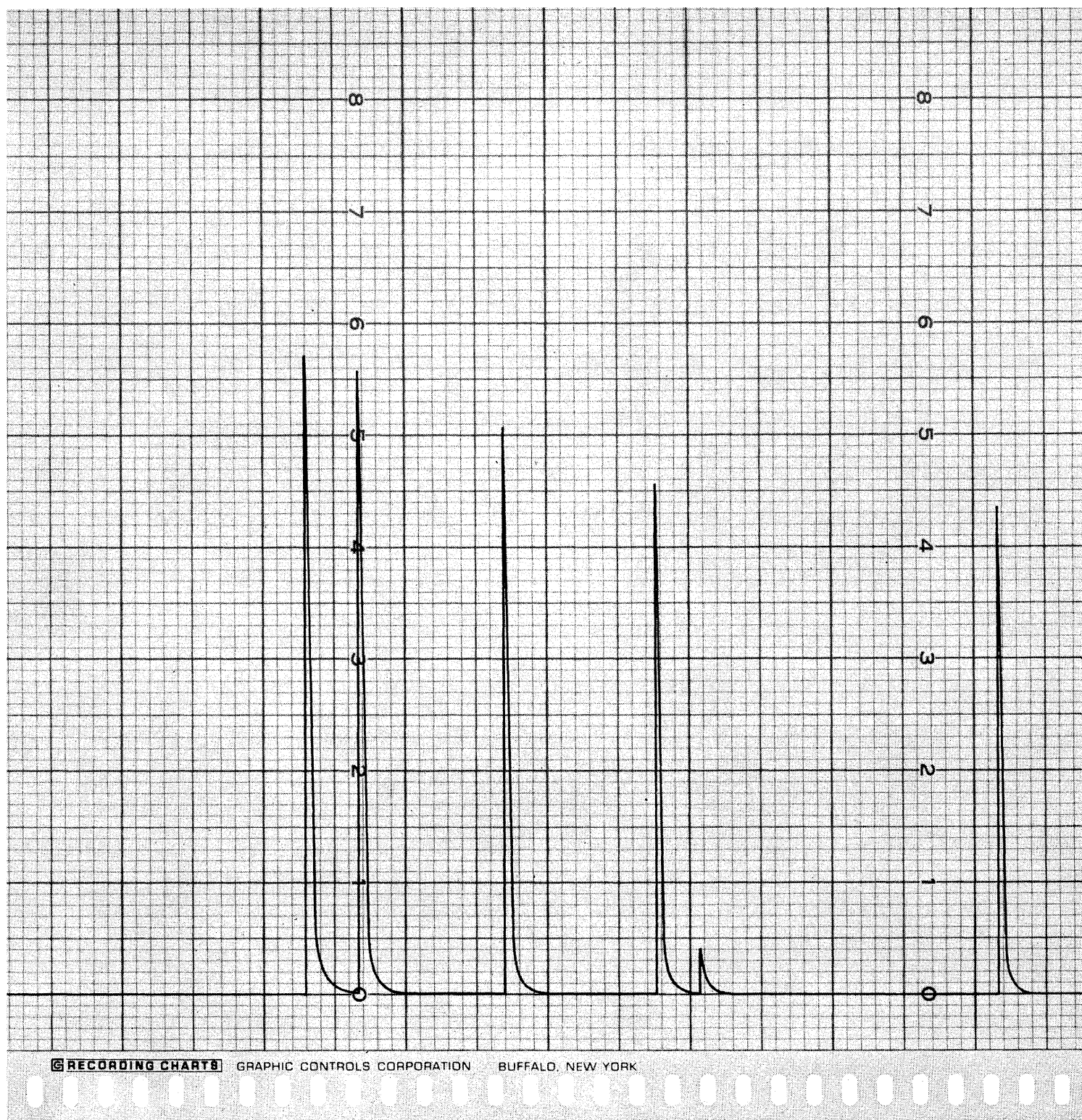
It's also a handy example of the kind of challenging assignments which creative programmers face week after week at CalComp.

If you are a talented programmer with a large innovational "bump" (we just can't get away from the phrenological), CalComp would like to show you what's ahead (oops) in computer graphics.

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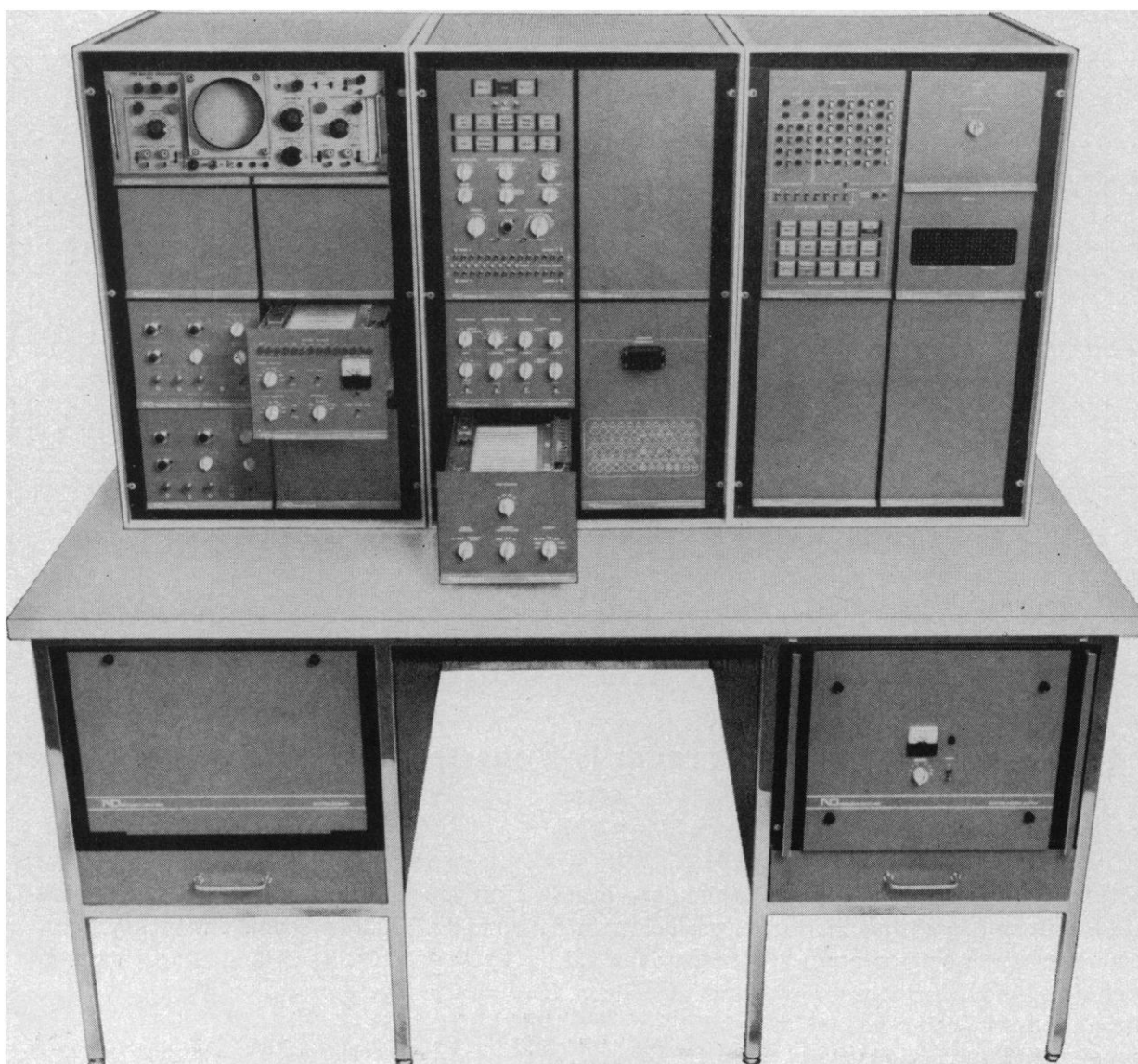
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For some time now Bolex has been making and selling (at $\frac{1}{4}$ to $\frac{1}{3}$ less than any one else) the best professional 16mm cine system you can buy.

ONE MAN OPERATION.—Bolex H-16 cameras have become famous for their ruggedness, dependability, quality optics and light weight, making them perfect for one man (Fig. 1) filming operations and eliminating the need for any kind of back-up crew.

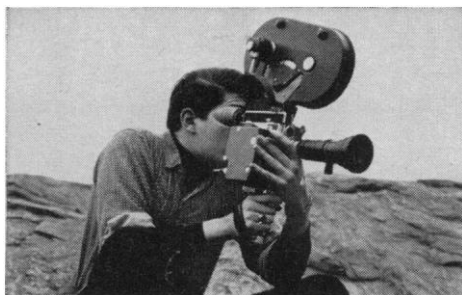


FIG. 1

FILM CAPACITY.—The only thing that Bolex H-16 cameras could be faulted on was that they only had a 100 ft. film capacity.

400 FT. MAGAZINE.—That's why we introduced the Bolex 400 ft. film magazine to fit both the H-16 REX-5 and the H-16 M-5 in the Bolex H-16 cine system.

SYNCHRONIZATION.—Used with the new constant speed motor (24 FPS) with sync output for lip-sync on $\frac{1}{4}$ inch tape and automatic built in clap-stick for easy synchronization, the 400 ft. magazine with either the H-16 REX-5 or the H-16 M-5, offers the professional user in any branch of movie production, science, industry or education unlimited versatility and scope.

THE TWO BASIC CAMERAS.—The H-16 REX-5 is a three lens-turret camera that offers reflex viewing and focusing on ground glass, allowing the photographer complete control of composition, framing and correct evaluation of depth of field. The H-16 M-5, built with economy in mind, is a single lens camera with viewing through a removable optical finder mounted on the side of the camera. The H-16 M-5 takes all standard "C" mount lenses or Pan Cinor and Angenieux zoom lenses, both equipped with reflex viewing and focusing.

LENSES AND ACCESSORIES.—There are 10 fixed focal length lenses from 10mm to 150mm in the H-16 system, and 7 zoom lenses giving a wide range of zooming ratios from 5 to 1 up to 10 to 1, including the Vario Switar 86EE, the world's first and only fully automatic 16mm variable focal length lens, with zoom from 18 to 86mm. Many accessories are available in the H-16 system including motors, close-up attachments, grips, matte box, titler, light meter, carrying cases and both optical sound and optical/magnetic sound projectors.

MANY APPLICATIONS.—Because of its ruggedness, compactness and light weight a single operator can use the Bolex H-16 system for any of the following applications:

Sports filming, including coaching and training films, for club and school use.
Medical photography, surgical and research filming, Cinephotomicrography.
Advertising, promotion and TV work for both studio and location shooting.
Travel and educational filming.
Wild life and nature photography.
Amateur film making.
Industrial filming, including training, recording, research and work study films.
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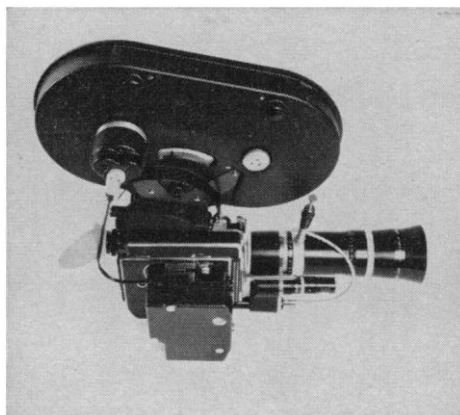


FIG. 2

The H-16 REX-5 camera (Fig. 2), with 400 ft. magazine, 24 FPS constant speed motor, detachable take-up motor on magazine eliminating the use of old fashioned take-up belts. The H-16 REX-5 offers reflex viewing and focusing on ground glass. Variable shutter. Filter slot. Accurate automatic dual frame counters and registrator claw for picture steadiness.

