SCIENCE

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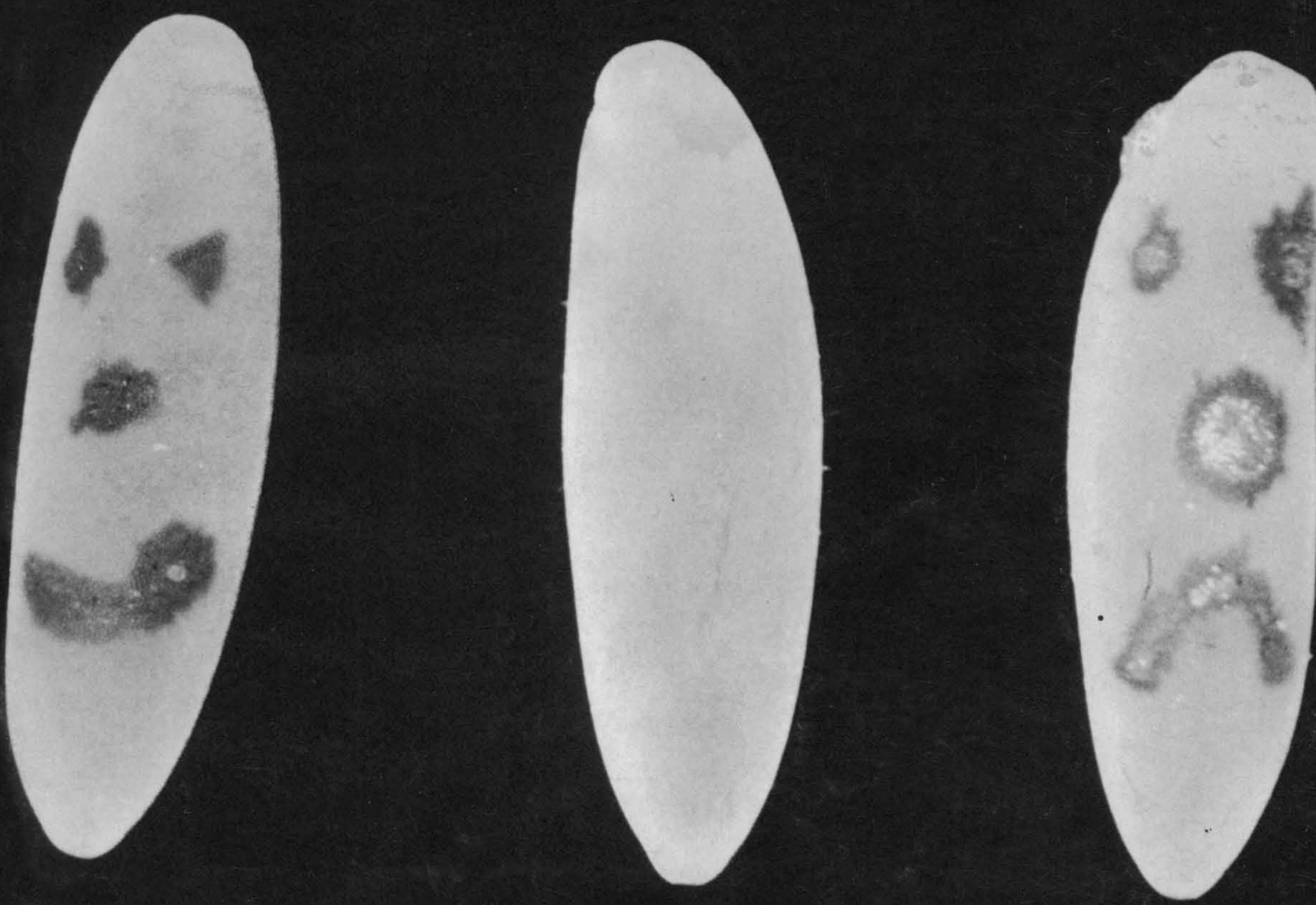
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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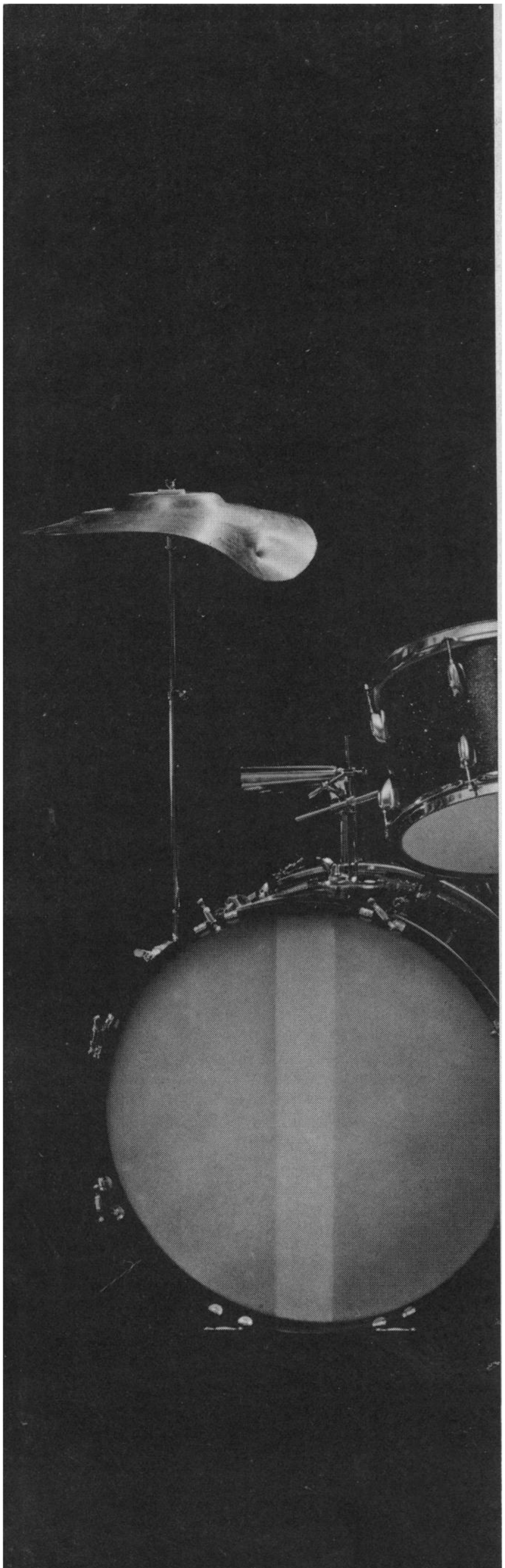

One of a series briefly describing GM's research in depth

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But we need to learn much more before we can tailor alloys for specific applications; for instance, how do magnetic domain walls interact with static and dynamic strain? What are the detailed effects of crystallographic orientation and of specific impurities?

Still, the spirit of science thrives on unanswered questions.

General Motors Research Laboratories
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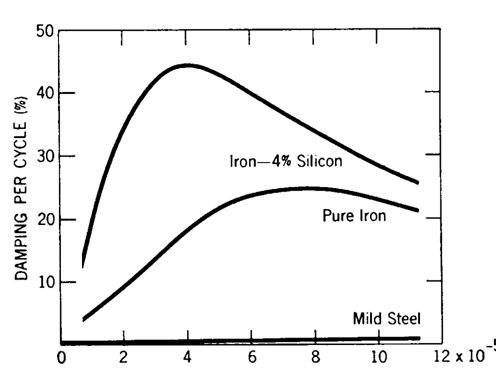

