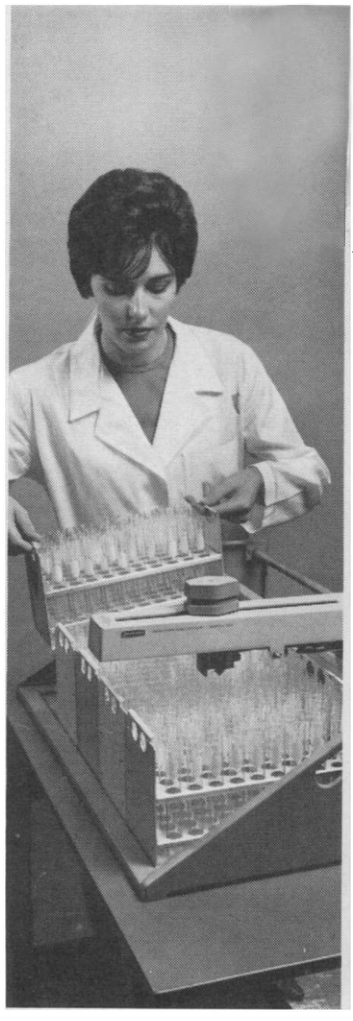
SCIENCE

22 October 1965
Vol. 150, No. 3695

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

OLD FAITHFUL



collect confidently

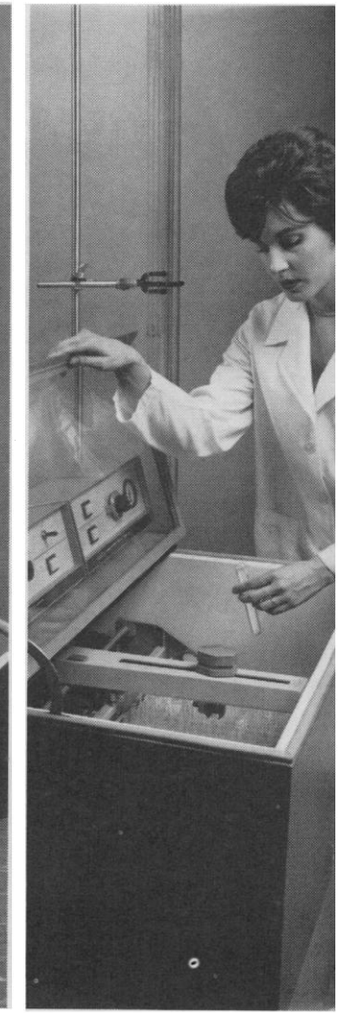
Whatever method of fraction collection you use (time, drop or volumetric), the delivery head of the Beckman 132 Fraction Collector will shut off automatically between tubes—to keep from spilling even a drop of valuable sample. Drip-proof delivery also makes it practical to fill tubes (there are 250 of them) in logical order, from front to back, row by row, for easier identification.

control remotely

The electronic control of this Fraction Collector (an expensive part of any collector) is a separate entity. You can keep it safely out of the way—to avoid damage by accidental spillage when tubes are handled. Equally important, the collector can be cooled completely while the control unit is kept outside the cooling area.

carry handily

Having the control unit separate also allows this Fraction Collector to be carried easily—it has convenient grip-slots on either side.



cool completely

This Fraction Collector has a companion Mobile Refrigeration Unit to save you cold room space. The unit holds fractions at 4° C, and cools an external column. Caster-mounted and easy to move, it permits refrigerated chromatographic analyses to be conveniently made anywhere in the laboratory. For more information about the refrigeration unit and the most advanced of Fraction Collectors, write for Data File 132-5.

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Vol. 150, No. 3695

SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Old Faithful erupting on a winter day. Seismic recordings made during the January 1965 expedition to Yellowstone Park can be correlated with geyser activity. Intervals between eruptions do not scatter around a single value, as formerly thought. A bimodal distribution in frequency of intervals occurs. Histogram measurements show the intervals to be about 50 minutes and 70 minutes. See page 494. [John S. Rinehart, U.S. Department of Commerce]

New Nikon attachment equips S-series microscopes for specialized polarization work

Affixed to any S-series Nikon microscope, the new Nikon Polarizing Attachment extends its capabilities to include the observation and study of rocks, minerals, plastics, textiles, chemicals, biological and other materials under polarized light. The outfit consists of a Bertrand lens and analyzer equipped with ¼-wave plate, tint plate and Sénarmont-type compensator; a condenser and polarizer; a calibrated, circular, rotating centerable stage with clips; 5x and 10x wide-field,high-eyepoint oculars; eyepiece micrometer; filters; 4x, 10x and 40x strain-free parfocal objectives; and a hardwood instrument case.

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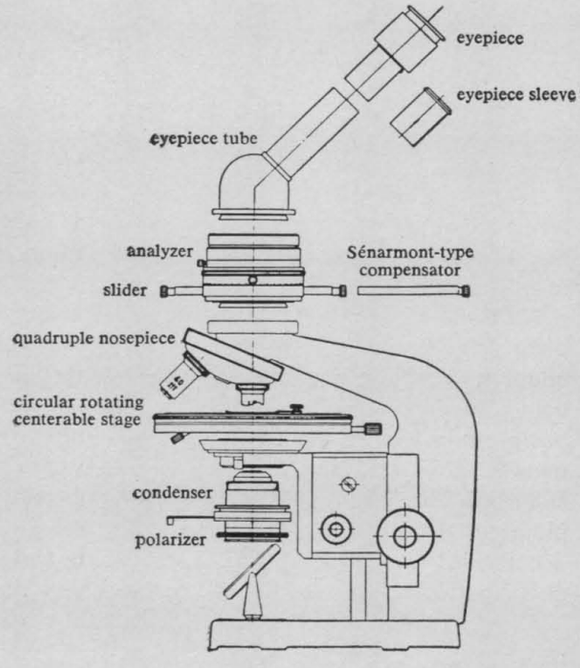