Shown on the camera is a Vario Switar 86EE zoom lens with automatic exposure control and a zoom range of 18 to 86mm. Maximum aperture f/2.5.

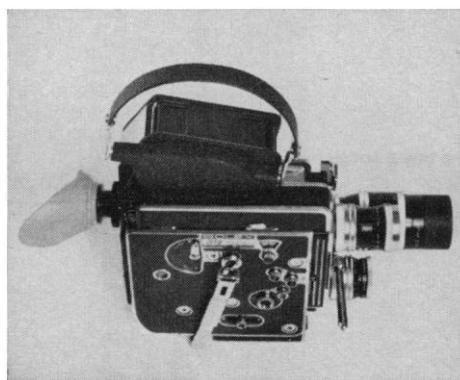


FIG. 3

The H-16 REX-5 (Fig. 3) shown without 400 ft. magazine. The camera takes 100 ft. film loads and has all of the traditional Bolex features such as filter slot, variable shutter for fades, dissolves and greater exposure control, automatic loading and provision to accept the 400 ft. magazine if desired. Lenses shown are Switar 10mm f/1.6, 25mm f/1.4, 75mm f/1.9.

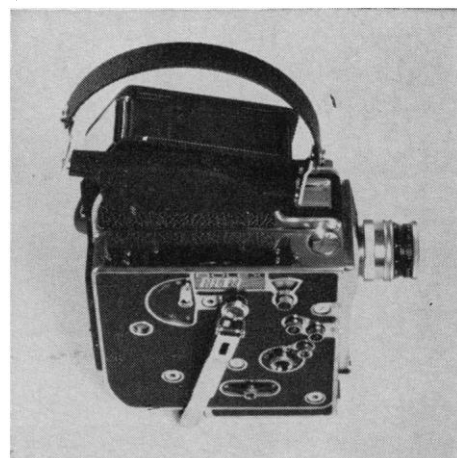


FIG. 4

The Bolex H-16 M-5 (Fig. 4), with single lens mount, an extremely economical, professional quality 16mm camera equipped with such features as variable speeds, single frame shooting, footage and frame counter, unlimited film rewind and automatic threading.

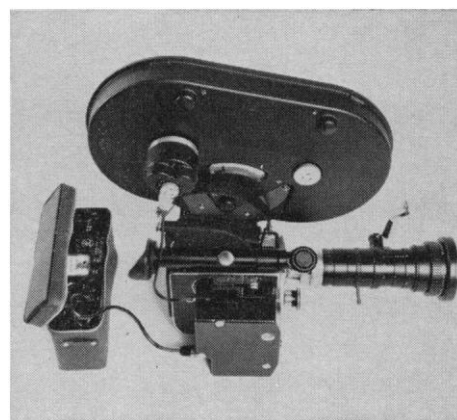


FIG. 5

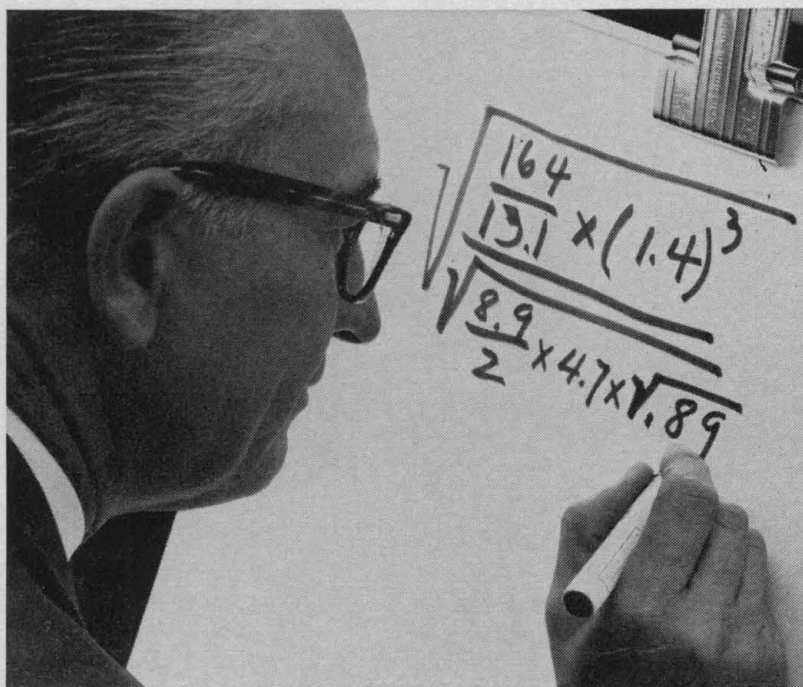
The H-16 M-5 (Fig. 5) can also be used in conjunction with the 400 ft. magazine, 24 FPS constant speed motor and rechargeable battery pack. This is an ideal set-up for sports filming where a large film capacity is desirable to avoid loss of action footage.

BOLEX.

SEND FOR BOOKLET.—If you would like a free 16 page School, Industrial or Medical Bulletin and a Bolex 16mm catalogue write: Paillard Inc., 1900 Lower Rd., Linden, N.J. 07036

*A division of Paillard Incorporated, manufacturers of Hermes office machines.

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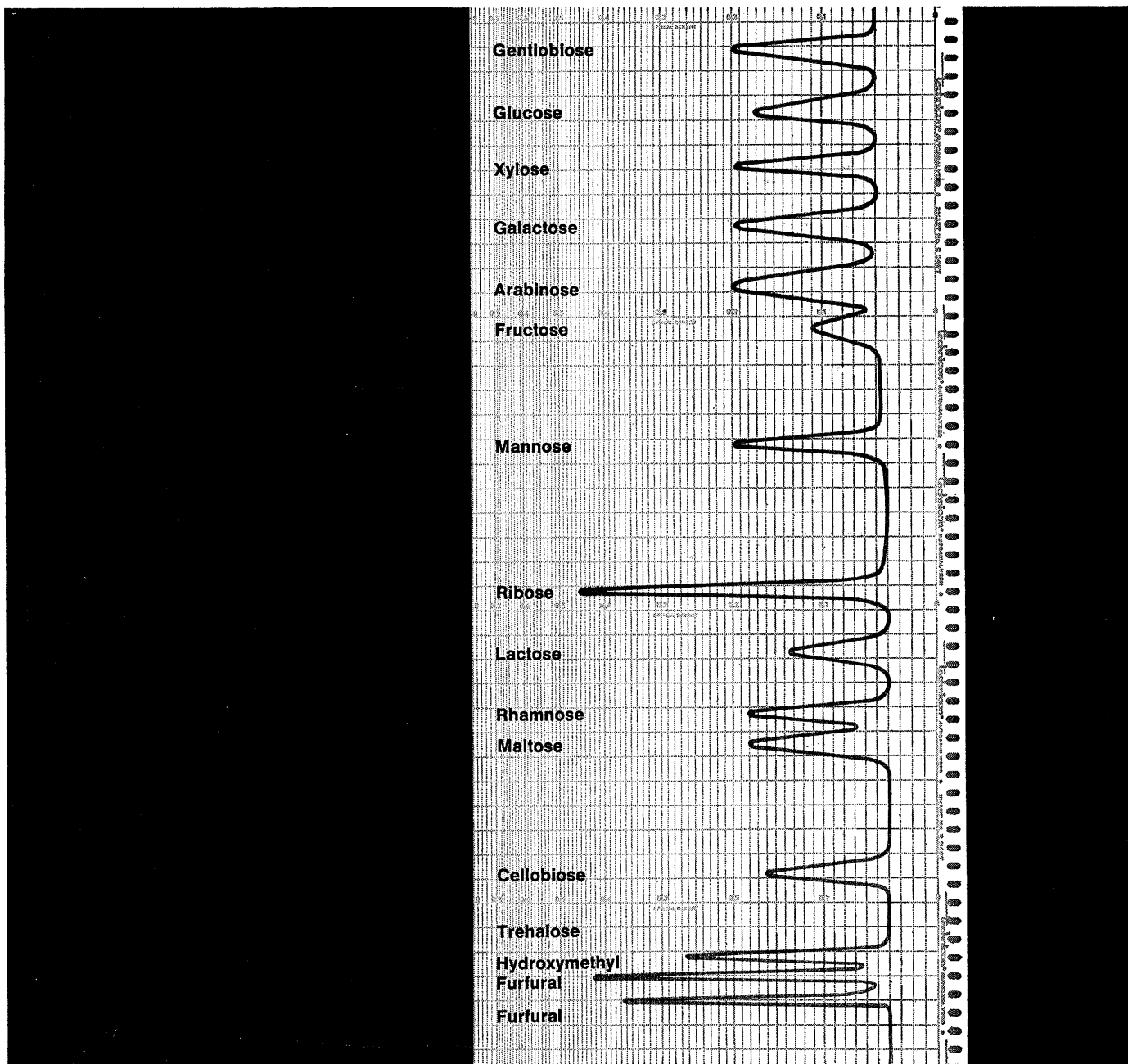
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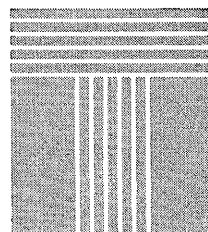


■ The 15-sugar chromatogram reproduced about one-sixth size above was produced on the new, automated Technicon Sugar Chromatography System in 7½ hours. Notice that furfural, hydroxymethylfurfural, pentoses, hexoses, and disaccharides are well resolved.