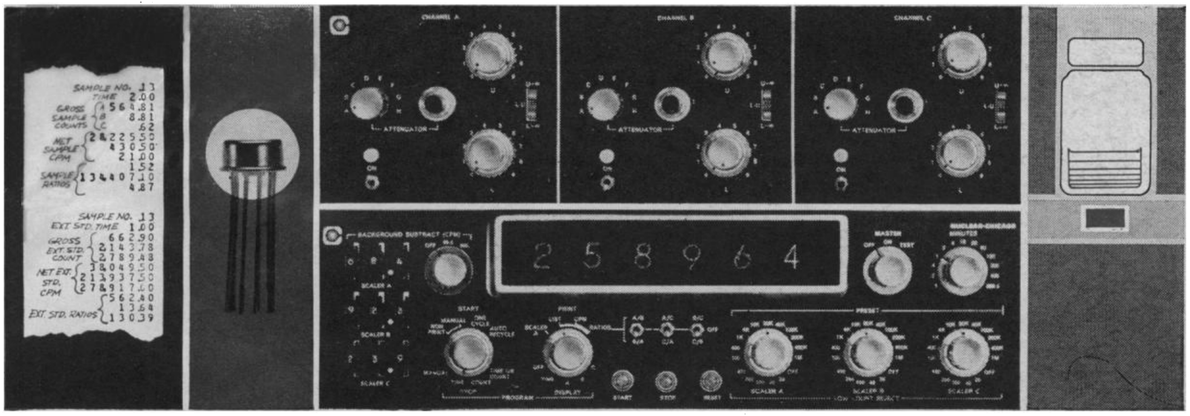

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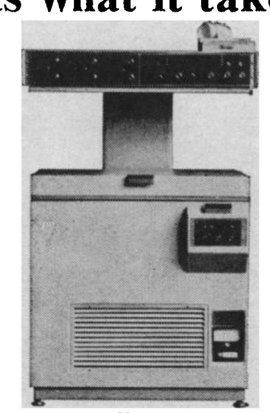

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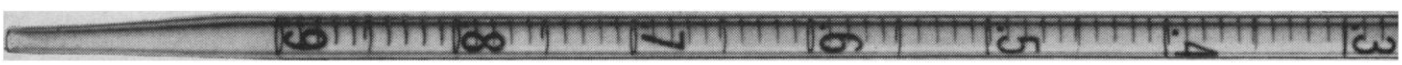
COVER

The eggs of the grasshopper, *Romalea microptera*, are yellow when first laid, but through the action of a secretion added to them at oviposition, they subsequently tan to a dark brown. The three eggs were dissected from the ovary of a gravid female. The eggs on either end have undergone localized tanning as a result of being spotted and streaked with secretion; the center egg is an untreated control (Actual size, 7 mm). See page 95. [Thomas Eisner, Cornell University]

Corning announces glass pipet.

Now there are three new standards in and one of them is what you should



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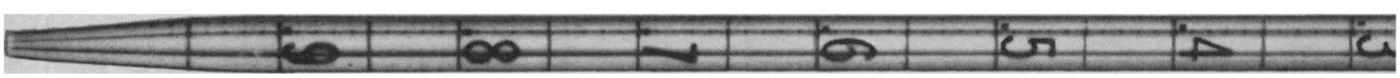

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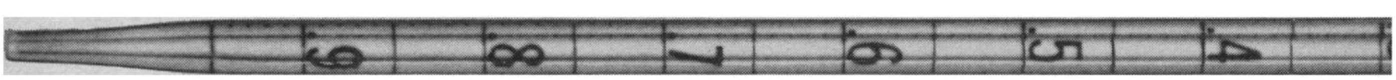

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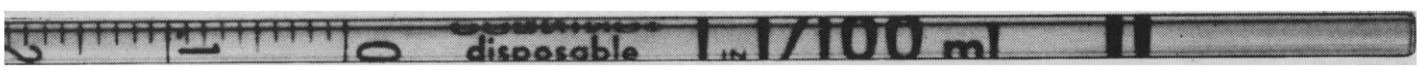

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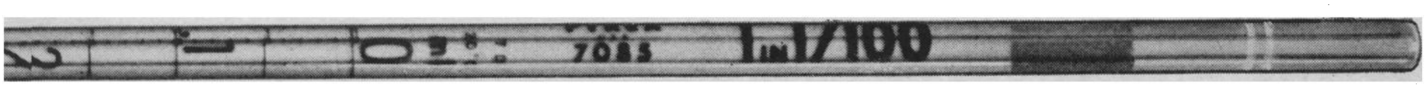

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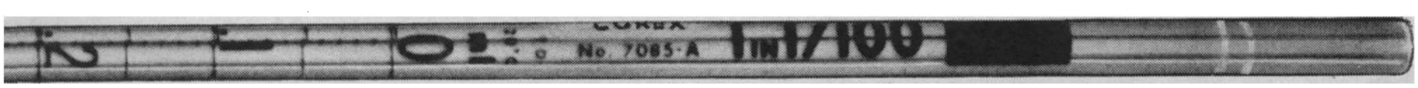

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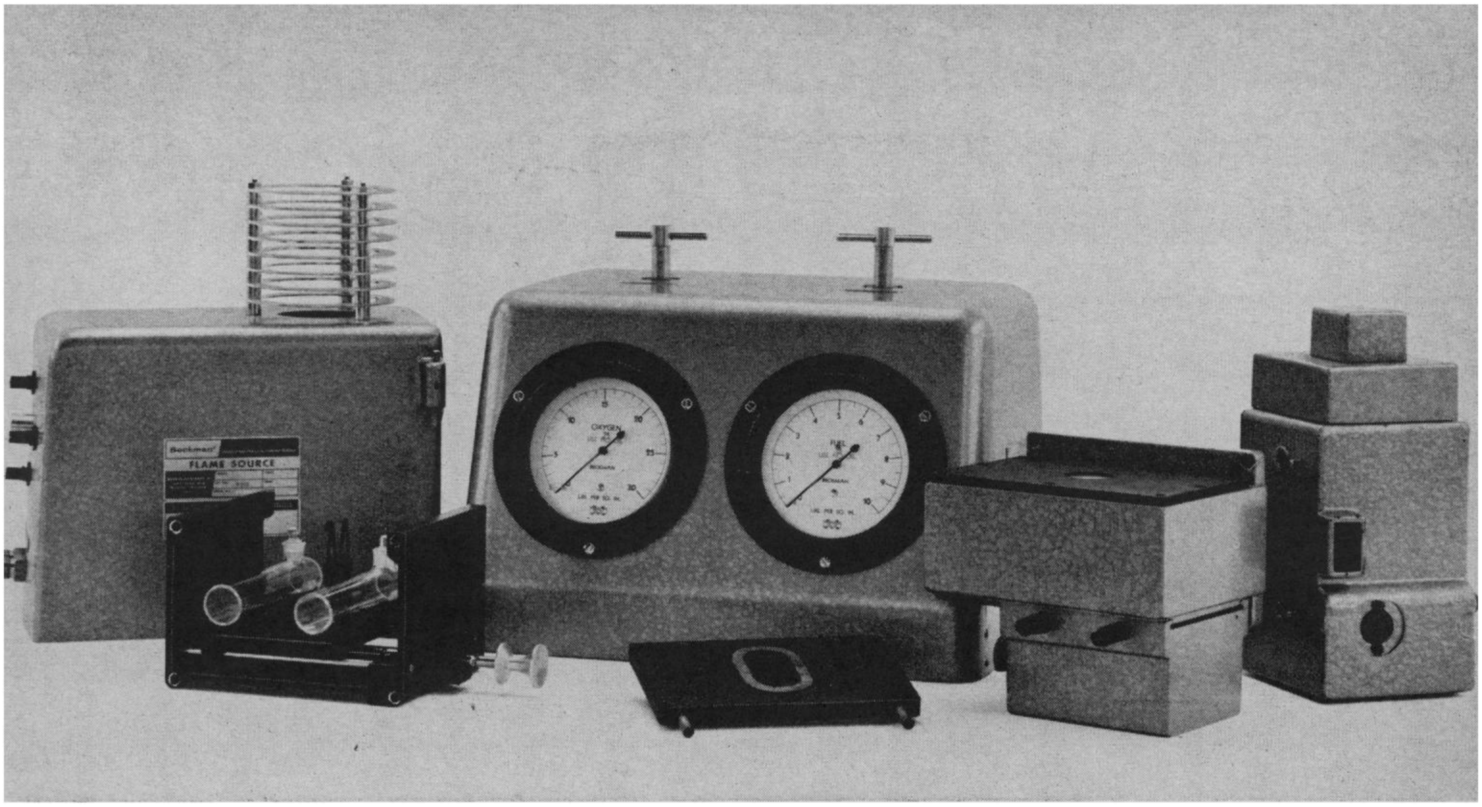