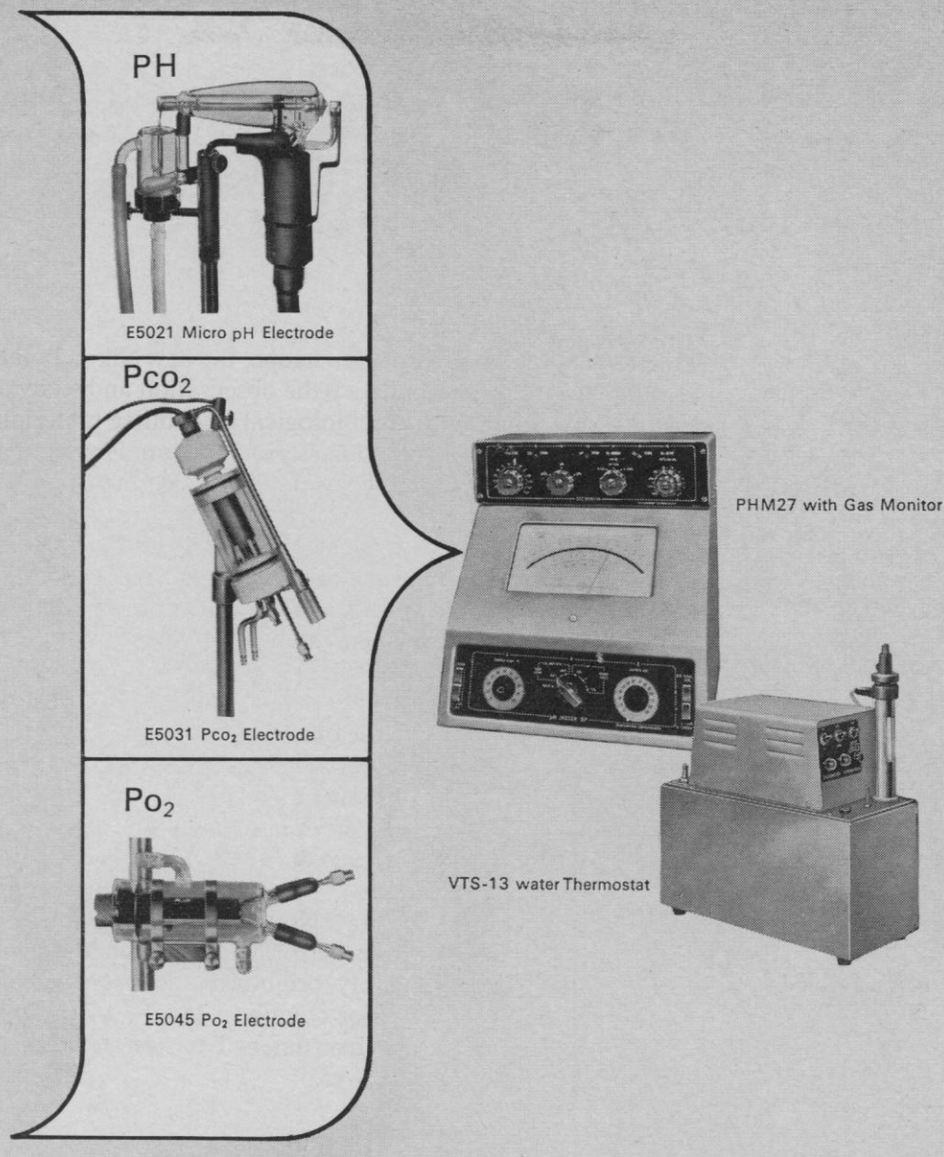

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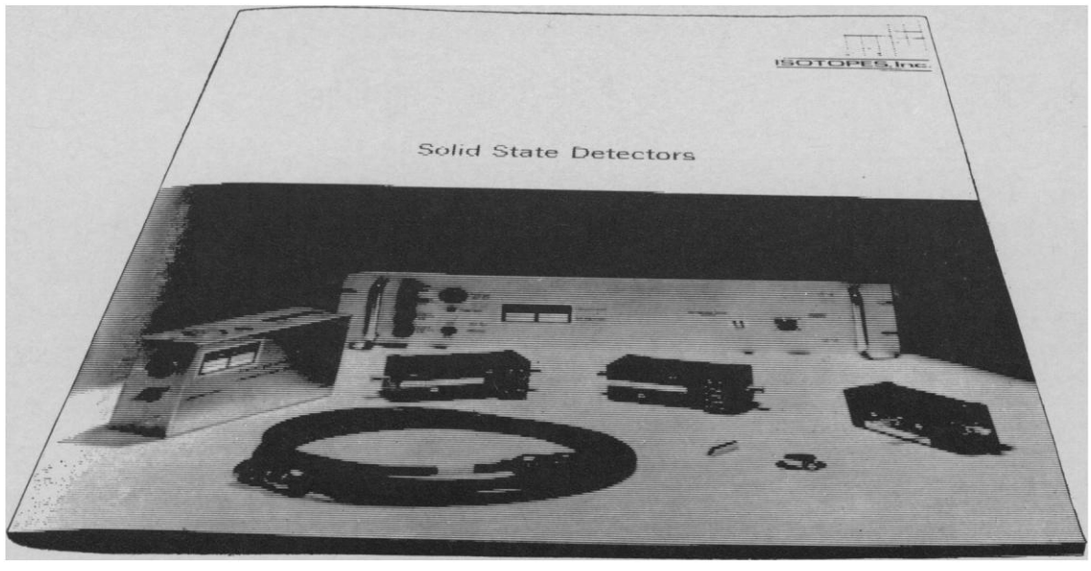

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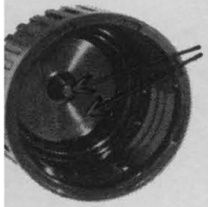

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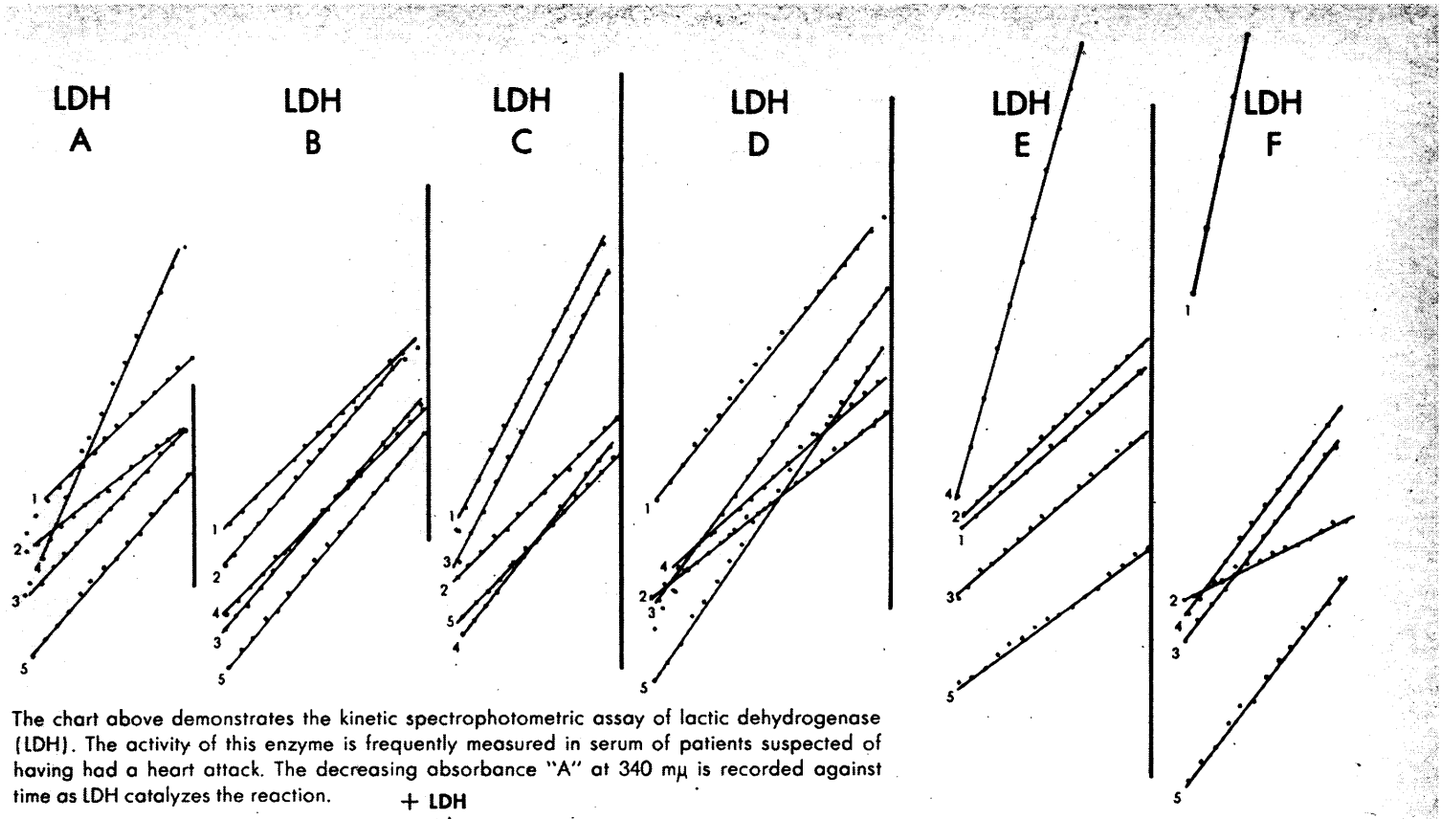