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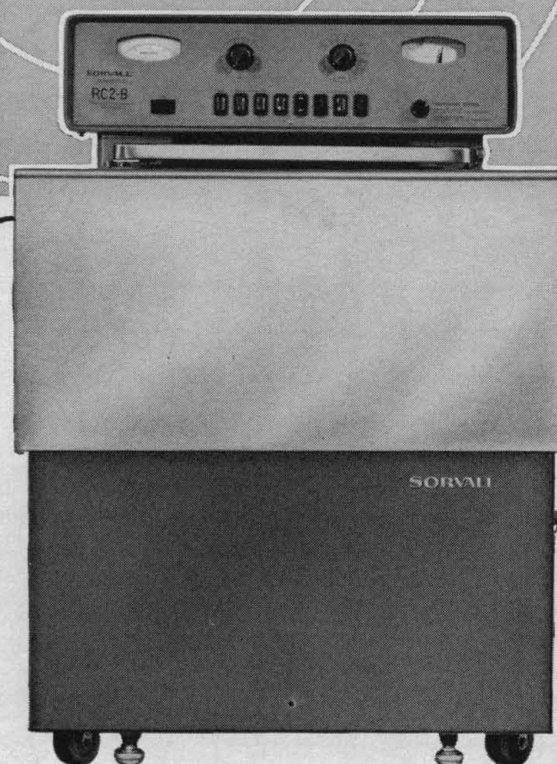
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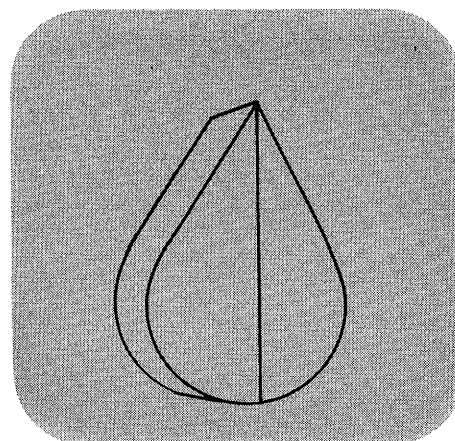
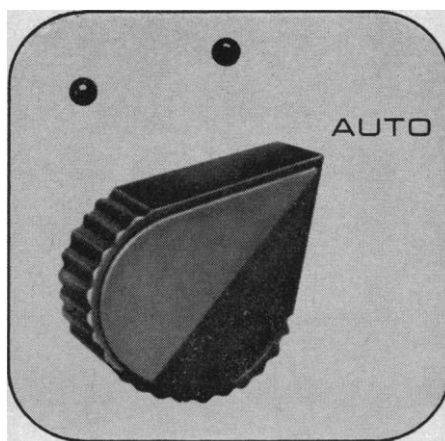
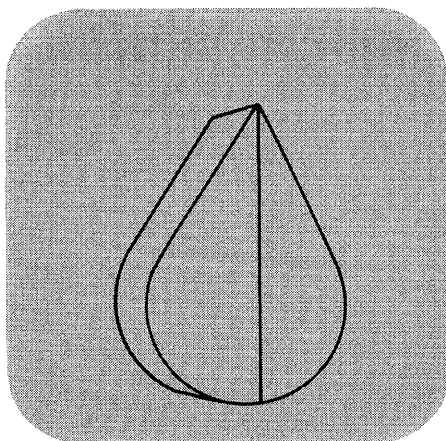
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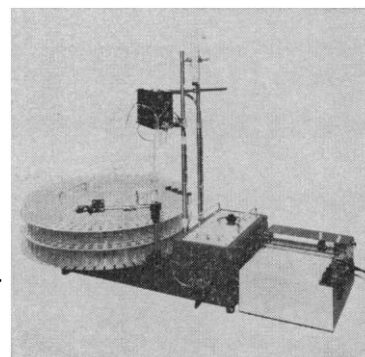
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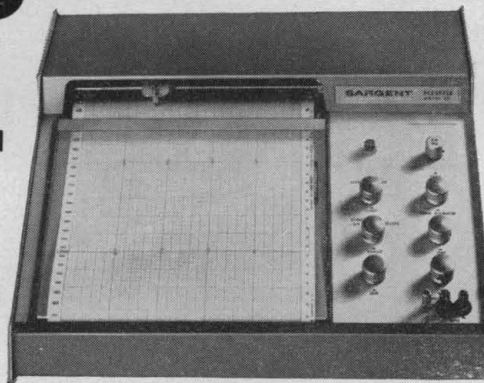
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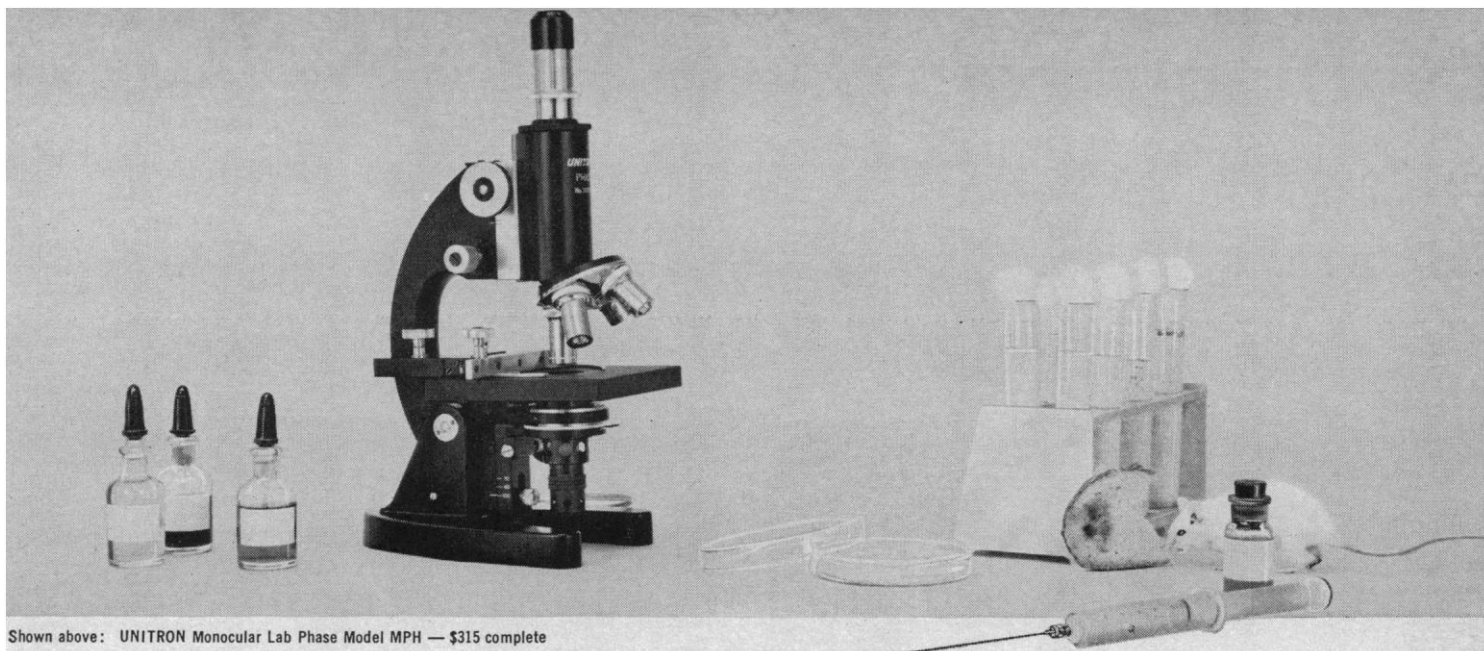
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There are 3 microscopes in this picture ...at a distinctly singular UNITRON price

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

So is UNITRON's MPH.

Some lab microscopes can also be used for *darkfield*.

So can UNITRON's MPH.

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

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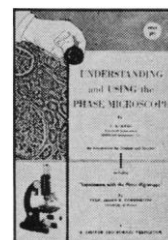
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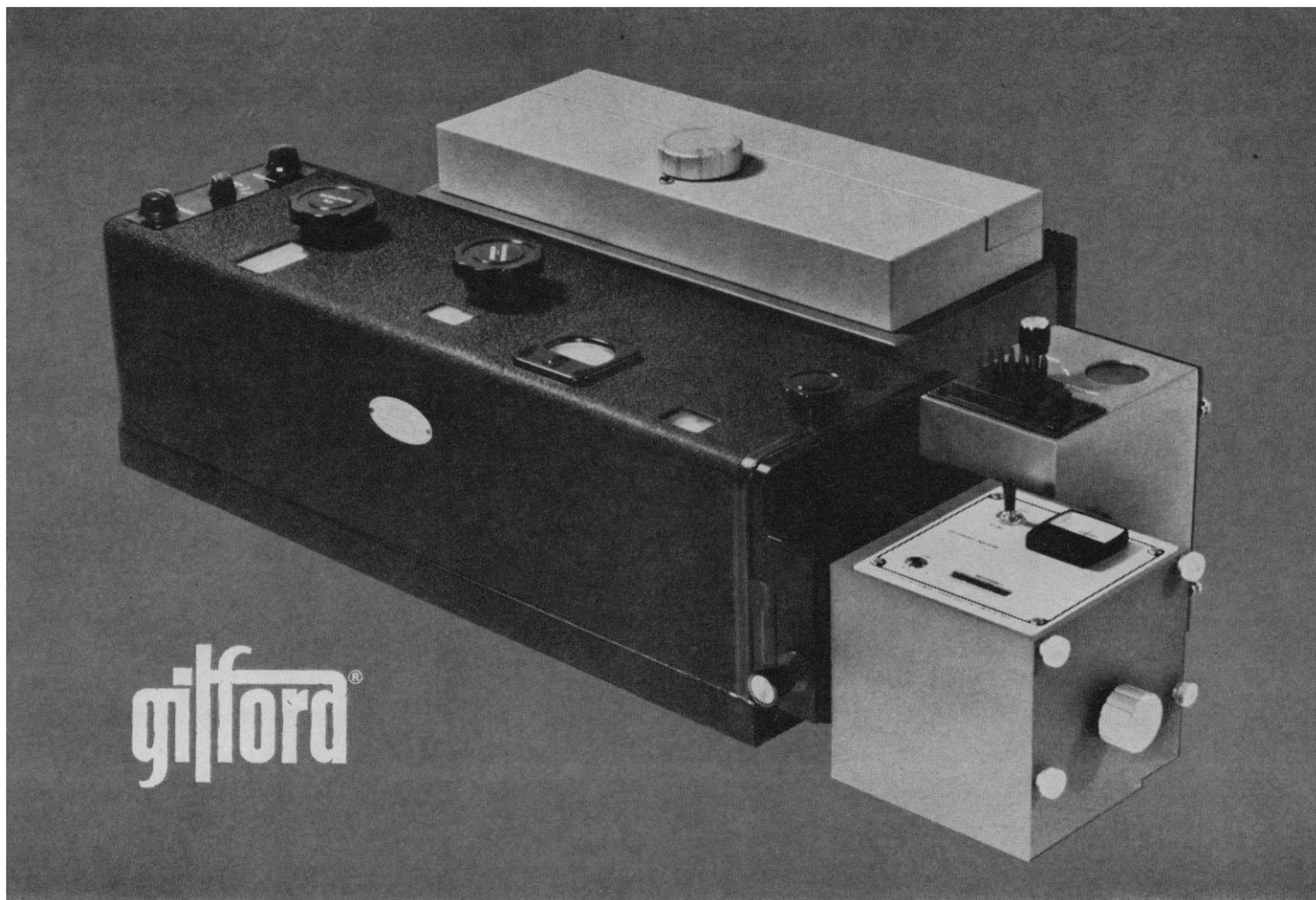