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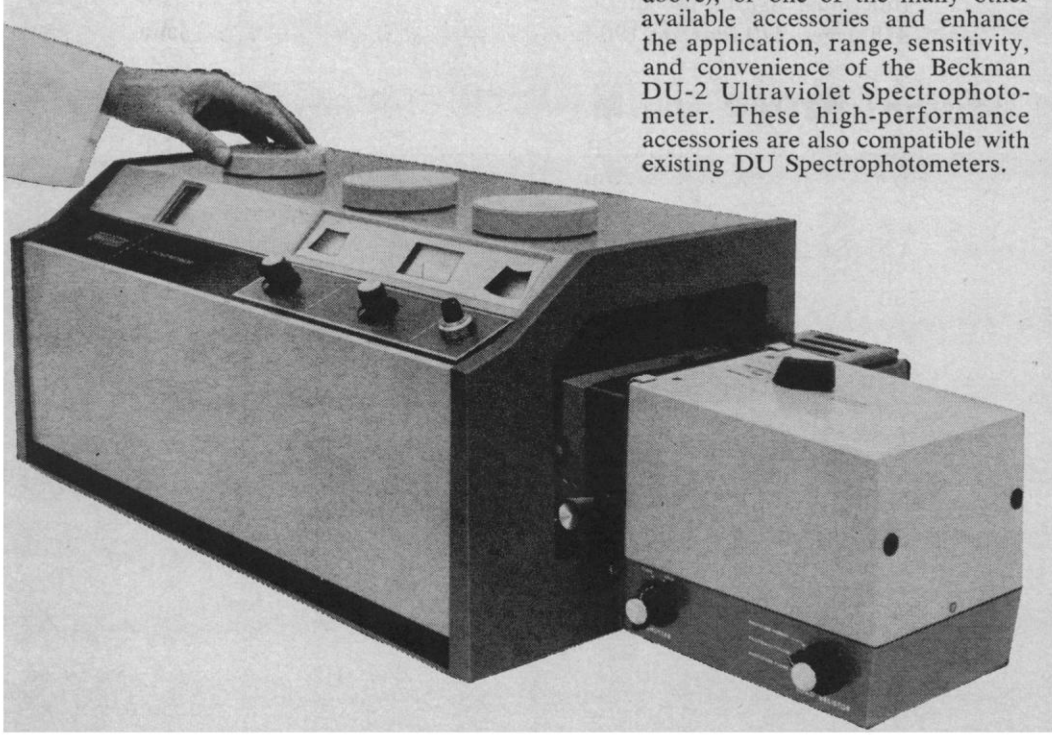

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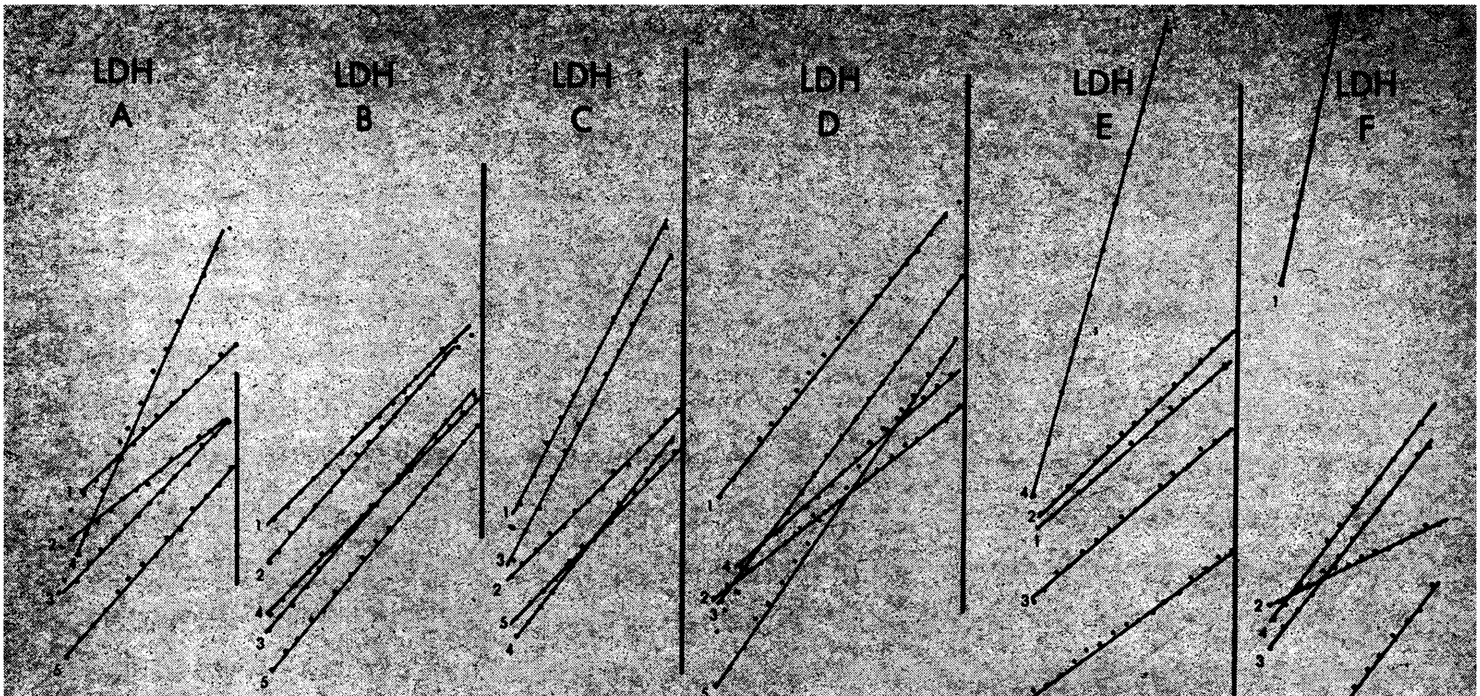

The chart above demonstrates the kinetic spectrophotometric assay of lactic dehydrogenase (LDH). The activity of this enzyme is frequently measured in serum of patients suspected of having had a heart attack. The decreasing absorbance "A" at 340 mμ is recorded against time as LDH catalyzes the reaction.

$$\text{pyruvate} + \text{DPNH} \overset{+\,\text{LDH}}{\rightleftarrows} \text{DPN} + H^+ + \text{lactate}$$

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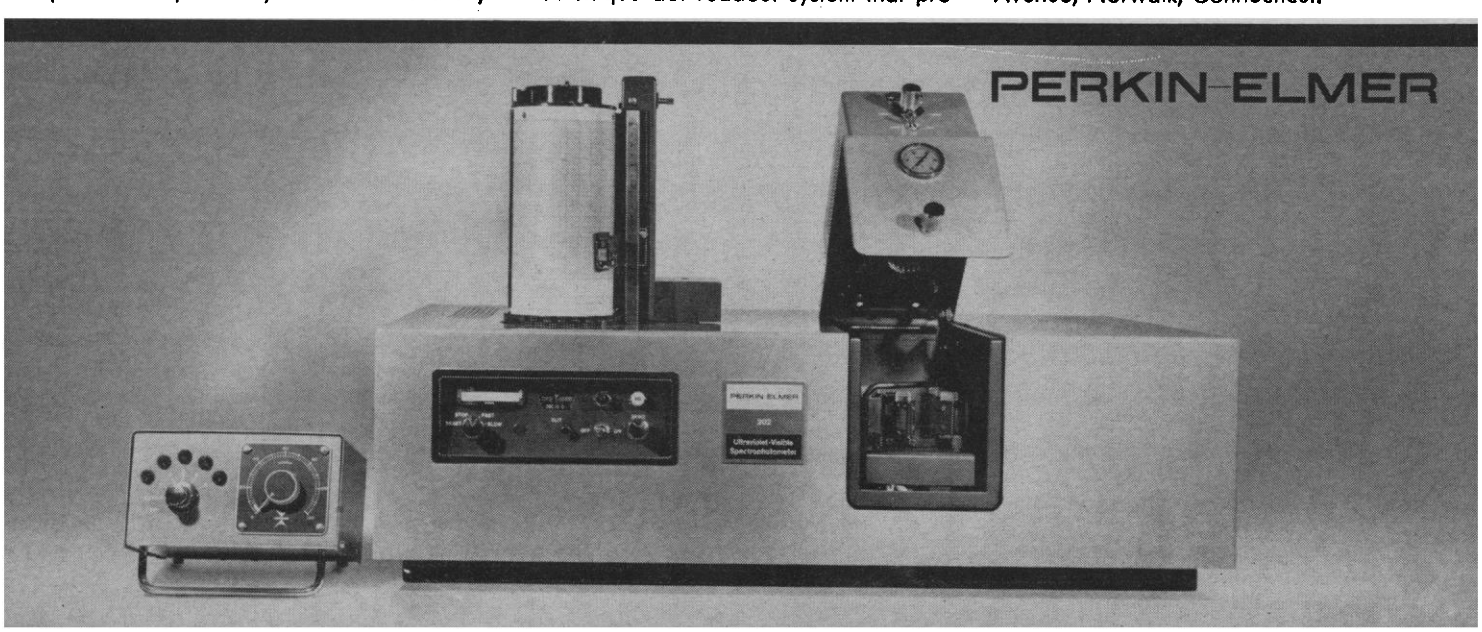