The chart above demonstrates the kinetic spectrophotometric assay of lactic dehydrogenase (LDH). The activity of this enzyme is frequently measured in serum of patients suspected of having had a heart attack. The decreasing absorbance "A" at 340 mμ is recorded against time as LDH catalyzes the reaction.

$$\text{pyruvate} + \text{DPNH} \xrightleftharpoons{+\ \text{LDH}} \text{DPN} + \text{H}^+ + \text{lactate}$$

The rate of this reaction (slope of dA/dt during the initial "O" order portion) is a measure of the enzyme's activity. Extreme slopes and/or deviation from linearity are indicative of an LDH abnormality. 30 production runs in 6 groups are recorded on one chart, at 3 minutes/ group.

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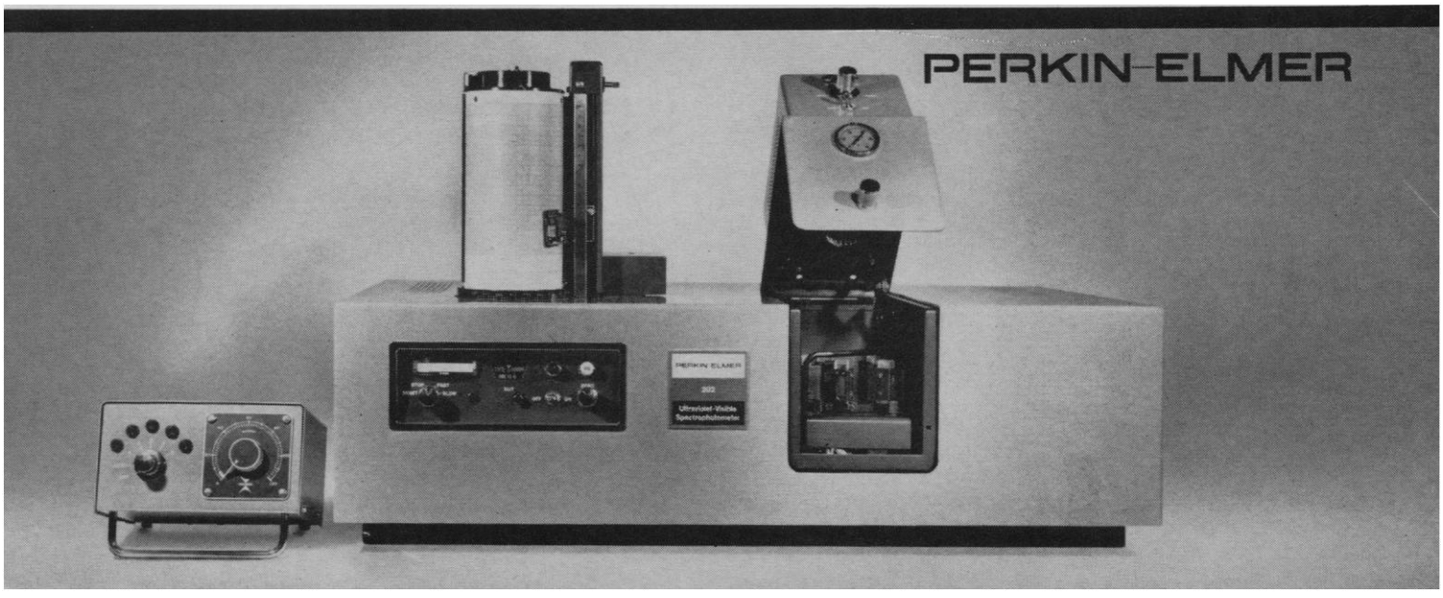
For more information about this new enzyme analysis technique plus details on the Perkin-Elmer Model 202 Spectrophotometer write to: Instrument Division, Perkin-Elmer Corporation, 723 Main Avenue, Norwalk, Connecticut.



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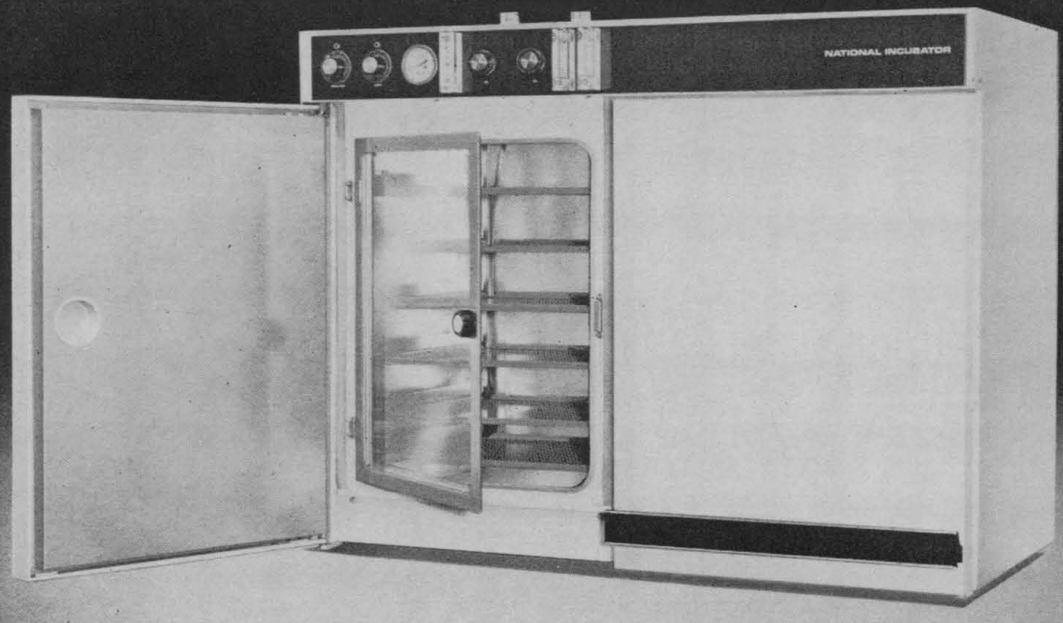