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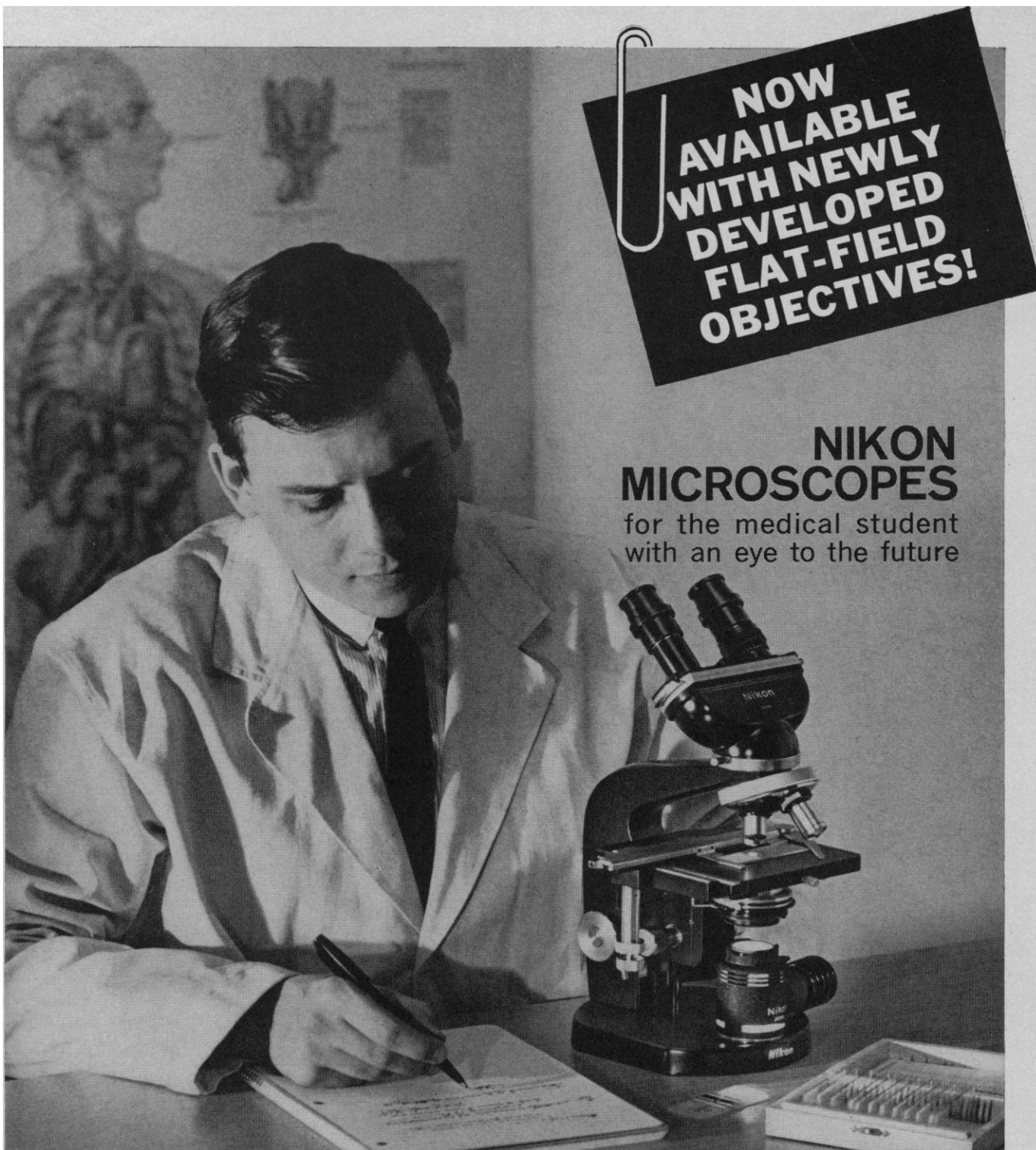
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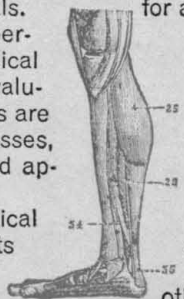
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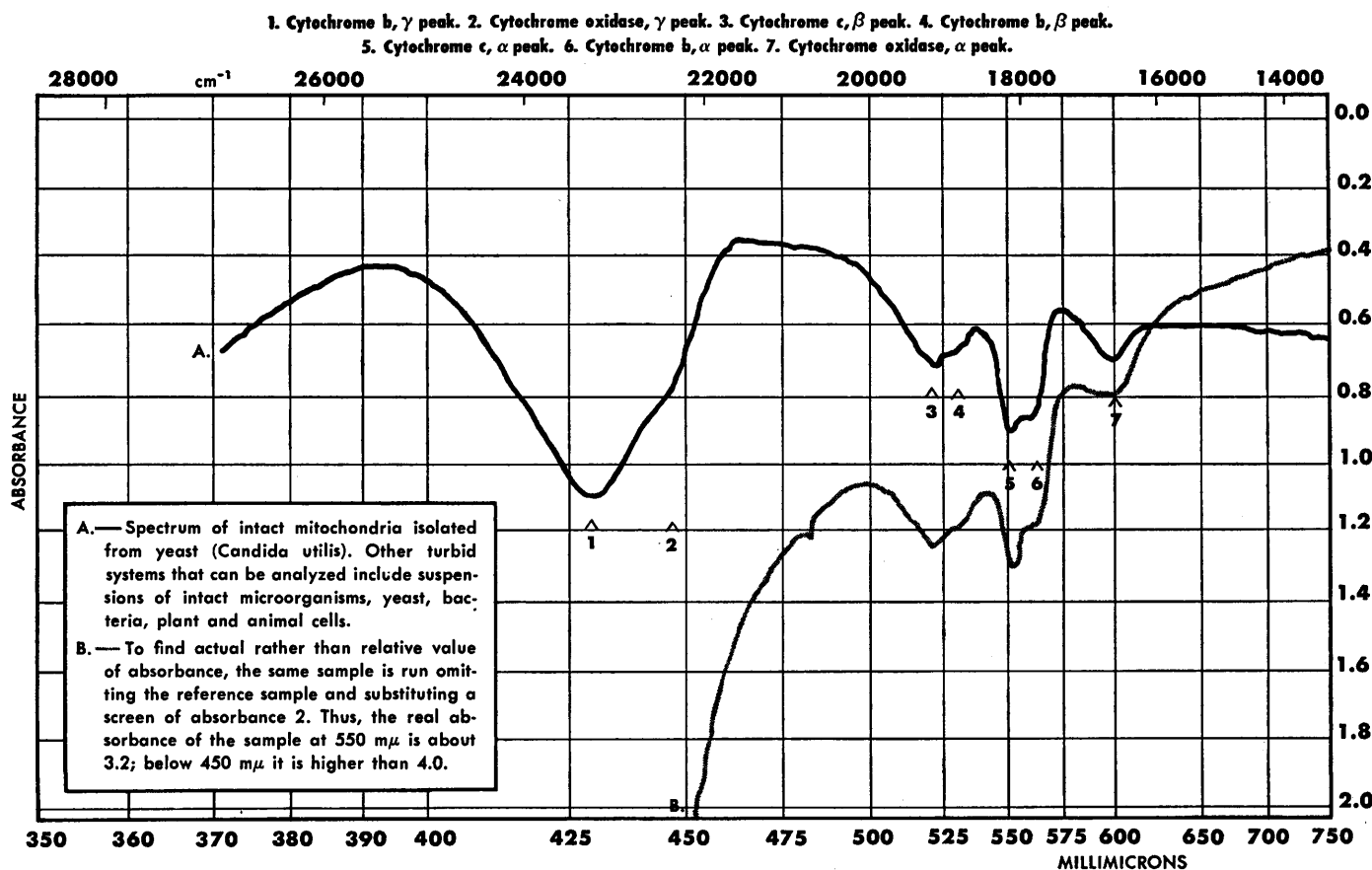
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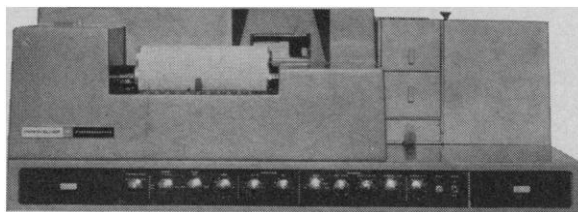
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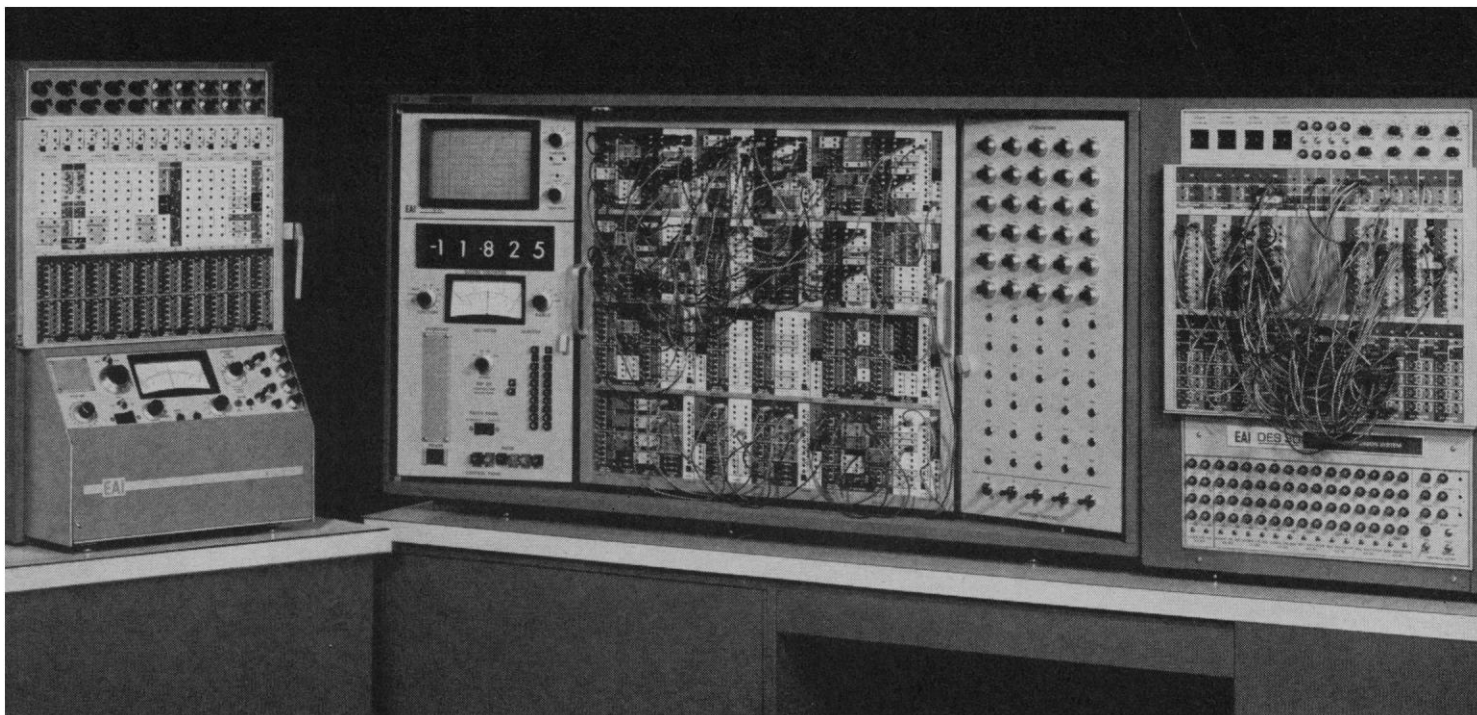
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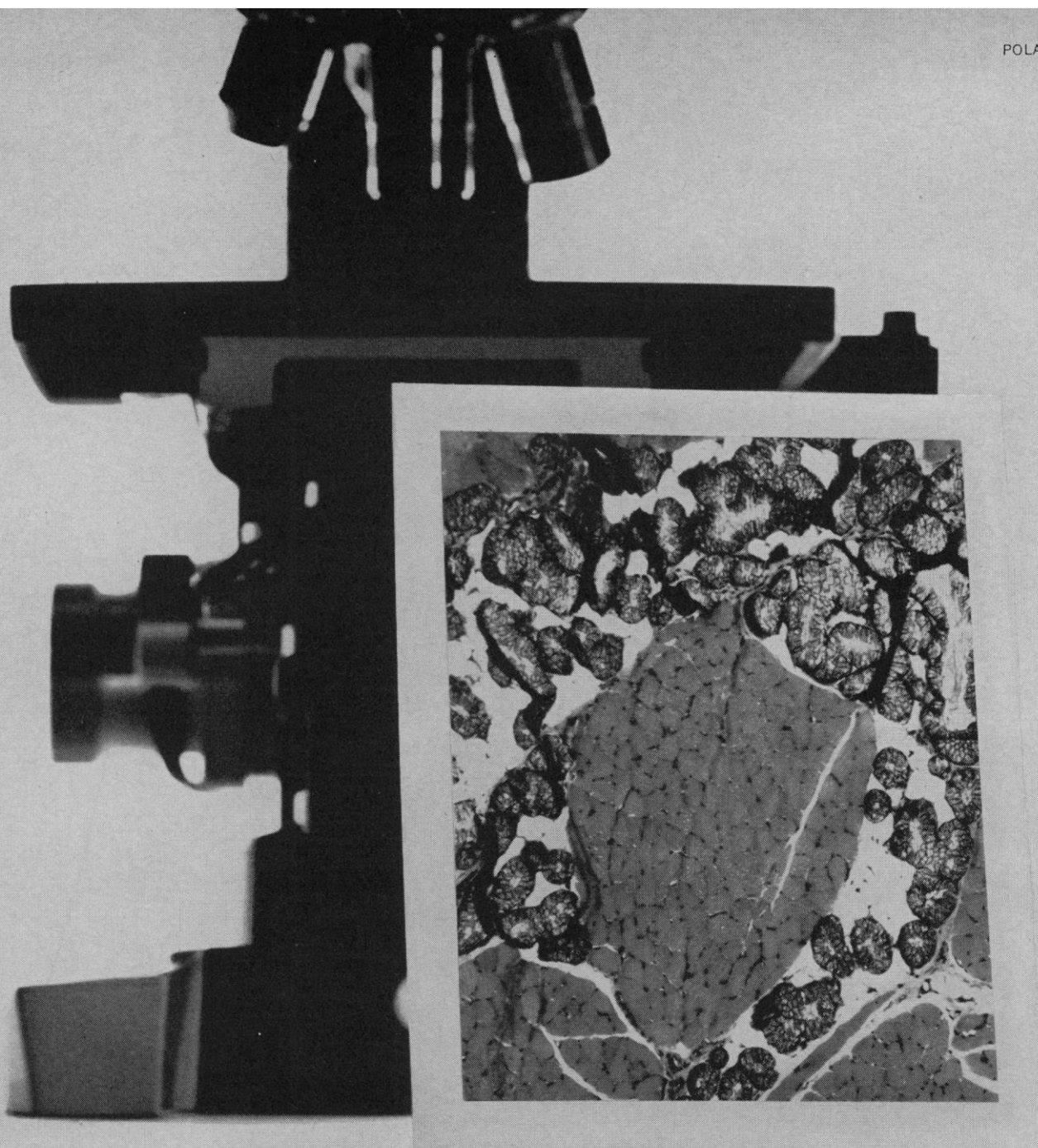
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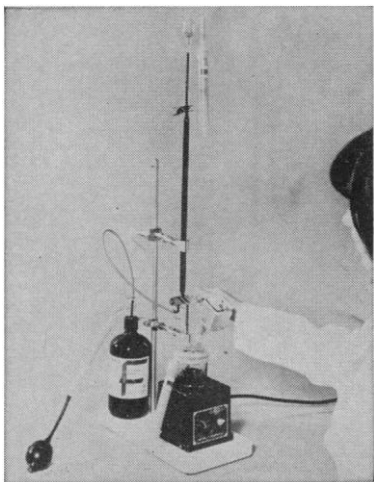
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With commendable discretion the authors recognize that only time and use will tell how helpful their interviews with scientists will be for historians; but, in fact, neither the authors nor others now working in this area question the general value of such oral histories. As for the manuscript materials (of which over 10,000 items are listed), professional historians of science with interest in the history of the physical sciences from about 1875 to 1935 will recognize the value of having this extraordinary source guide within arm's length.