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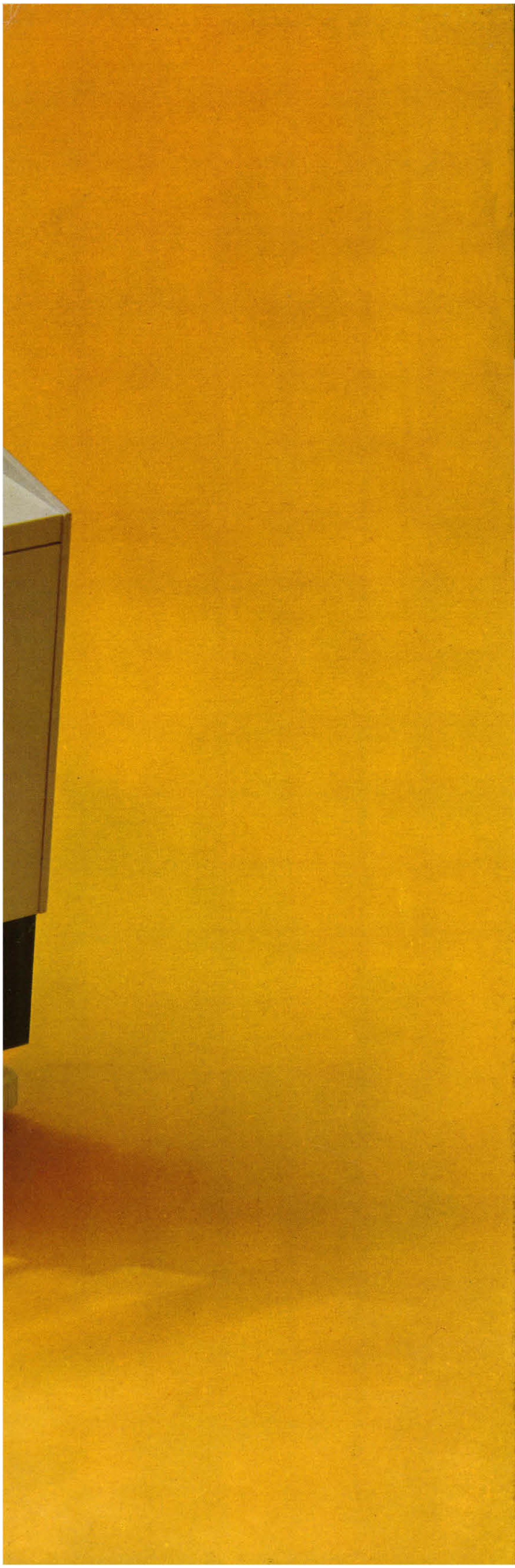

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OPTICAL RANGE	1000 g	1000 g	1000 g	100 g	10 g	1000 g
One Scale Div. (digital)	1 g	1 g	1 g	0.1 g	10 mg	1 g
Readability	0.1 g	0.1 g	0.1 g	0.01 g	1 mg	0.1 g
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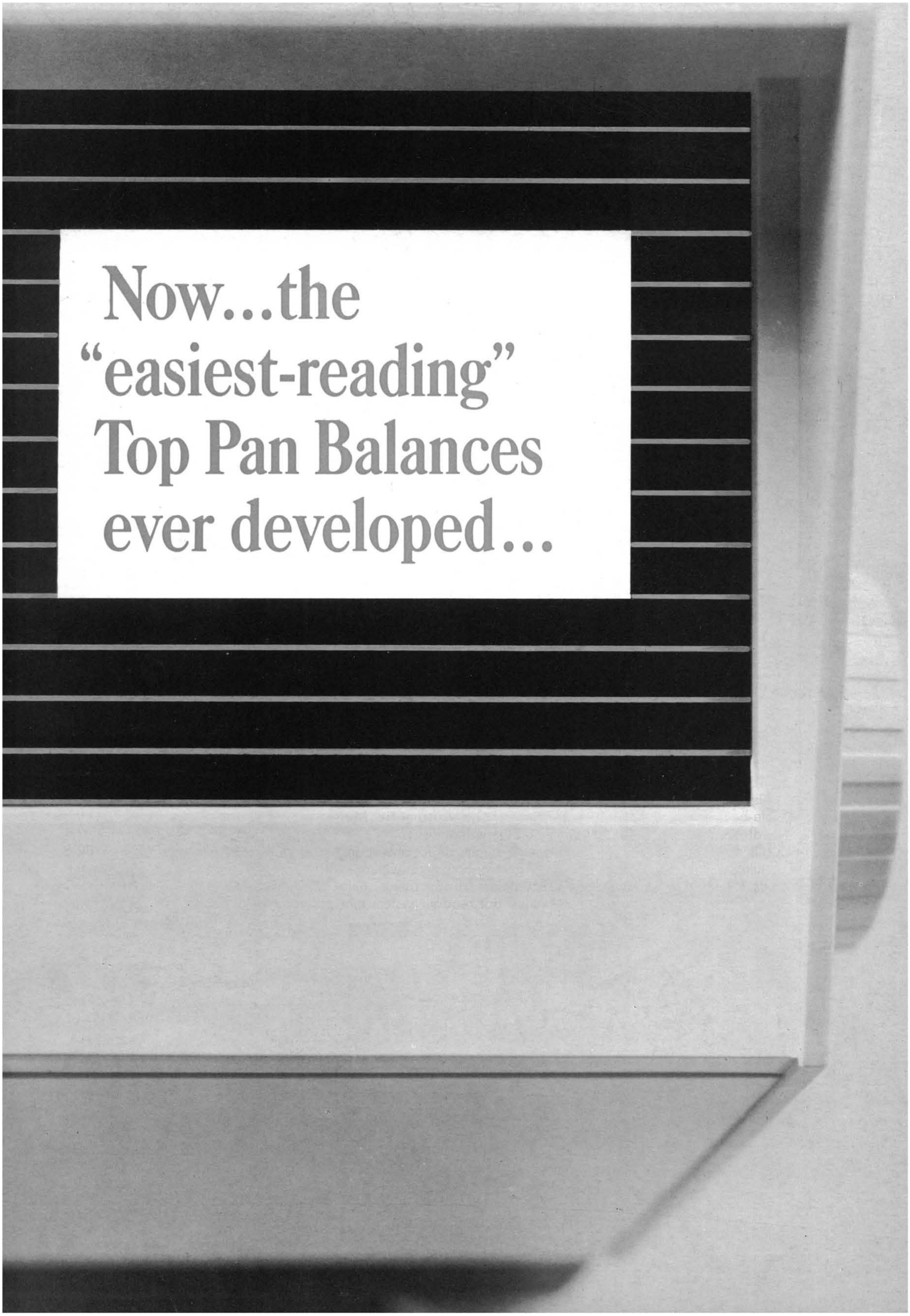
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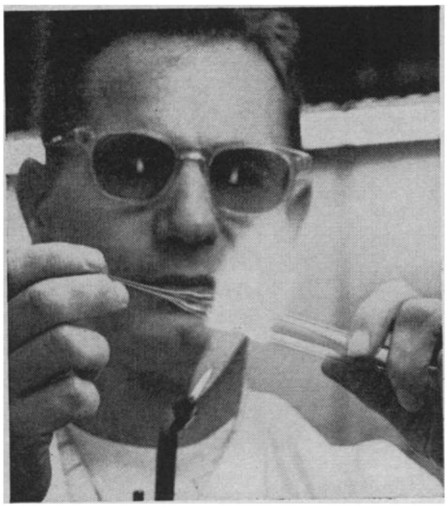

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ideally their ages should be related exponentially, "such that whatever the youngest unit age (A), others would be A^2, A^3, A^4, and so on." G. G. Simpson (4 Feb., p. 517) correctly notes the difficulty that arises if the unit chosen is 1, and observes that if A equals ½ year, or its equivalent, 182 ½ days, the difficulties are "too much to cope with even for a paleontologist"!