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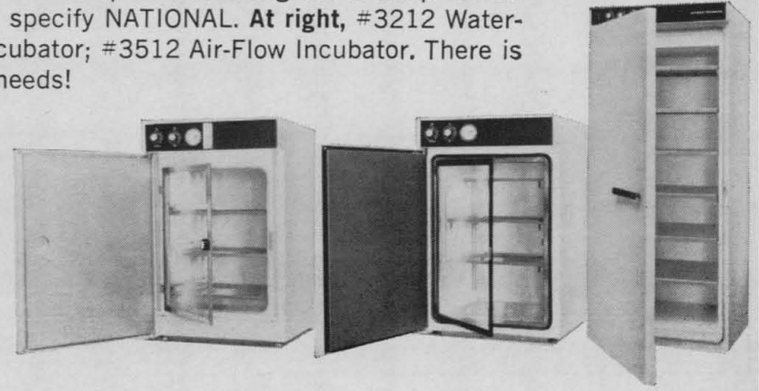

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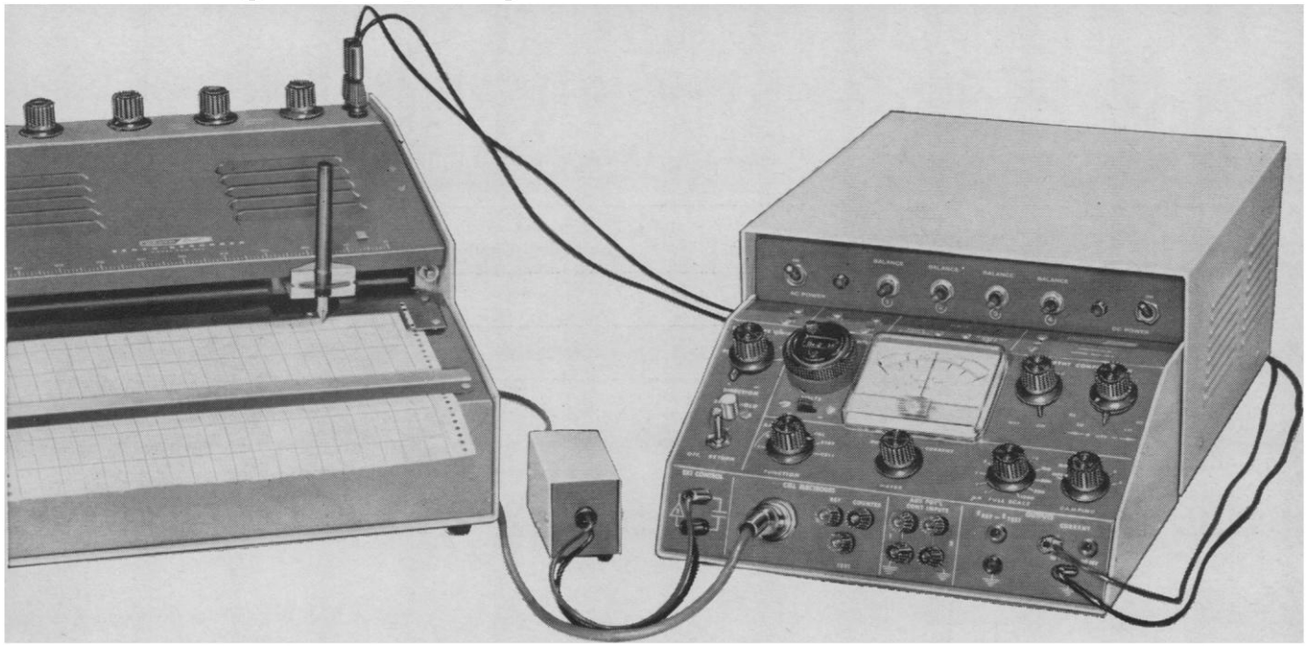

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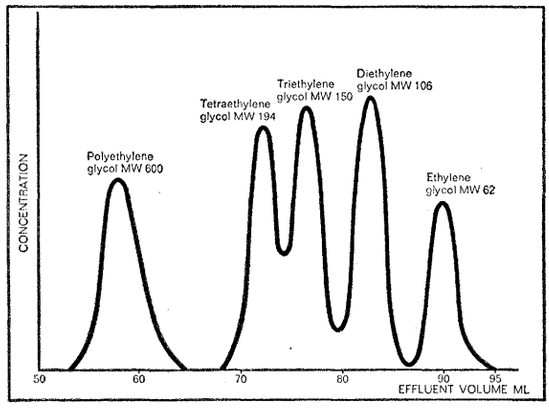
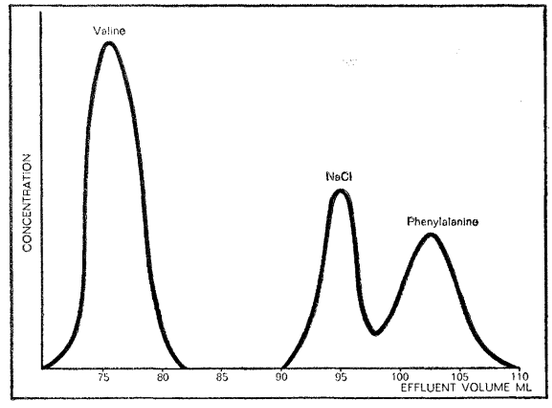
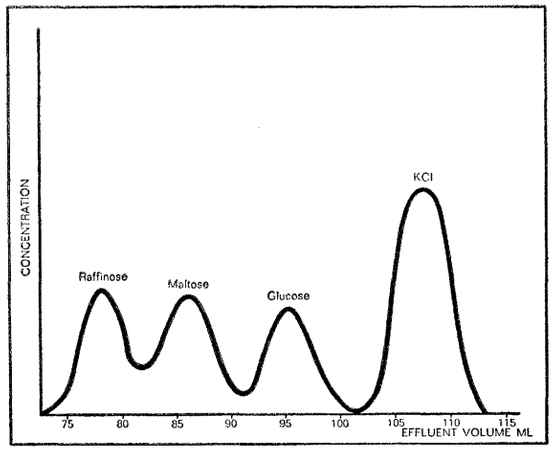


Fractionation of oligomers of ethylene glycols on Sephadex G-10.