ERWIN HIEBERT

*Department of History of Science,
University of Wisconsin, Madison*

Ph.D.'s: Pesky Foreign Languages

Feininger's opinions (Letters, 2 June) concerning the value of Ph.D. foreign language requirements lead me to express some observations of my own, gathered from years of teaching language reading courses to Ph.D. candidates. The old arguments for studying foreign languages (notably German and French for "scientific" reasons) are no longer viable. English is strongly entrenched as the medium through which contemporary scientific research is made known internationally. The English-speaking scientist is under no special constraint to write in any other language, while his non-English-speaking colleague may feel a very strong compulsion to use English if he wishes to advertise his work beyond the boundaries of his own country or language community. This state of affairs underlies the sentiment that the foreign language requirement is "something extra" in our Ph.D. curricula. Little progress has been made toward changing the archaic and sometimes informal method of testing via written translation of selections chosen for their special difficulty. I have yet to find proof that the skill to translate is a proper measure of fluency and I suspect that few Ph.D. candidates in the so-called "hard" sciences are willing to use the foreign language actively once they have passed that pesky translation exam. The candidate in the non-English speaking country, by contrast, remains ever aware of the lasting importance of English to his career.

While I approve Feininger's plea for better style and expression in the scientist's native language, I am not ready

to sacrifice foreign languages. Why should our scientists be deprived of the intellectual pursuit of learning another man's way of expression and his different cultural values? For one who must always be concerned with logical processes, what justification is there for disallowing the stimulating mental activity of having to reformulate and validate his thinking in another language? Many a physicist or chemist participating in an international convention or doing foreign research has felt the need to converse in any number of languages. Learning to speak or write a foreign language admittedly takes valuable time. Therefore let us make certain that our fledgling scientists get their language training early in the undergraduate years and let us give them greater latitude in selecting the language they wish to study.

ROBERT J. DI PIETRO

*Georgetown University Institute of
Languages and Linguistics,
Washington, D.C. 20007*

As a technical editor I am aware that many a keen scientific mind has not been trained to put together a concise and logically organized paragraph or even a grammatically correct sentence. It's a pity that our age of specialization should permit—even condone—such ill-balanced development. I would not, however, want English composition to be stressed at the expense of a foreign language requirement. Having observed members of the European scientific community speaking (not only reading) three or four different languages, I have become vividly aware of the language shortcomings of our U.S. education. I should like to see the pendulum swing toward true command of both English and some other language.

CHARLOTTE E. MAUK

*Lawrence Radiation Laboratory,
Berkeley, California 94720*

Measles Vaccines: Assured Safety

In Albrecht's letter (26 May) "Can measles be eradicated?" he states that "to the best of my knowledge" the duration of the controlled field trials of live attenuated measles virus vaccines have been for only one month's duration. Obviously, he is not familiar with the large amount of data on controlled studies now available (1-6). The controlled field trials of the new live

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acteristic that is incalculably more important than the usual "detector linearity" spec.

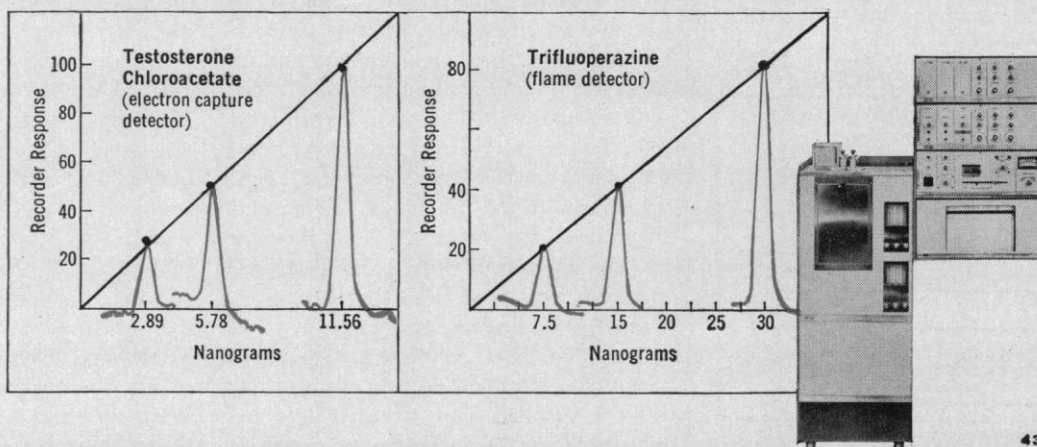
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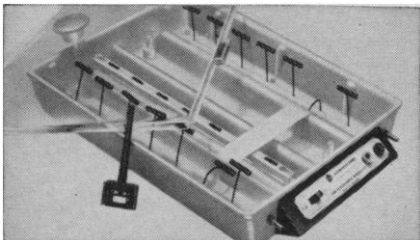


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attenuated mumps virus vaccine stated by Albrecht to have lasted for only 2 weeks were initially reported for a 7-month period (7–9). These data have now been extended over a 21-month period covering two mumps epidemic seasons.

The protective efficacy of Enders' live attenuated measles virus vaccine is in excess of 90 percent. This high level of protective efficacy has been demonstrated to persist for at least 4 years. The pattern of neutralizing antibody following Enders' vaccine parallels that for natural measles and has been demonstrated to remain essentially unchanged for at least 8 years, the longest period of observation, indicating that immunity will be lasting. Similar high level efficacy has been shown in the extensive measles vaccine trials carried out in West Africa, Chile, and other parts of the world. The savings in lives, to date, have numbered in the hundreds of thousands.

Once a live attenuated measles virus has produced a mild or inapparent infection with a clear-cut elevation of neutralizing antibodies, it would appear probable that natural, unmodified measles would not again occur, but that exposure to measles would either produce no symptoms or a highly modified infection. There would appear to be no justification for Albrecht's fears in this respect.

He also voices fears concerning extraneous agents of disease in the vaccines. In the production of vaccines under the strict procedures required by the U.S. Public Health Service (10), chick embryo cell cultures have been used which are prepared from eggs obtained from leukosis-free chickens. Had chick tissue been potentially dangerous, this should have been demonstrated in some of the millions of persons injected, starting in the 1930's, with the live attenuated yellow fever virus vaccine from chick tissue. Such vaccine was used long prior to demonstration of leukosis in chickens and in all probability contained this viral agent which apparently has been harmless to man in the intervening years. At present, no known extraneous viral agent has been found in chick tissue cultures used for vaccines. Also there is no known tumor virus pathogenic for chickens that has also been demonstrated as pathogenic for man.

Fears, such as Albrecht's, that needlessly have been raised concerning carefully controlled and licensed live attenuated viral vaccines have been

proved to be unfounded. The USPHS is fully cognizant of the prevention of thousands of deaths and of mental crippling by means of the live attenuated measles virus vaccine and should be fully supported in its urgent program to eradicate the natural disease. When a virus is of a single antigenic type, such as measles, a balance of nature can best be established by a live attenuated virus vaccine which produces an antibody curve, slightly lower but closely paralleling that of the natural disease.

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Who Pays for Pollution?

In Wolfe's editorial "Industry and environment" (16 June, p. 1441), he suggests industry should play a role in controlling our environment and then inadvertently (I suppose) gives the reason why it will not: "... most of the cost of polluting land, air, and water ... are passed on to others. ..." He also suggests government agencies and universities could help by "conducting studies" and "conducting necessary research."