The series above is correct for properly chosen values of A, such as 2 weeks or 2 months. Obviously if the unit time is 1 (1 week, 1 month, 1 year), then the series should be A, 2A, $(2A)^2$, $(2A)^3$, and so forth, in time units suitable to the longevity of the animal. [See "Temporal design of geriatric research," *J. Amer. Geriat. Soc.* **13**, 501 (1965).] It is important to note that if the unit chosen leads too soon to unusual ages, then the youngest animal is too old to yield data regarding its early life. The first 10 percent of the life span may give the most definitive information concerning the aging process.

N. O. CALLOWAY
Veterans Administration Hospital, Tomah, Wisconsin 54660

The many biological changes whose rates are inversely proportional to the age of the organism led Calloway to suggest, essentially, that in appropriate studies the animals employed should be chosen so that their ages are distributed exponentially. Simpson observes that choosing ages A, A^2, A^3, . . . leads to several anomalies. These however are easily resolved.

Time is not measured absolutely but as the difference of two clock readings. Thus it is perfectly reasonable to start our clock at $t = 1$. Letting $t' = \log_a t$ with $a > 1$, we have a reasonable time scale. If t is taken to be the age of an organism when it comes into being, its logarithmic age at that time is 0. At time a its logarithmic age is 1, and at time a^n its logarithmic age is n. Since we started our clocks at $t = 1$ the difficulties involving fractional times do not arise. The logarithmic age and the time are monotone increasing functions of each other.

It might be thought that differing time scales would radically affect the logarithmic age. This is not the case. If a and b are different bases,

$$\log_a t = \frac{\ln b}{\ln a} \log_b t.$$

Hence the times measured on the logarithmic scales are proportional. If we change the linear time scale, that is, if $t' = at$ and have a base time $t = b$,

$$\log_b t = (\log_b a + 1)(\log_{ab} t' - \log_{ab} a),$$

so the time scale is linearly magnified and displaced.

As Simpson observes, the actual age of organisms chosen to be linearly distributed on a logarithmic scale rises very rapidly. But this is as it should be; organisms do change much more rapidly when they are young than when they are older. . . . In order to develop a reasonable time scale the base time may have to be very small. In practical terms, this difficulty is easily overcome by not insisting that the base time be the time of first observation.

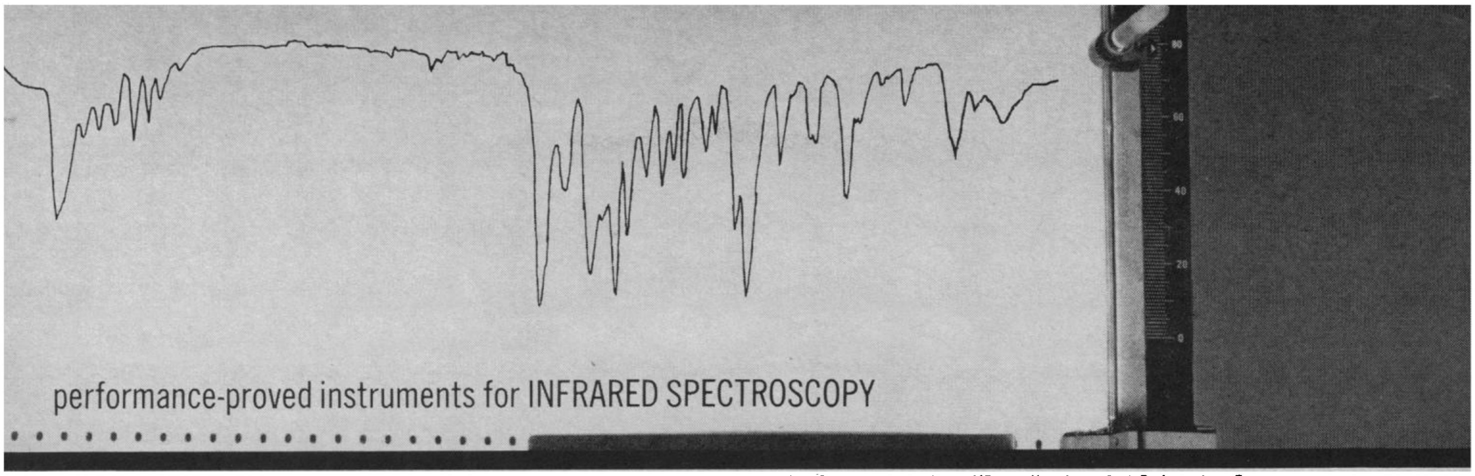
Finally, any difficulty involved in calculating $\log_a x$ is resolved by the formula

$$\log_a x = \frac{1}{\log_{10} a} \log_{10} x.$$

ROBERT M. LEVY
Courant Institute of Mathematical Science, New York University, New York 10012

I believe that there is a way of accomplishing what Calloway is wisely getting at but preferable to either his or Levy's approach. One could equate the maximum age, the highest available age, or the highest age desirable or relevant for a particular study with 100 on a graphic log scale. On that scale 1 would then designate the point from which one counts age, normally birth or hatching, as in Levy's approach. Then decide how many steps (stages, samples) one wants and lay them off on the graphic scale at equal distances between 1 and 100. That will give a true and accurate exponential series adjusted to the significant biological cycle of any organism. If one wishes to study or emphasize just part of the cycle, one can select this and put the desired number of equidistant steps within it. This does not depend on the base of the logarithmic scale, so one can ignore the value of Levy's a, or for purposes of calculation set $a = 10$, handiest because of available tables.

GEORGE GAYLORD SIMPSON
Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts



This uninterrupted 12-minute scan of phenacetin was run on the Model 257 using a .5mm KBr pellet in a 1x4 Refracting Beam Condenser. Sample volume was 1 microgram. A Refracting Beam Condenser was also placed in the Reference Beam.

FLEXIBILITY AT THE TOUCH OF A BUTTON— THE MODEL 257

Here is a high-resolution double-grating infrared spectrophotometer that gives you flow-chart recording and automatic control features not found in any other instrument in its moderate price range. The Model 257 offers·

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- Automatic reset—at the end of the run, monochromator automatically returns to 4000 cm^{-1}.
- Abscissa expansion, by factors of 2.5 and 10X, to spread out the close, sharp bands typical of grating spectra—particularly in the analysis of gases.
- Time drive, to permit the quantitative determination of kinetic changes in a sample, at one significant frequency, over a period of time.
- Variable slit control, allowing very narrow slits for high resolution, as well as the wide openings required for energy-limited analyses such as by ATR and micro-sampling.
- Visual mode and frequency indicators: you always have a positive indication of mode of operation and frequency position.

The Model 257's large f / 5 aperture enables you to obtain accurate spectra even with very small samples. You can vary the slit program to suit the requirements of the analysis. Or you can keep the frequency fixed and record the changes in transmittance as a function of time.

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You read your results on a flow chart recording system (linear transmittance vs. linear frequency) which is continuous in presentation. The chart is synchronized with the monochromator drive, and both start with a single pushbutton.