Separation of valine, NaCl and phenylalanine on Sephadex G-10.



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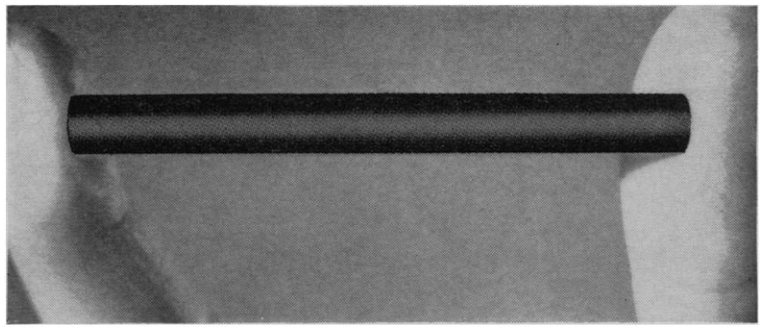
(Inquiries outside North America should be directed to AB PHARMACIA, Uppsala, Sweden.)



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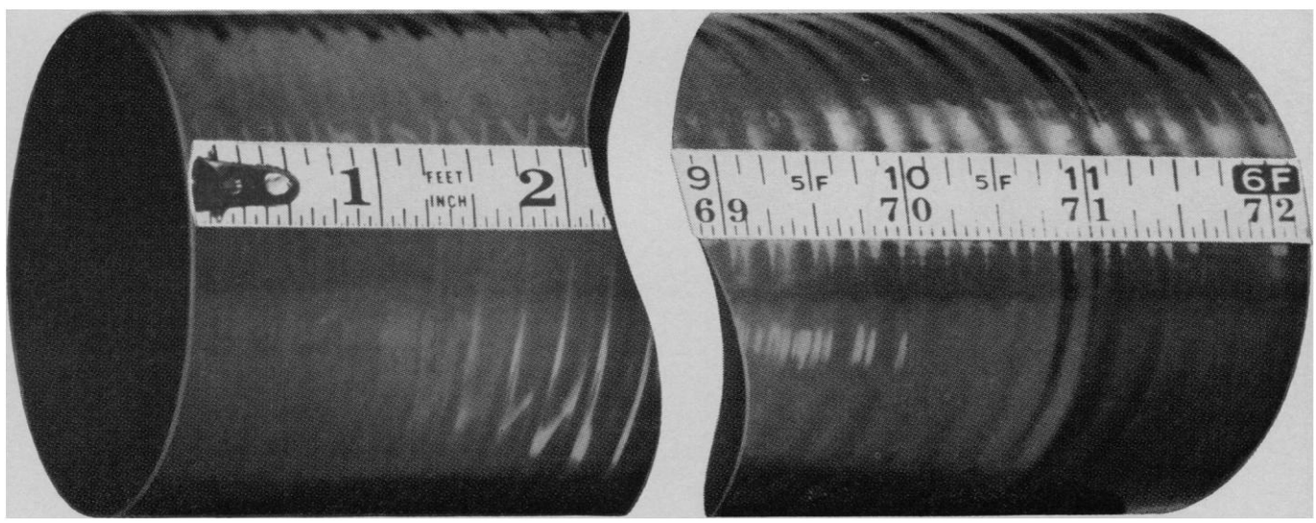

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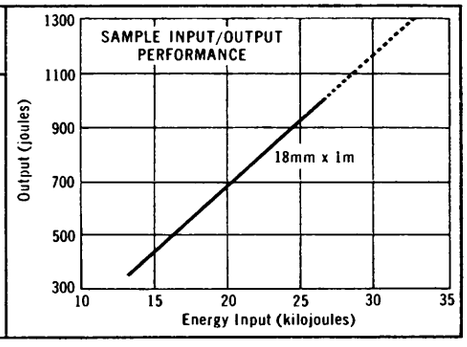

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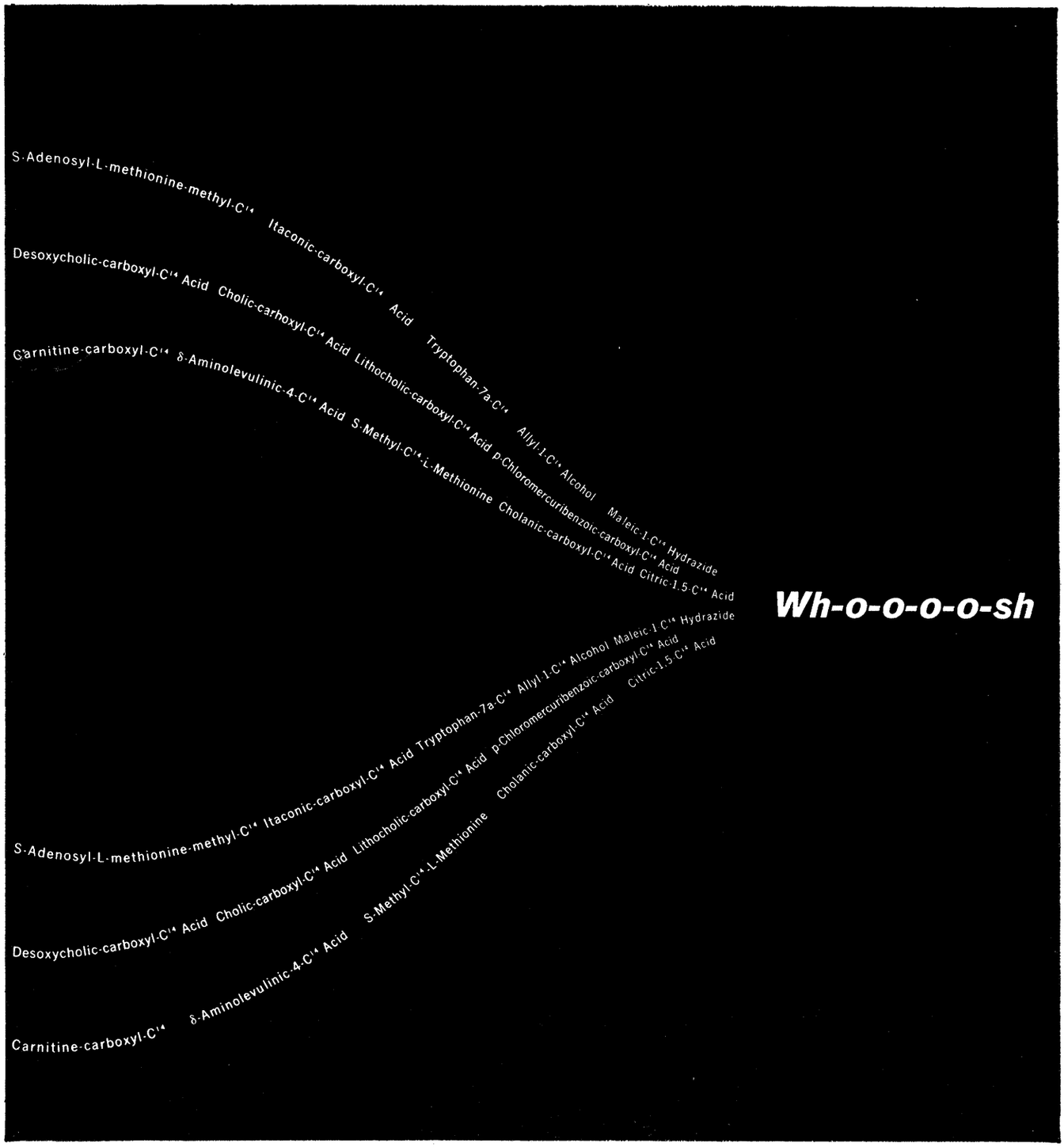