I contend that conducting studies and necessary research will not remedy the problems. In fact, studies and research have been done and will continue to be done without further prodding. What we need is a way to put the cost of polluting back where it belongs—on

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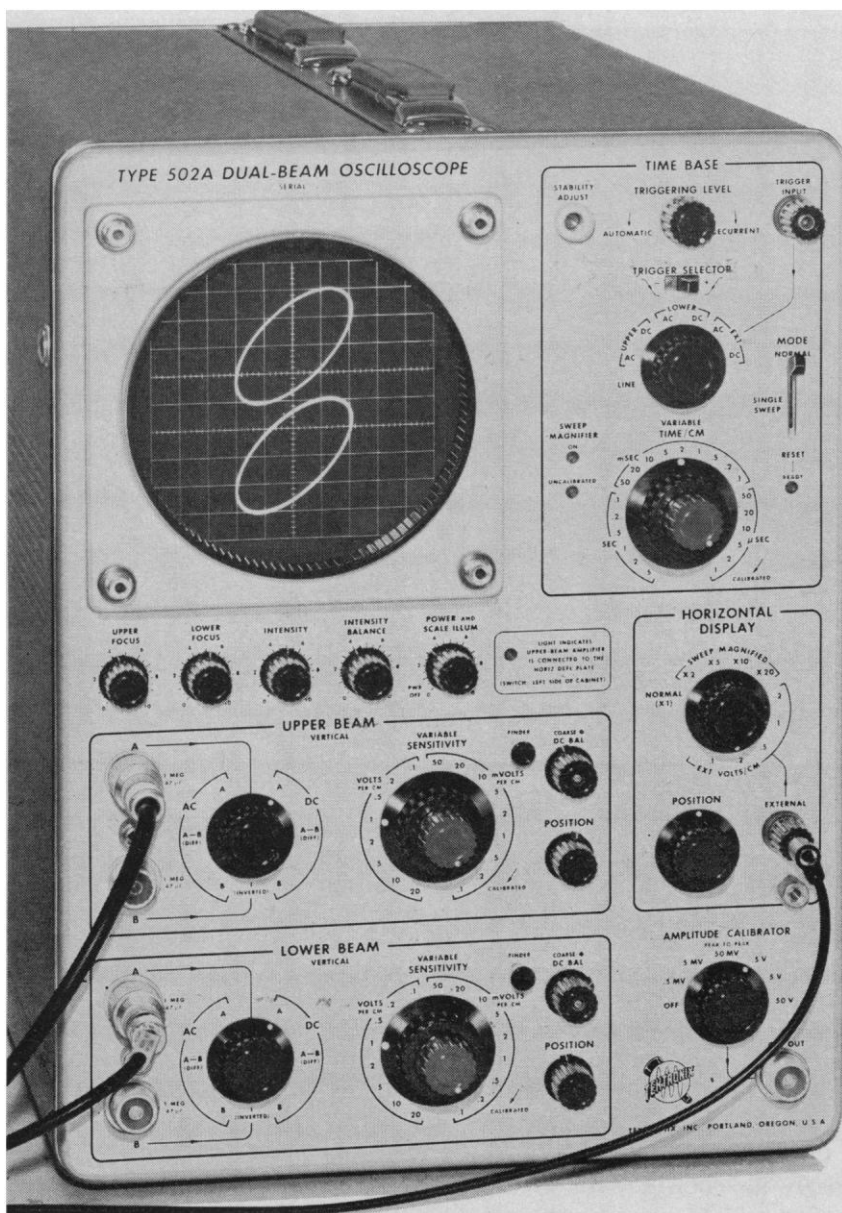
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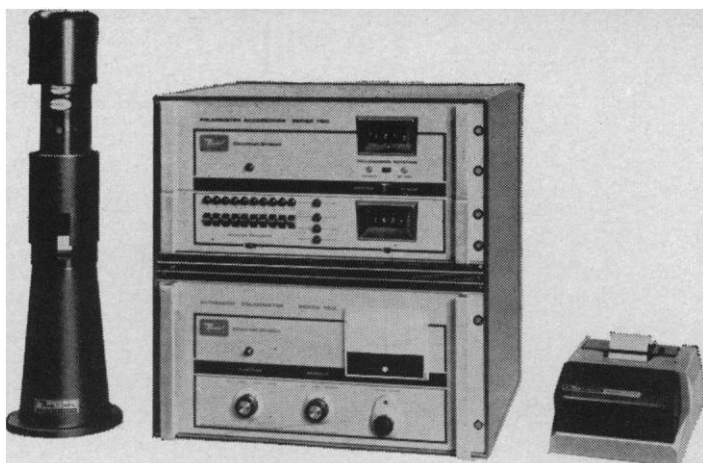
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the polluter. This can be done by outright punitive action by the federal government. If one calls the *federal* air pollution office here in San Francisco about a specific problem, he will be immediately referred to a *local* enforcement agency. Why? Because there are no enforceable federal laws to place the burden of the cost of polluting the community on the offender.

Wolfe is correct in feeling that practical solutions can best come from industry itself. The difficulty is that there is no incentive. If the housewife could bring her fly-ash-covered linen to the president of an industry for rewashing and if the husband could demand the board of directors repaint his house; if the emphysema patient could insist the stockholders donate their lungs, then you can be sure industry would have an incentive and would find a solution.

Industry is not necessarily the sole culprit. Many fine companies treat their effluents effectively, but not because they are so compelled by strict laws. They do so to improve public relations or to recover a by-product. It does not matter who is the polluter. It matters that if the polluter is made to bear the cost of pollution (rather than the public), the polluter will soon find a way to stop polluting.

ARTHUR R. GREGORY

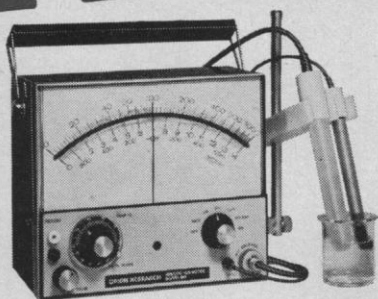
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Immobilizing Drugs Lethal to Swimming Mammals

Recent widespread use of central-nervous-system depressants in capture or restraint of wild animals has led to expansion of attempted telemetric experiments by greatly facilitating attachment of sensor-transmitters. In general, the use of many of these drugs on land animals has been successful once the appropriate dosage has been determined. For aquatic mammals in the water (especially cetaceans) attempts to use these drugs have been disastrous.

With very few exceptions, aquatic mammals swim with slightly negative buoyancy (that is, they are heavy rather than neutral or light), so that immobilization leads to sinking and drowning. Moreover, to simplify the situation a little, cetaceans breathe less automatically and more "on command" than terrestrial forms. As a result, early attempts to anesthetize porpoises led

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to death. Lilly, reporting experiments in 1955 by a team of eight neurologists, said, "These animals, in contrast to dry land ones, fail to breathe with relatively light doses of anesthetic, one-fourth that required for surgical levels of anesthesia. In other words, they lack our unconscious, automatic, self-sustaining breathing system" (1). In 1964 Nagel, Morgane, and McFarland (2) reported an ingenious technique for porpoise anesthesia, later extended by Ridgway (3). This involves dislodging and intubating the larynx, and, for this and other reasons, is suitable only for operating-room conditions, not for field use on free-swimming wild animals.

In summary, the use of presently known drugs to immobilize an aquatic mammal in the water is almost certain to kill the animal by suffocation, either by allowing it to sink or by stopping breathing, or both.

It is, of course, possible that a combination of drug and technique may be developed (we know of one thoughtful colleague who is engaged in this task), but it must be emphasized that such studies should be begun on captives under conditions that permit adequate autopsy of mistakes. There have recently been several attempts, for the most part not reported in the literature, to immobilize free-swimming cetaceans, resulting in the pointless death of a number of whales, none of which appears to have been recovered even as a carcass for useful study.

Apparently reports on only two such attempts on cetaceans have been published. One (4) was incomplete, and in another (5), fortunately, the whales eluded the would-be anesthetist. Three recent papers on immobilizing seals (6) are confined to animals out of water.

WILLIAM E. SCHEVILL, CARLETON RAY

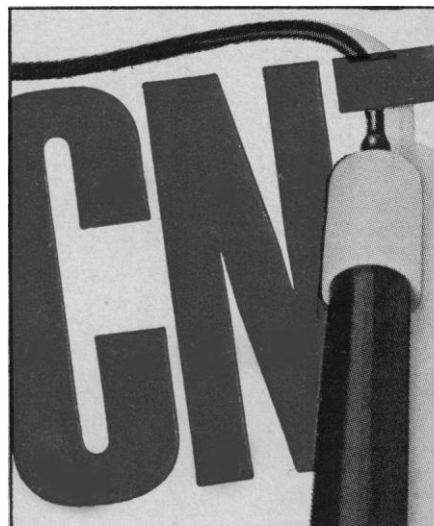
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Woods Hole Oceanographic Institution; Johns Hopkins University; Marine Mammal Committee, American Society of Mammalogists; California Academy of Sciences; American Museum of Natural History

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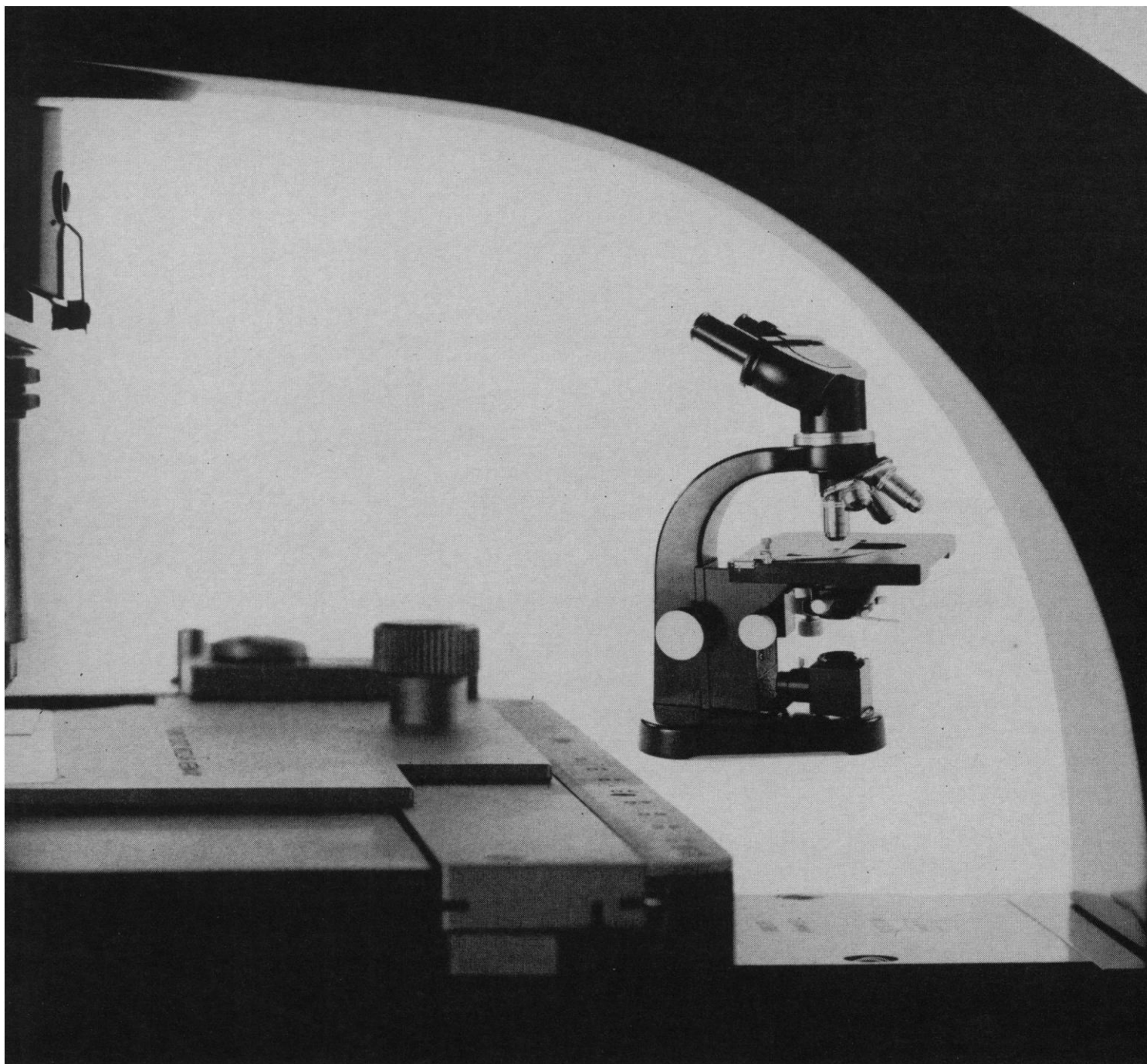
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Will Society Be Prepared?