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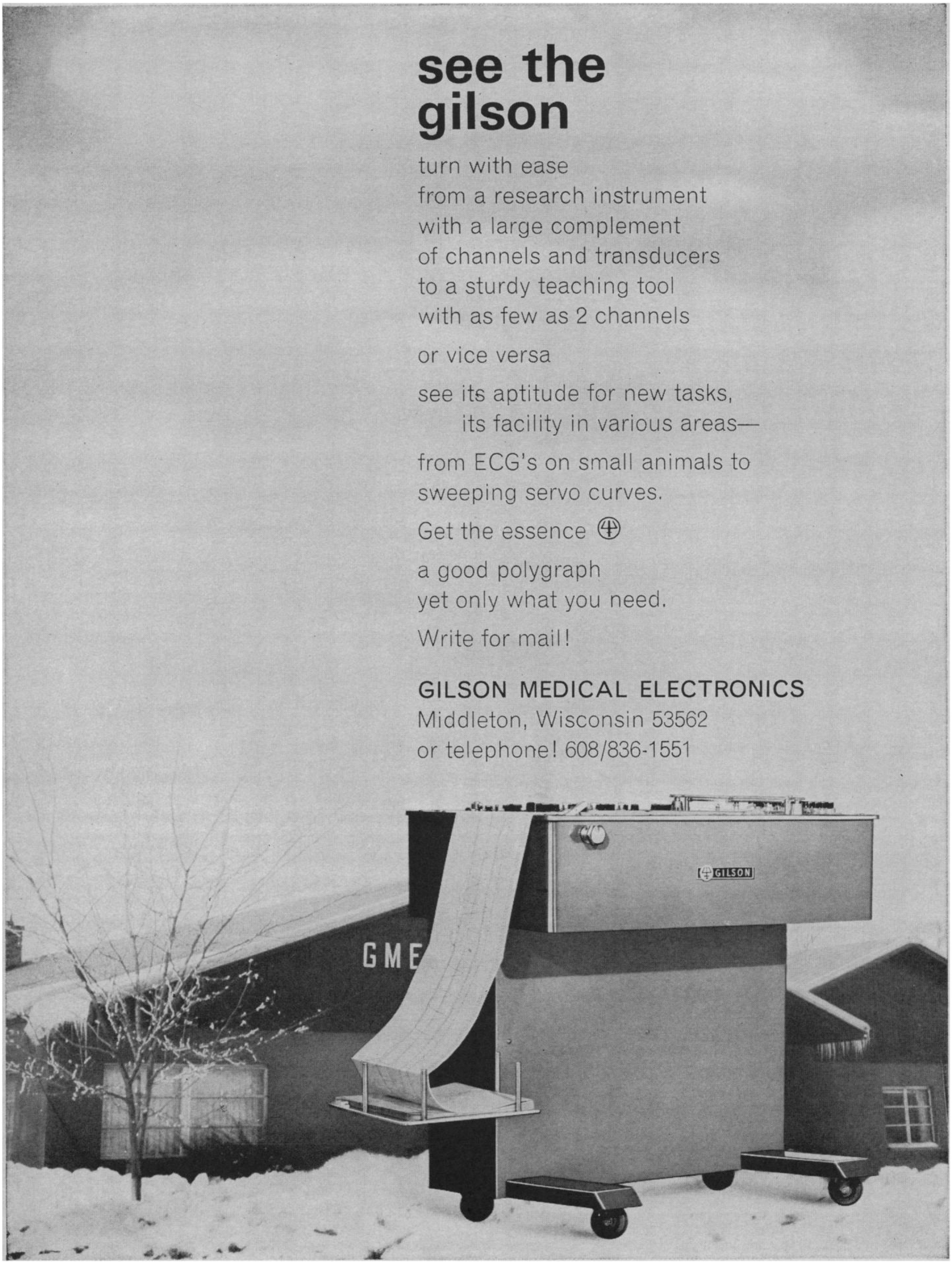
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1 April 1966, Volume 152, Number 3718

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Graduate Student Support

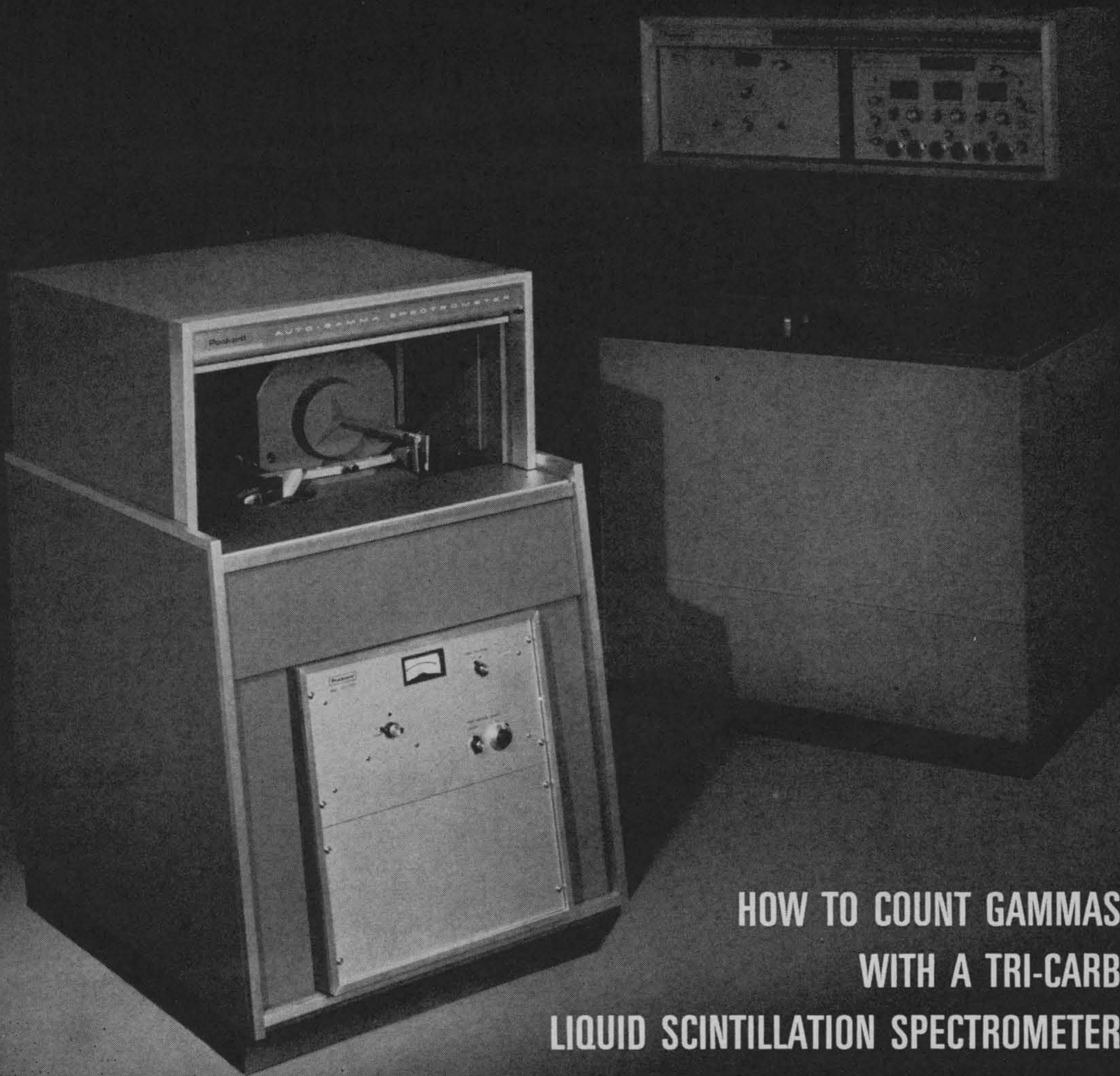
Universities are limited in their ability to provide maximum educational opportunities for all students in graduate school because the several forms of support for graduate students often carry restrictions as to the kind of work or service the student may render. Recipients of many federally supported fellowships and traineeships are free from any service obligation associated with that support. Some students who are employed as research assistants get substantial research experience but no teaching experience and no period of time free from service requirements. Still others serve as teaching assistants throughout their graduate years.

The decision as to how each student will spend his years of working for the doctorate is therefore often determined by the source of his financial support rather than by what would be educationally most beneficial. Ideally, whether in a particular year he works as a teaching assistant, as a research assistant, or as neither should depend upon his previous experience, his present stage of development, and his future plans. One student might do well to spend the first year or two as a teaching assistant, benefiting from the opportunity teaching provides of clarifying one's ideas and consolidating one's grasp of his field. Then, when he had completed his course work and while plans for the dissertation were maturing and the work was being started, he might spend a year or two as a research assistant. Finally, a year or so free from any service obligation would provide an opportunity for doing the intensive work of completing the dissertation and preparing for doctoral examinations. For another student it would be better to start with a fellowship year, and for others, still different sequences or patterns would be more appropriate.

Such individual planning is made difficult, however, by the regulations which govern the federal programs that now provide a large fraction of the support for graduate students. The length of tenure varies. Recipients of some forms of federal support are limited in the amounts of service they may render. Some forms of support are available only to students in certain fields.

Federal agencies have been quite flexible in pioneering new forms of support for scientific research and education. One direction of change has been to give the receiving institution much greater responsibility for deciding how research money can most usefully be employed. Federal funds for the support of graduate students have reached such a size as to make one ask whether comparable modifications in programs for graduate student support might not increase their educational value.