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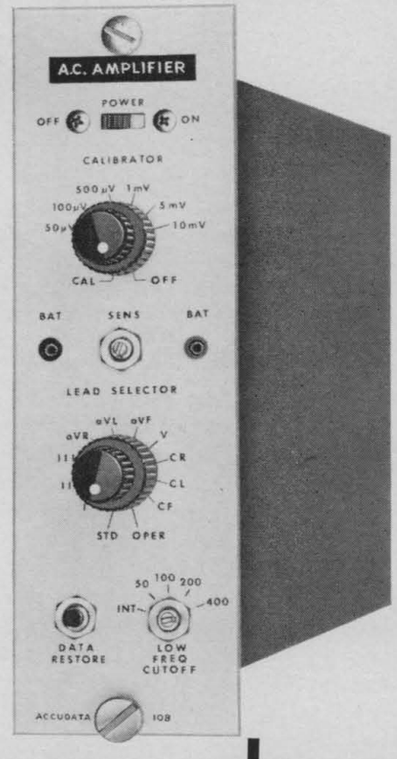

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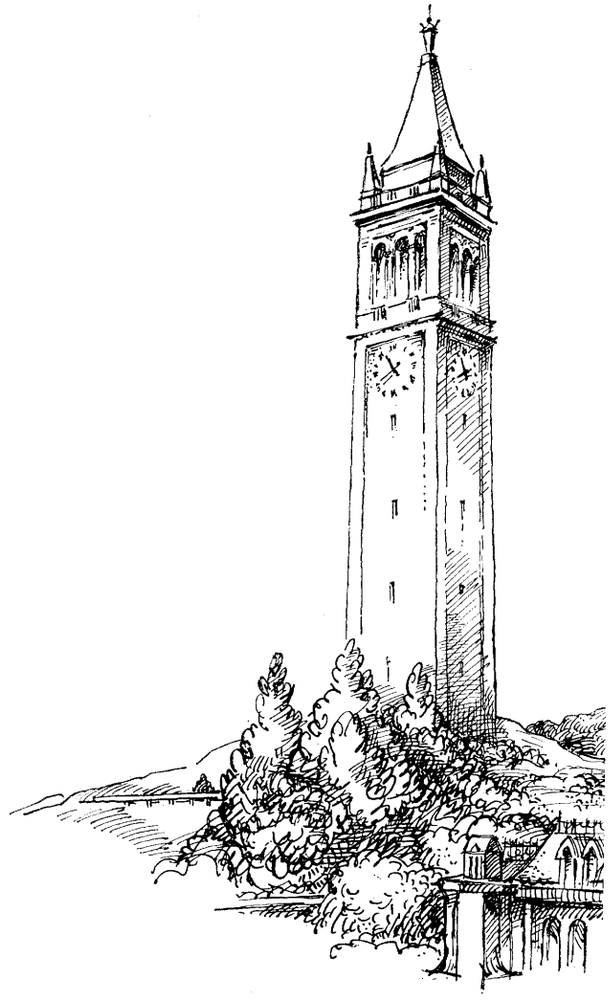

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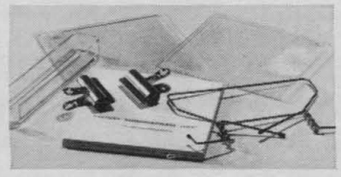
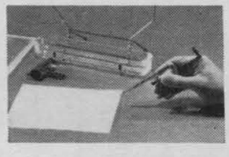
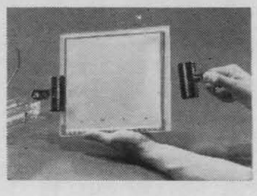
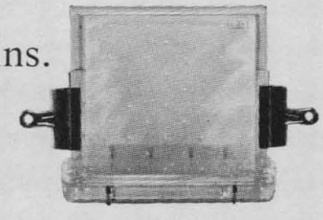
The EASTMAN CHROMAGRAM System for thin-layer chromatography consists of EASTMAN CHROMAGRAM Sheet and EASTMAN CHROMAGRAM Developing Apparatus.  It makes TLC—once messy and cumbersome—fast, neat, and uncomplicated. Gone are the bulk and expense of coating equipment and the problems of breakage and siliceous dust. You take EASTMAN CHROMAGRAM Sheet out of a box, spot it,  place it in the EASTMAN CHROMAGRAM Developing Apparatus,  and separation begins. 

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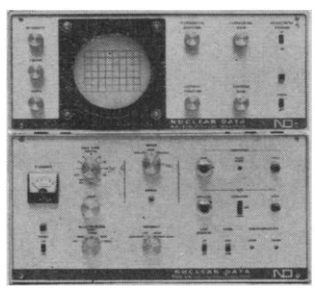

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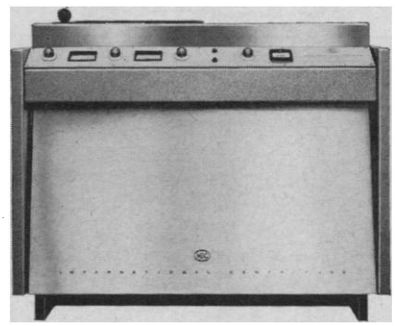