New information is being obtained in the field of biochemical genetics at an extremely rapid rate. Thus far, this knowledge has had relatively little effect upon man. More information must be obtained before practical application will be possible, and the technical problems that must be overcome are formidable. However, when these obstacles have been removed this knowledge will greatly influence man's future, for man then will have the power to shape his own biologic destiny. Such power can be used wisely or unwisely, for the betterment or detriment of mankind.

Salvador Luria has said: "the progress of science is so rapid that it creates an imbalance between the power it places in the hands of man and the social conditions in which this power is exerted. Then neither warnings of scientists, nor breadth of public information, nor wisdom of citizens may compensate for inadequacies of the institutional framework to cope with the new situations."

The public understands to some extent the recent developments in biochemical genetics, but has only a vague notion of what may be expected in the future, in spite of the efforts of many scientists to inform the public about probable future developments.

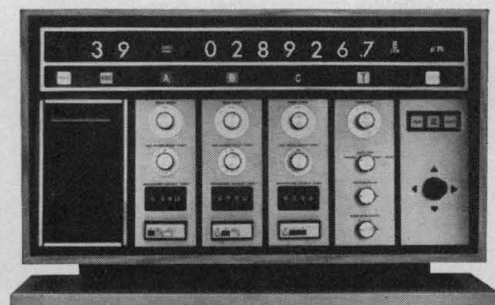
Where do we stand today? The genetic language now is known, and it seems clear that most, if not all, forms of life on this planet use the same language, with minor variations. Simple genetic messages now can be synthesized chemically. Genetic surgery, applied to microorganisms, is a reality. Genes can be prepared from one strain of bacteria and inserted into another, which is then changed genetically. Such changes are inheritable. Thus far, it has not been possible to program mammalian cells in this way.

What may be expected in the future? Short but meaningful genetic messages will be synthesized chemically. Since the instructions will be written in the language which cells understand, the messages will be used to program cells. Cells will carry out the instructions, and the program may even be inherited. I don't know how long it will take before it will be possible to program cells with chemically synthesized messages. Certainly the experimental obstacles are formidable. However, I have little doubt that the obstacles eventually will be overcome. The only question is when. My guess is that cells will be programmed with synthetic messages within 25 years. If efforts along those lines were intensified, bacteria might be programmed within 5 years.

The point which deserves special emphasis is that man may be able to program his own cells with synthetic information long before he will be able to assess adequately the long-term consequences of such alterations, long before he will be able to formulate goals, and long before he can resolve the ethical and moral problems which will be raised. When man becomes capable of instructing his own cells, he must refrain from doing so until he has sufficient wisdom to use this knowledge for the benefit of mankind. I state this problem well in advance of the need to resolve it, because decisions concerning the application of this knowledge must ultimately be made by society, and only an informed society can make such decisions wisely.—MARSHALL W. NIRENBERG, *National Heart Institute*

This editorial is adapted from remarks made in accepting the Research Corporation's 1966 award.

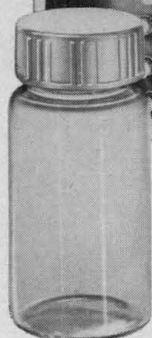
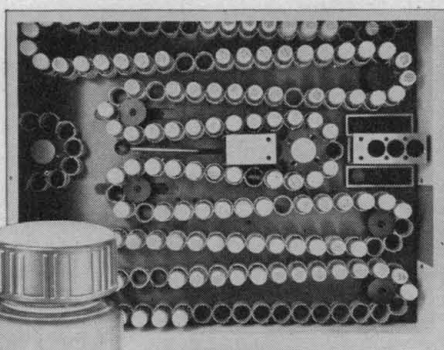
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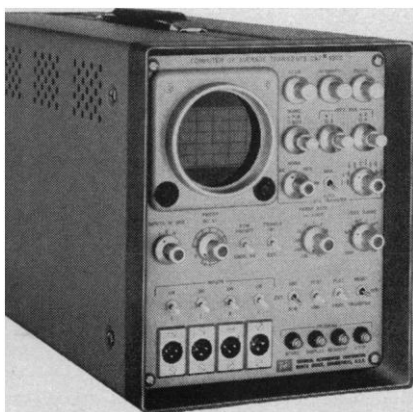
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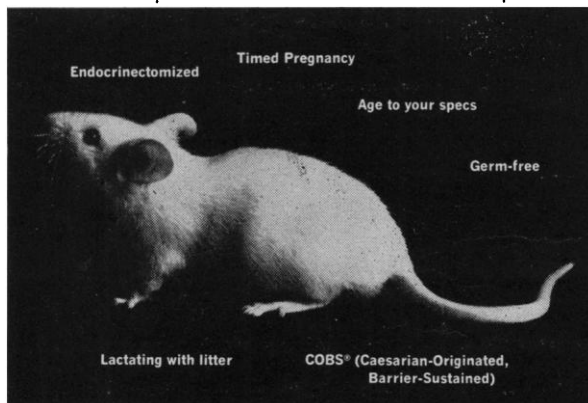


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Calendar of Events

National Meetings

August

23-25. **Gas Dynamics Symp.**, Evanston, Ill. (The Symposium, Northwestern Univ., Evanston)

23-25. **Wave Propagation and Dynamic Properties of Earth Materials**, symp., Albuquerque, N.M. (G. E. Triandafilidis, Univ. of New Mexico, P.O. Box 188, University Station, Albuquerque 87106)

23-26. **American Physiological Soc.**, fall mtg., Washington, D.C. (Executive Secretary, 9650 Wisconsin Ave., Bethesda, Md.)

24-26. **Phytochemical Soc. of America**, annual mtg., Madison, Wis. (T. J. Mabry, Univ. of Texas, Austin 78712)

27. **American Assoc. of Electromyography and Electrodiagnosis**, annual mtg., Miami Beach, Florida. (M. K. Newman, 16861 Wyoming Ave., Detroit, Mich.)

27-31. **American Soc. for Pharmacology and Experimental Therapeutics**, fall mtg., Washington, D.C. (Executive Officer, 9650 Wisconsin Ave., Bethesda, Md.)

27-1. **American Congr. of Physical Medicine and Rehabilitation**, 45th annual session, Miami Beach, Fla. (Executive Director, 30 N. Michigan Ave., Chicago, Ill.)

27-1. **American Inst. of Biological Sciences**, 18th annual mtg., College Station, Tex. (AIBS, 3900 Wisconsin Ave., NW, Washington, D.C.)

The following societies will meet in conjunction with the AIBS. Additional information is available from AIBS or from the program chairmen listed below.

American Bryological Soc. (Secretary-Treasurer, Box 36, S.W. Missouri State College, Springfield)

American Soc. for Horticultural Science. (Executive Director, 615 Elm St., St. Joseph, Mich. 49085)

American Soc. of Human Genetics. (c/o Division of Medical Genetics, Dept. of Medicine, Johns Hopkins Hospital, Baltimore 5, Md.)

American Soc. of Naturalists. (Executive Director, 3900 Wisconsin Ave., NW, Washington, D.C. 20016)

American Soc. of Plant Physiologists. (Secretary, c/o Dept. of Biology, Yale Univ., New Haven, Conn.)

American Soc. of Plant Taxonomists. (Secretary, c/o Botany Dept., Univ. of California, Berkeley)

Botanical Soc. of America. (Secretary, c/o Botany Dept., Indiana Univ., Bloomington)

Ecological Soc. of America. (Secretary, c/o Ecology Section, Health Physics Div., Oak Ridge National Lab., Oak Ridge, Tenn.)

Genetics Soc. of America. (Executive Director, 3900 Wisconsin Ave., NW, Washington, D.C. 20016)

Mycological Soc. of America. (Secretary-Treasurer, c/o Pioneering Res. Div., Natick Labs., Natick, Mass.)

28-30. **Gatlinburg Conf. on Special Topics in Nuclear Education and Research**, Gatlinburg, Tenn. (J. E. Mott, Oak Ridge Associated Universities, Box 117, Oak Ridge, Tenn. 37830)



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Ref.: 1. Fed. Proc., 21, 412.

2. J. Am. Chem. Soc., 86, 304-5, 1964.

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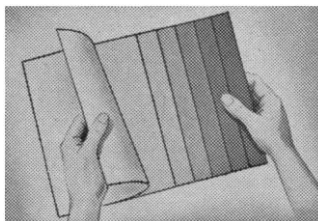
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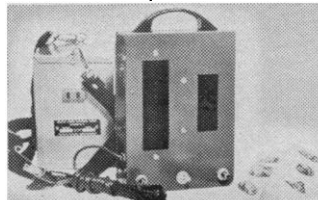
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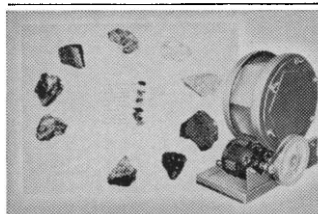
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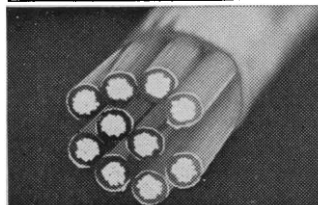
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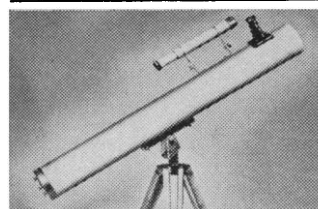
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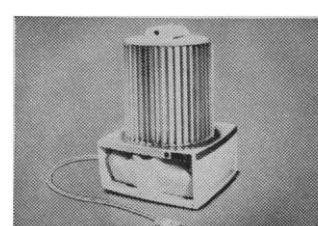
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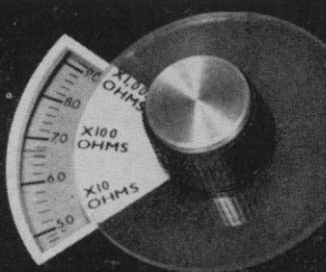


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28-30. Preparation and Properties of **Electronic Materials**, 9th annual conf., New York, N.Y. (L. R. Weisberg, RCA Labs., David Sarnoff Research Center, Princeton, N.J. 08540)

28-30. **Space Program Issues of the 70's**, conf., Seattle, Wash. (AIAA, Meetings Manager, 1290 Sixth Ave., New York 10019)

28-31. **Clay Minerals Soc.**, 16th natl. conf., Golden, Colo. (L. G. Schultz, U.S. Geological Survey, Bldg. 25, Federal Center, Denver, Colo. 80225)

28-1. **Electron Microscope Soc. of America**, 25th annual mtg., Chicago, Ill. (Executive Director, c/o School of Chemical Engineering, Olin Hall, Cornell Univ., Ithaca, N.Y. 14850)