Suppose the presidents of several universities that now receive substantial funds for fellowships, traineeships, and research assistantships were jointly to approach the major federal science agencies with this proposal: "For the next five years we would like to receive approximately the same amount for the support of graduate students that we would receive under the present arrangements, but with freedom to arrange, for each student who receives some part of this support, the program that seems best for him, using, each year, funds from whatever source seems appropriate. If you approve this experimental program, we will keep full records for each student who receives any portion of his support from federal funds. Periodically we will review the records with you so that we may jointly judge whether these experimental arrangements seem beneficial and should be continued." If a few good universities were to propose such a plan, they should be given the opportunity to try it.—DAEL WOLFLE



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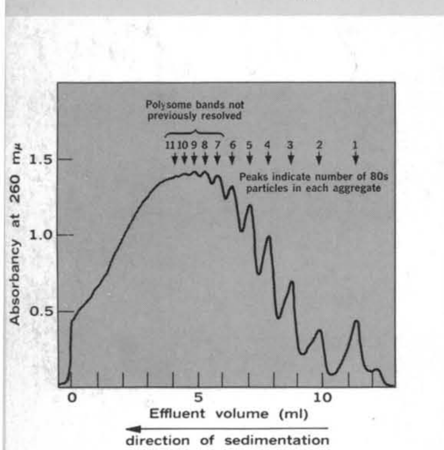
The other evening we were discussing sophisticated density
gradient techniques and IEC's ultracentrifuges came up

From large volume preparative work to sophisticated density gradient techniques with analytical capabilities, IEC places at your service advanced instrumentation, including computer designed rotors that never need derating, and exceptional combinations of g-force and volume that not only reduce sedimentation time very significantly, but often do the work of two conventional instruments operating simultaneously.

If you are working anywhere in the ultracentrifuge spectrum, IEC's capabilities offer you special advantages that may well re-orient your entire thinking about equipment in this field. Two new advanced ultracentrifuges plus a full series of interchangeable rotors handle, in the preparative phase, up to two full liters at 28,500 g, and in the density gradient/analytical phase, up to 25.2 ml at 405,900 g.

The strip chart recording below shows a sedimentation pattern of ribosomal aggregates called polysomes. They are made up of 80s ribosomal particles. It is evident that aggregates consisting of as many as 10 ribosomes can still be recognized as a single peak in the presence of larger and smaller aggregates. The fact that polysome peaks 9 and 10 are separated indicates that the instrumentation is capable of resolving two macromolecular objects of equal density and similar shape which differ in mass by as little as 10%.



Typical of the work for which this instrumentation is intended is the concentration and isolation of viruses, enzymes and proteins; preparation of mitochondria; separation of microsomes, bacteriophage and subcellular fractions; determination of sedimentation coefficients; the separation of particles differing in sedimentation rates and the separation of various macromolecules differing only slightly in density. The 400,000 plus g-capabilities of this equipment can also open many new areas of biological study.

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The swinging bucket rotors are of th six bucket design, allowing multipl sample studies to be performed simu taneously. Slotted ball and socket cor struction makes loading and unloadin easy without danger of disturbing th gradient. Increased length-to-diamete ratio of the bucket has greatly in proved resolving power, and measure ment of band widths and movement Compared with old-style short bucket the range of gradient/analytical studie is considerably expanded. In additio these new advanced-design rotors offe definite advantages in capacity at hig g-levels. As a result, this IEC instrumer tation often increases efficiency by a much as a factor of two, over previou equipment. The SB-405 rotor, for e ample, develops 405,900 g at 60,00 rpm with a capacity of 6x4.2 ml. Th SB-269 rotor swings 6x14 ml t 269,400 g.

A new series of fixed angle rotors repre sents considerable advancement in th preparative phase, offering greatly in creased capacities and g-forces. Th low inertia A-28 is a new concept i preparative rotor design. It will acce erate two liters to 14,000 rpm in thre minutes, developing 28,500 g and dece erate to rest in ten minutes. Thi performance results in significant speed up in large volume preparative work.

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he new B-35 is a versatile preparative nstrument that develops ultra high g ensity gradients at 206,200 g in a x 14 ml long tube swinging bucket otor; and can spin two liters at 28,500 , or 440 ml at 147,100 g. It thus ombines in a single instrument, the apabilities of a true preparative ultra-entrifuge and a high speed, high volume efrigerated centrifuge. For a laboratory ith the ever increasing problem of pace conservation or the requirement r processing a variety of work, this ngle instrument that does the work of o will be of special interest.

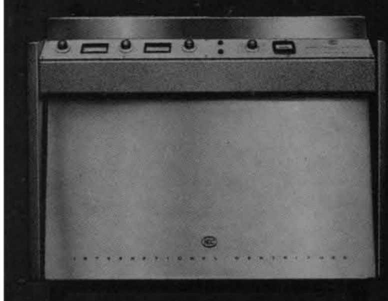
he temperature and speed control sys-ems are the same as for the Model B-60 escribed at right. One master switch ontrols all operating systems, once the rogram has been set on the panel.

he vacuum system features a 150 liter er minute fore pump providing an oper-tional vacuum level below 50 microns.

he belt-type flexible drive system, is ater cooled and at 35,000 rpm is alanced, vibrationless, and requires nly eye-level rotor balancing techniques.

ositive electrical devices protect from ilure of water, oil or vacuum systems.

he whisper-quiet B-35 is built for heavy uty operation over a long service life.



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A-28 ALUMINUM
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A-170 — ALUMINUM
6 x 90 ml — 40,000 rpm.
170,300 g

A-147 — ALUMINUM
8 x 55 ml — 35,000 rpm.
147,100 g

*Model B-35 only.

MODEL B-60

The new B-60 is an instrument that provides capabilities for the investigation of new areas of advanced biological research. It offers the most sophisticated techniques of density gradient/analytical and preparative work. It provides speeds to 60,000 rpm, gravities to 405,900 g, volumes to 2 liters, unusual combinations of volume/gravity levels – features which make its performance exclusive in the ultracentrifuge field.

The temperature control system is a precision thermistorized unit, electronically calibrated to the temperature of the rotor and temperature is continuously indicated on a panel meter. System controllability is from ambient to 0°C; lower if desired.

A solid-state speed control system with positive lock-in speed selector provides stable speed calibration and permits precise reproducibility of experimentation.

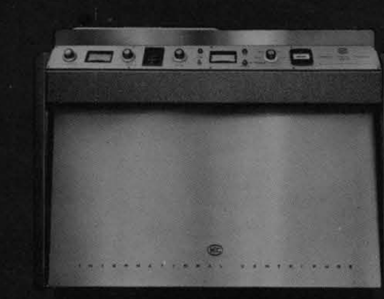
One master switch controls all operating systems, once the program has been set on the panel.

The vacuum system features a 150 liter per minute fore pump and a silicone oil diffusion pump which provide an ultimate vacuum of 0.3 microns.

The gear-type flexible drive system is water cooled and at 60,000 rpm is inherently balanced, vibrationless, and requires only eye-level rotor balancing techniques.

Positive electrical devices protect the centrifuge from any failure of water, oil or vacuum systems.

At 60,000 rpm the B-60 is so quiet that in a normal laboratory noise environment, the panel light must be checked to be certain the instrument is running.



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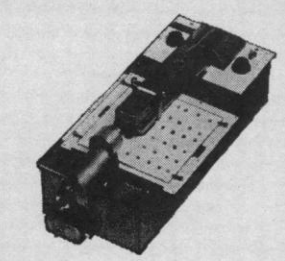

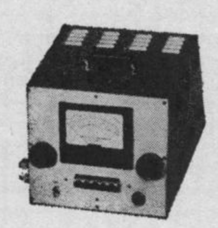

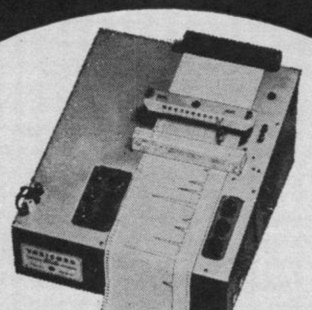

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Forthcoming Events

April

8–9. American Soc. for **Artificial Internal Organs**, Atlantic City, N.J. (B. K. Kusserow, Dept. of Pathology, Univ. of Vermont College of Medicine, Burlington)

8–9. **Pennsylvania Acad.** of Science, 42nd annual mtg., Lehigh Univ., Bethlehem. (J. J. McDermott, Franklin and Marshall College, Lancaster, Pa. 17604)

8–11. **Animal Toxins**, intern. symp., Atlantic City, N.J. (F. E. Russell, Box 323, Los Angeles County General Hospital, 1200 N. State St., Los Angeles, Calif.)