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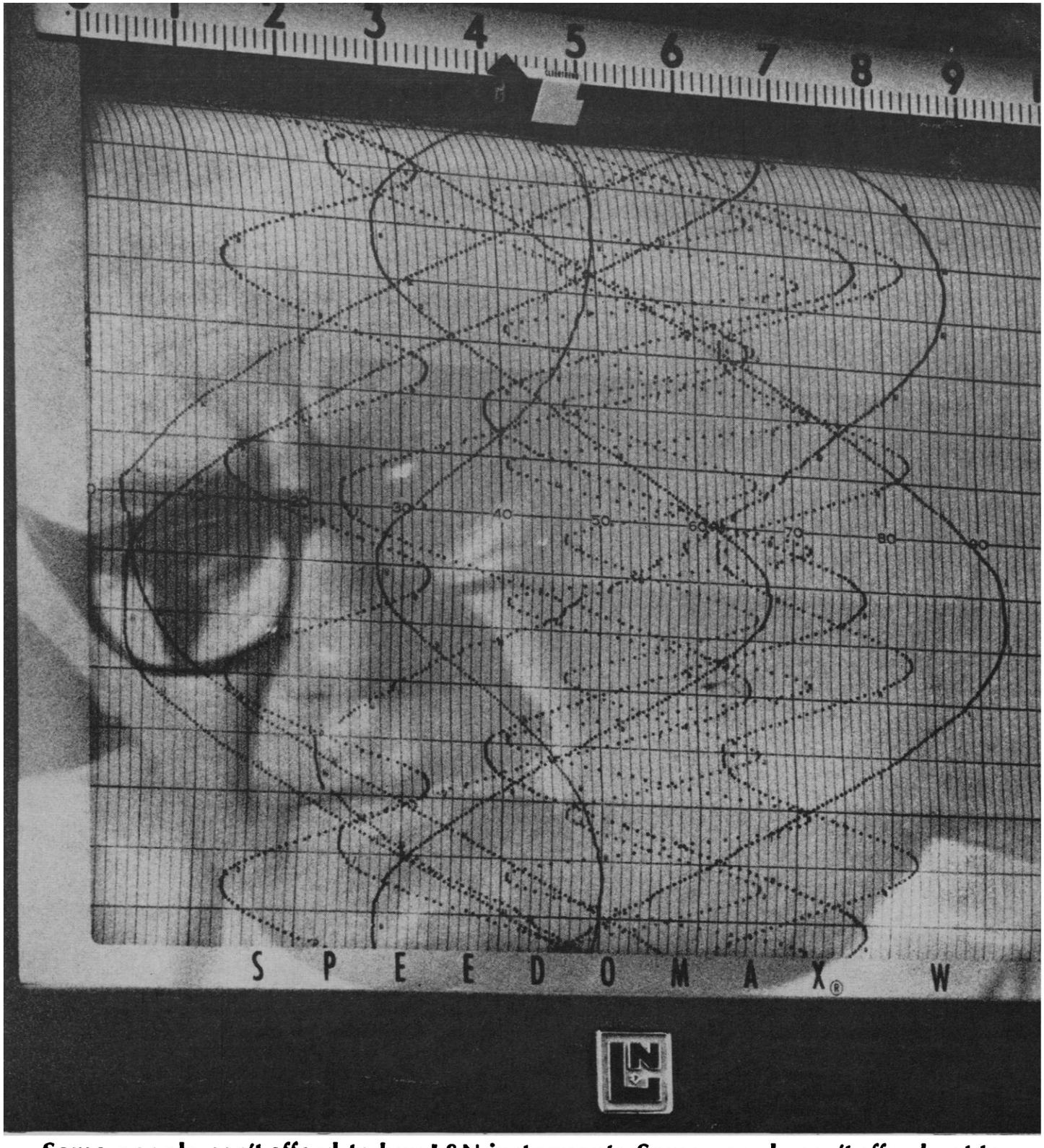

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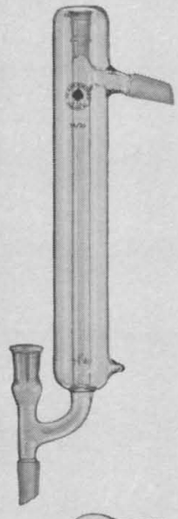

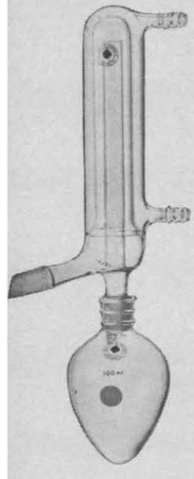

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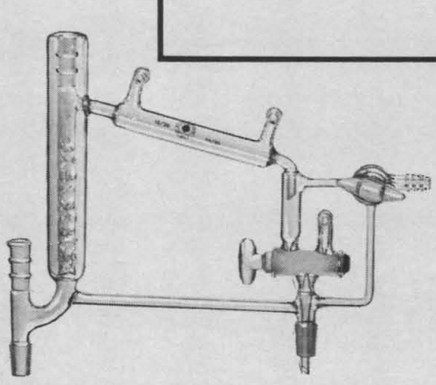