28-2. **Alaska Science Conf.**, 18th, College. (P. Morrison, Inst. of Arctic Biology, Univ. of Alaska, College 99735)

29-31. **Association for Computing Machinery**, 22nd natl. conf., Washington, D.C. (T. Willette, Box 6, Annandale, Va. 22003)

29-1. **Electron Microscopy Soc. of America**, annual mtg., Chicago, Ill. (A. V. Loud, Pathology Dept. College of Physicians and Surgeons, Columbia Univ., 630 W. 168 St., New York 10032)

31-2. **American Physical Soc.**, Seattle, Wash. (Executive Secretary, 538 W. 120 St., New York 10027)

31-6. **American Psychological Assoc.**, annual mtg., Washington, D.C. (APA, 1200 17th St., NW, Washington 20036)

International and Foreign Meetings

August

22-25. **Nematology**, 9th intern. symp., Warsaw, Poland. (H. Sandner, c/o Inst. of Ecology, Dept. of Applied Biology, Nowy Swiat 72, Warsaw)

22-31. **International Astronomical Union**, 13th general assembly, Prague, Czechoslovakia. (Asst. Secretary-General, Astronomical Institute, Czechoslovak Acad. of Sciences, Budecka 6, Prague)

23-25. **Canadian Assoc. of Physical Medicine and Rehabilitation**, 15th annual mtg., Winnipeg, Man., Canada. (Secretary-Treasurer, 153 Lyndhurst Ave., Toronto 4, Ontario)

23-25. **Computational Linguistics**, intern. conf., St. Martin-Dheres, France. (A. H. Roberts, Center for Applied Linguistics, 1717 Massachusetts Ave., NW, Washington, D.C. 20036)

24-28. **Anaesthesia**, 3rd intern. symp., Poznan, Poland. (W. Jurczyk, Ul. Długa 1/2, Poznan)

24-28. **Marine Biology**, 2nd European symp., Bergen, Norway. (H. O. Brattstrom, Biological Station, Univ. of Bergen, Bergen)

25-30. **Hyperfine Interactions Detected by Nuclear Radiation**, intern. conf., Pacific Grove, Calif. (K. E. Sebrell, Lawrence Radiation Lab., Univ. of California, Berkeley 94720)

25-31. **Physical Medicine**, 5th intern. congr., Montreal, P.Q., Canada. (B. Talbot, 6300 Darlington Ave., Montreal 26)

25-1. **First Intern. Health Conf.**, Copenhagen, Denmark. (P. A. Wells, 90 Buckingham Palace Rd., London, S.W.1, England)

BOOKS RECEIVED

(Continued from page 675)

Handbook of Electronic Instruments and Measurement Techniques. Harry E. Thomas and Carole A. Clarke. Prentice-Hall, Englewood Cliffs, N.J., 1967. 410 pp. Illus. \$16.

The Hidden Order of Art: A Study in the Psychology of Artistic Imagination. Anton Ehrenzweig. Univ. of California Press, Berkeley, 1967. 320 pp. Illus. \$8.95.

High-Temperature Polymers. A symposium (Los Angeles, Calif.), November 1965. Charles L. Segal, Ed. Arnold, London; Dekker, New York, 1967. 205 pp. Illus. \$8.75. Ten papers previously published in *Journal of Macromolecular Science (Chemistry)*, vol. A1, No. 1, 1967.

Histologie und Mikroskopische Anatomie des Menschen. W. Bargmann. Thieme, Stuttgart, 1967. 796 pp. Illus. DM 69.80.

A History of Psychology in Autobiography. vol. 5. Edwin G. Boring and Gardner Lindzey, Eds. Appleton-Century-Crofts (Meredith), New York, 1967. 463 pp. Illus. \$8. Century Psychology Series.

Human Neural and Behavioral Development: A Relational Inquiry, with Implications for Personality. Esther Milner. Thomas, Springfield, Ill., 1967. 419 pp. Illus. \$17.50.

Hyperfine Interactions. Arthur J. Freeman and Richard R. Frankel, Eds. Academic Press, New York, 1967. 774 pp. Illus. \$16. Twenty-five papers.

The Importance of Antibonding Orbitals. Milton Orchin and H. H. Jaffé. Houghton Mifflin, Boston, 1967. 112 pp. Illus. Paper, \$2.50.

Informal Geometry. Lawrence A. Ringenberg. Wiley, New York, 1967. 163 pp. Illus. \$5.50.

Instrumentation in Nuclear Medicine. vol. 1. Gerald J. Hine, Ed. Academic Press, New York, 1967. 676 pp. Illus. \$27.50. Twenty-one papers.

The Intellectuals and McCarthy: The Radical Specter. Michael Paul Rogin. M.I.T. Press, Cambridge, Mass., 1967. 384 pp. Illus. \$12.50.

Intravenous Abdominal Aortography and Placentography. Melvyn H. Schreiber, Fred J. Wolma, and Charles K. Hendrick. Thomas, Springfield, Ill., 1967. 67 pp. Illus. \$8.75.

Introduction to Computational Linguistics. David G. Hays. Elsevier, New York, 1967. 247 pp. Illus. \$9.75. Mathematical Linguistics and Automatic Language Processing Series.

Introduction to Geochemistry. Konrad B. Krauskopf. McGraw-Hill, New York, 1967. 735 pp. Illus. \$12.50.

An Introduction to Magnetohydrodynamics. P. H. Roberts. Elsevier, New York, 1967. 274 pp. Illus. \$11.

Introduction to Organic Chemistry. Charles H. DePuy and Kenneth L. Rinehart, Jr., Wiley, New York, 1967. 406 pp. Illus. \$8.95.

Introduction to Probability and Statistics. San Francisco, 1967. 592 pp. Illus. \$10.75. Holden-Day Series in Industrial Engineering and Management Science.

Introduction to the Principles of Heterogeneous Catalysis. J. M. Thomas and

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L-Aspartic acid-UL-C-14

L-Glutamic acid-UL-C-14
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Glycine-2-C-14
Glycine-UL-C-14
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5-Hydroxy-DL-Tryptophan-
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L-Isoleucine-UL-C-14
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L-Leucine-1-C-14
L-Leucine-UL-C-14
L-Lysine-UL-C-14
L-Methionine-(methyl-C-14)
L-Phenylalanine-1-C-14
L-Phenylalanine-UL-C-14
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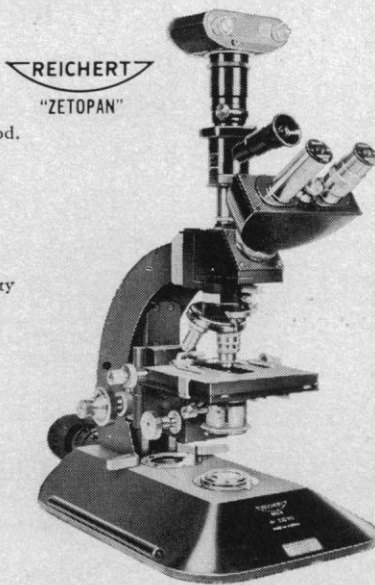
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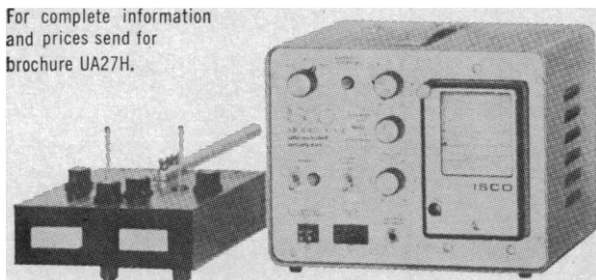


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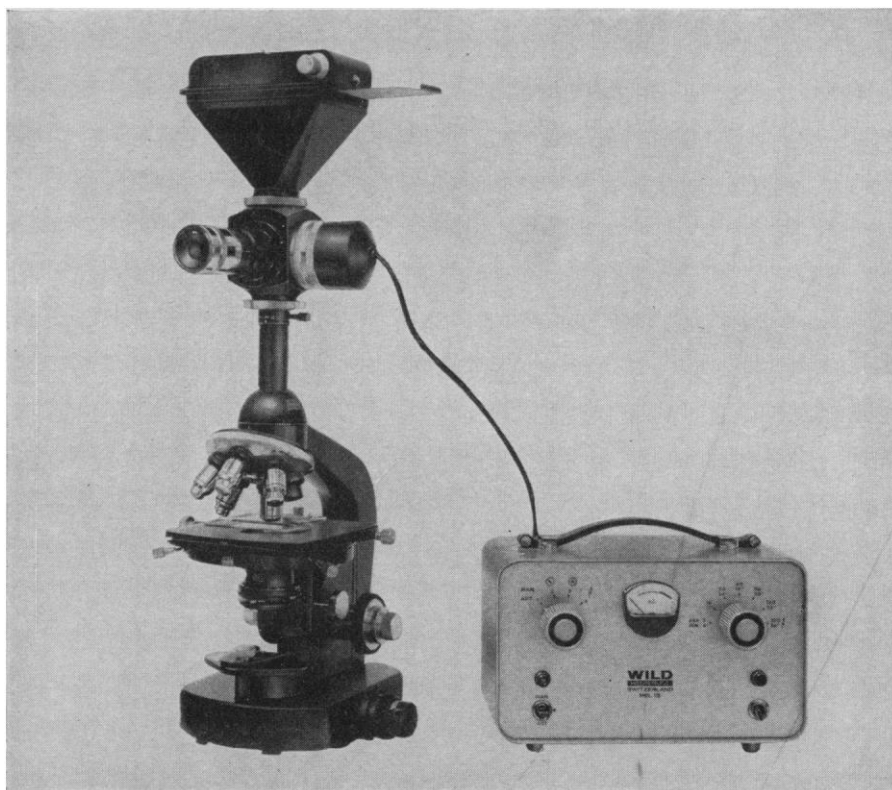
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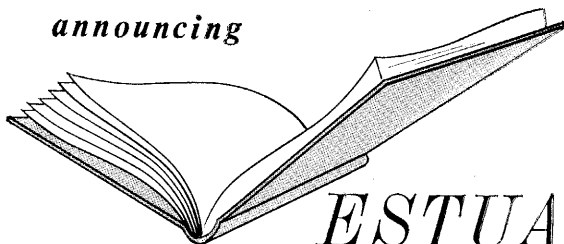


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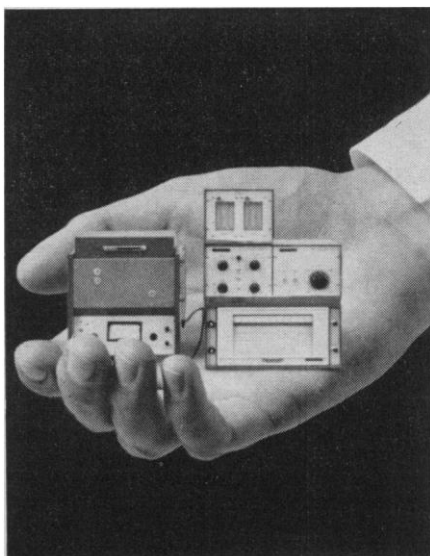
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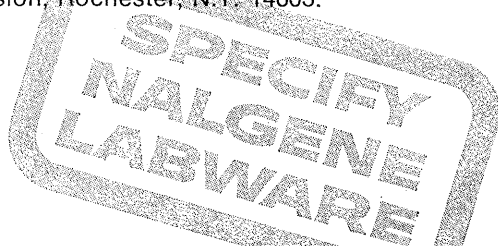
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