9. **Paleontological Research** Inst., semiannual mtg., Ithaca, N.Y. (The Institution, 109 Dearborn Pl., Ithaca, N.Y. 14850)

10–11. **Microcirculatory Soc.**, 14th conf., Atlantic City, N.J. (H. J. Berman, Dept. of Biology, Boston Univ., Boston, Mass. 02215)

11–13. Institute of **Electrical and Electronics Engineers**, Region 3, conv., Atlanta, Ga. (M. D. Price, Dept. 72-14, Zone 400, Lockheed-Georgia Co., Marietta, Ga.)

11–13. Comparative **Hemoglobin** Structure, intern. symp., Salonika, Greece. (Secretary, P.O. Box 201, Salonika)

11–15. **Aeronomic Studies of Lower Ionosphere**, conf., Ottawa, Ont., Canada. (W. Pfister, Air Force Cambridge Research Laboratories, Upper Atmosphere Physics Laboratory, L. G. Hanscom Field, Bedford, Mass.)

11–15. American Assoc. of **Cereal Chemists**, New York, N.Y. (R. J. Tarleton, The Association, 1955 University Ave., St. Paul, Minn. 55104)

11–16. Federation of American Societies for **Experimental Biology**, 50th annual mtg., Atlantic City, N.J. The following societies will meet in conjunction with the FASEB; information may be obtained from FASEB, 9650 Rockville Pike, Bethesda, Maryland 20014:

American Physiological Society

American Soc. of Biological Chemists

American Soc. for Pharmacology and Experimental Therapeutics

American Soc. for Experimental Pathology

American Inst. of Nutrition

American Assoc. of Immunologists

12–13. Frontiers in **Food Research**, symp., Cornell Univ., Ithaca, N.Y. (W. F. Shipe, Dept. of Dairy and Food Science, Cornell Univ., Ithaca)

12–14. **Generalized Networks**, intern. symp., New York, N.Y. (H. J. Carlin, Polytechnic Inst. of Brooklyn, 333 Jay St., Brooklyn, N.Y. 11201)

12–14. **Remote Sensing of Environment**, 4th symp., Univ. of Michigan, Ann Arbor. (Extension Service, Conference Dept., Univ. of Michigan, Ann Arbor 48104)

12–15. **Quantum Electronics**, intern. conf., Phoenix, Ariz. (J. P. Gordon, Bell Telephone Laboratories, Murray Hill, N.J.)

12–16. Society for Applied **Mathematics and Mechanics**, annual scientific mtg., Darmstadt, Germany. (F. Reutter, Gesellschaft für Angewandte Mathematik und Mechanik, Templergraben 55, 51, Aachen, Germany)

12–29. **Soil Conservation**, 1st Pan American congr., São Paulo, Brazil. (J. Abramides Neto, avda. Francisco Matarazzo 455, Caixa Postal 8366, São Paulo)

13–15. Institute of **Environmental Sciences**, 12th annual tech. mtg. and equipment exp., San Diego, Calif. (The Institute, 34 S. Main St., Mount Prospect, Ill.)

13–15. Use of **X-Rays in Medicine and Industry**, public health conf., Univ. of Miami, Coral Gables, Fla. (M. Dauer, Div. of Radiological Physics, Jackson Memorial Hospital, Univ. of Miami, Miami, Fla.)

13–16. **Geological Soc.** of America, southeast section, Univ. of Georgia, Athens. (L. D. Ramspott, Dept. of Geology, Univ. of Georgia, Athens 30601)

13–16. American **Orthopsychiatric** Assoc., 43rd annual mtg., San Francisco, Calif. (M. F. Langer, The Association, 1790 Broadway, New York 10019)

13–16. National Soc. for **Programmed Instruction**, natl. conv., St. Louis, Mo. (M. Arky, 714 Kingsland, University City, Mo. 63130)

13–16. American **Radium** Soc., annual mtg., Phoenix, Ariz. (J. L. Pool, Memorial Soc., 444 E. 68 St., New York 10021)

13–16. National Council of **Teachers of Mathematics**, 44th annual mtg., New York, N.Y. (J. D. Gates, 1201 16th St., NW, Washington, D.C. 20036)

14–15. British **Biophysical** Soc., spring mtg., Oxford, England. (D. Noble, Balliol College, Oxford)

14–15. **Molecular Interactions and the Crystallography of Ceramics**, Univ. of Nottingham, Nottingham, England. (S. C. Wallwork, Dept. of Chemistry, Univ. of Nottingham, University Park, Nottingham)

14–16. Association of Southeastern **Biologists**, Raleigh, N.C. (M. Y. Menzel, Dept. of Biological Sciences, Florida State Univ., Tallahassee)

14–16. American **Cleft Palate** Assoc., Mexico City, Mexico. (C. G. Wells, Parker Hall, Univ. of Missouri, Columbia)

14–16. Eastern **Psychological** Assoc., New York, N.Y. (M. A. Iverson, Queens College, Flushing, N.Y. 11367)

14–17. American Assoc. of **Endodontists**, 23rd annual mtg., San Francisco, Calif. (J. F. Bucher, 6828 Winterberry Lane, Bethesda, Md. 20034)

14–19. American **Dermatological** Assoc., Hot Springs, Va. (R. R. Kierland, Mayo Clinic, Rochester, Minn.)

14–20. **Geodetical Measuring Technique and Instruments**, conf., Budapest, Hungary. (F. Raum, Preparatory Committee of the Conference, Technika Haza, Szabadsag ter 17, Budapest 5)

15–16. Iowa **Acad. of Science**, Pella. (G. W. Peglar, Dept. of Mathematics, Iowa State Univ., Ames)

15–16. Montana **Acad. of Sciences**, Missoula. (L. H. Harvey, Univ. of Montana, Missoula 59801)

15–17. American Soc. of **Internal Medicine**, New York, N.Y. (A. O. Whitehall, 3410 Geary Blvd., San Francisco, Calif.)

16–18. **Lateral Line Detectors**, intern. conf., New York, N.Y. (P. H. Cahn, Stern College, Yeshiva Univ., 253 Lexington Ave., New York 10016)

17–20. **Electron and Ion Beam Science and Technology**, 2nd intern. conf., American Inst. of Mining, Metallurgical, and

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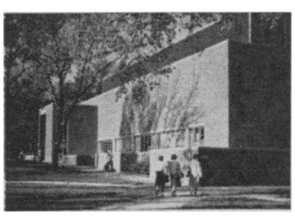

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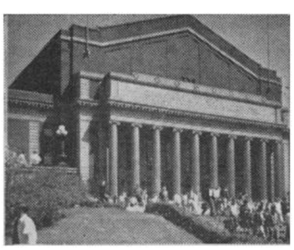

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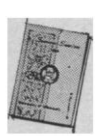

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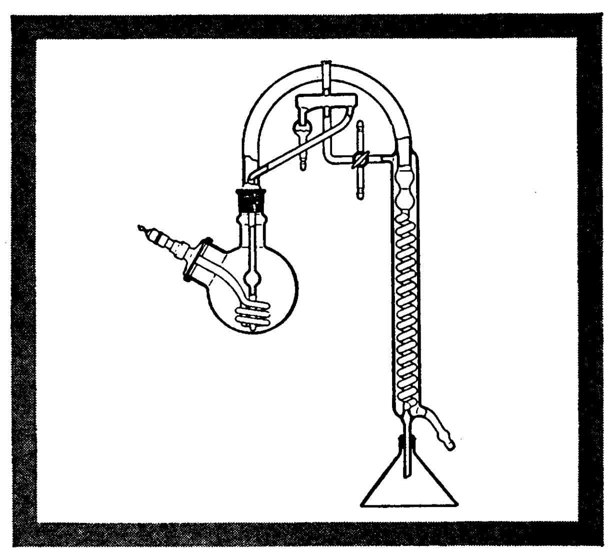

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