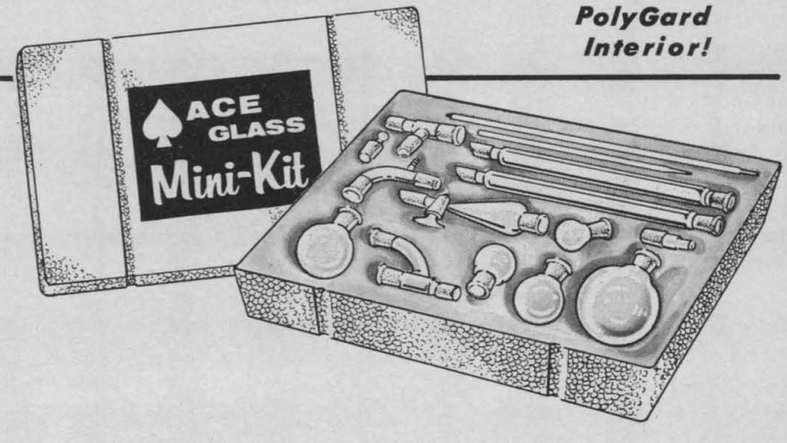

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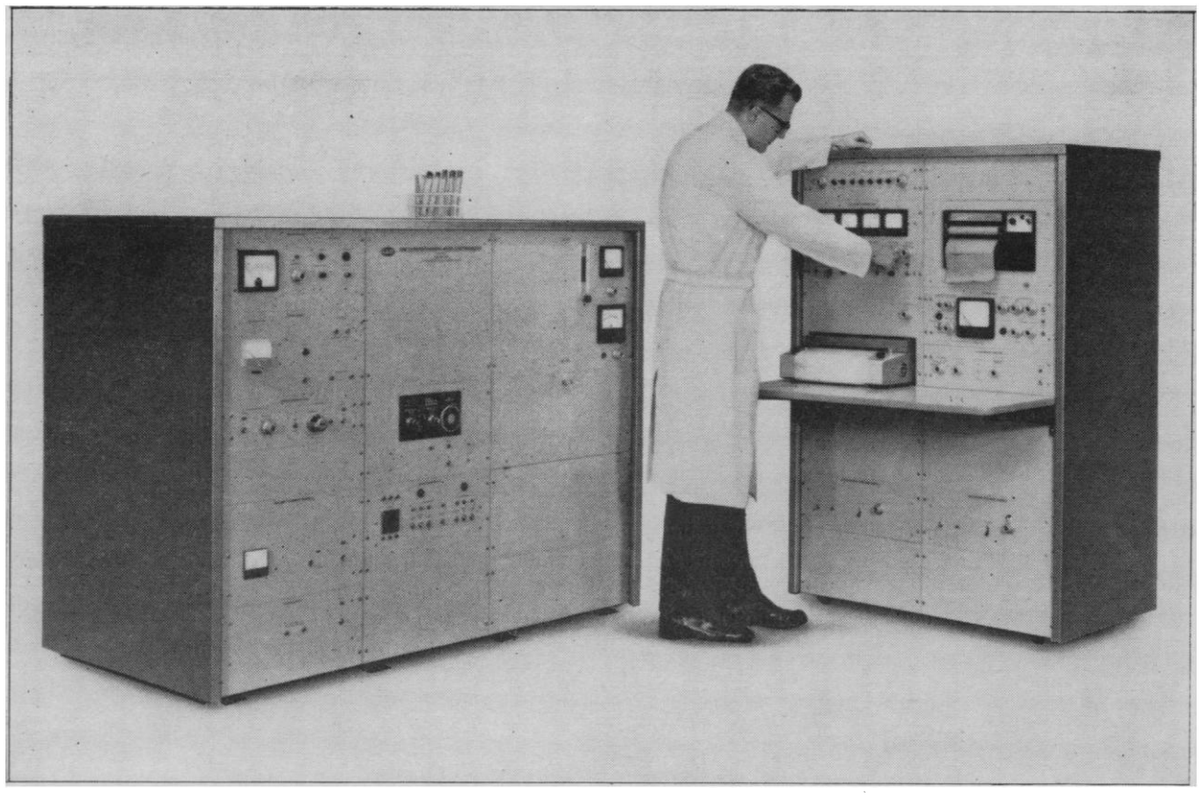

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metric units are permitted by law but are little used.

In 45 countries, total population 1775 million, neither system predominates. China and India make up almost two-thirds of this population. In all these countries, indigenous systems are in wide use; English units are also used to a considerable extent; the metric system has been introduced but has made little headway.

Thus out of a population of 3030 million (97 percent of the world's population in 1962), the metric system is used predominantly by 22 percent; the English system by 19 percent; indigenous systems or a mixture of systems by 59 percent. The main conclusion to be drawn from these figures is that unless the metric system is made mandatory (not just permissible) by law, it makes little headway. In short, for the most part metric conversion means compulsion. . . .

JOSEPH MAYER
Chestnut Lane, Oxford, Ohio

Reference

1. Based upon *World Weights and Measures* (United Nations Statistical Office, New York, 1955), pp. 23–147. Countries with less than 100,000 population are omitted. The population figures are for midyear 1962 and are taken from *Demograhic Yearbook 1963* (United Nations, New York, 1964), pp. 148–161.

Parapsychology and Spontaneous Cases

J. B. Rhine and Charles G. Morris wrote independent letters ("Parapsychology not guilty," 27 Aug., p. 910) in response to my letter entitled "A pseudo experience in parapsychology" (18 June, p. 1541). Morris apparently endorsed my conclusions in his first paragraph, but then, like Rhine, chided me for taking a typical story from the "popular parapsychological literature" rather than from the "more serious parapsychological literature." He concluded that the latter "would be the more appropriate and worthwhile for the inquiring scientist." (In the following quotations, all emphasis has been added by me.)

Rhine concluded his letter with the following two sentences: *"In my 40 years of work in parapsychology I have not come upon any attempt to base a serious conclusion upon spontaneous case material* even when such material does belong to the parapsychological category, as that cited by Alvarez does not. [Rhine apparently missed the point of my example, which was that *no one* could believe that it had parapsychological content.] If Alvarez or anyone else wishes to become acquainted with the parapsychological literature to which he refers, a request for a reference list will be promptly filled."

Naturally, I consider myself to be an inquiring scientist, and I do not wish to be unfair to Rhine. So I visited our Psychology Library and took down the latest bound volume of the *International Journal of Parapsychology*. Its table of contents listed a paper entitled "Approaches to the study of spontaneous cases." I confirmed the fact that spontaneous cases are those of the type I used as my model; they are sent to parapsychology laboratories by people who have had unusual experiences of the kind I tried to show might well be explained as coincidental. One of the references cited in this paper was an article by Louisa E. Rhine, of the Duke University Parapsychology Laboratory, entitled "Conviction and associated conditions in spontaneous cases" [*J. Parapsychol.* **15,** 164 (1951)]. This volume was on the shelf directly below the volume I had just been examining, so it took me only 5 minutes after entering the library to locate Louisa E. Rhine's article.

L. E. Rhine's article is based on a study of 1600 spontaneous cases on file at Duke. She abstracts 19 of the cases in sufficient detail that one can be convinced she is dealing with examples of the type I referred to in the first paragraph of my note. Her concern is with the degree of conviction felt by the subject that his revelation was authentic and not merely coincidental. The last page of her "Discussion" starts with this paragraph:

> *This case study* has shown first that conviction occurs with considerable frequency in *spontaneous psi experiences.* It is reported from widely different sources and, although in varying proportions, in all types of cases. *It is therefore a natural phenomenon* to be studied by appropriate research methods *and should no longer be overlooked by parapsychological experimenters.*

The fact that I was able to discover, in 5 minutes, an example of an *"attempt to base a serious conclusion upon spontaneous case material,"* whereas J. B. Rhine was unsuccessful in 40 years of similar search, may of course be attributable to "luck" on my part.

LUIS W. ALVAREZ
Physics Department,
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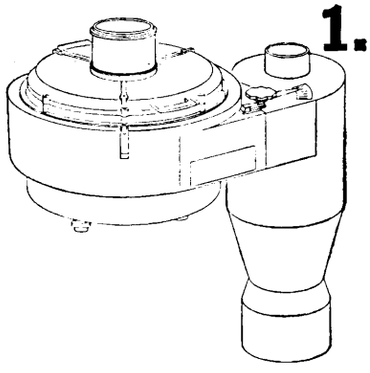

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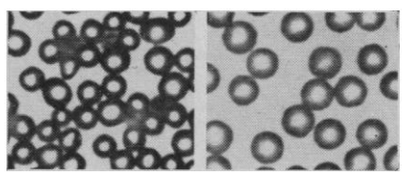

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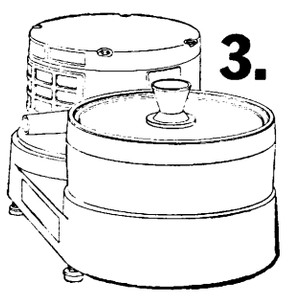

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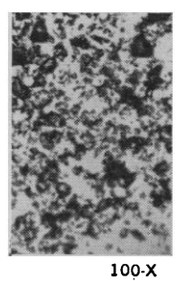

100-X

1. The Vortec C-1 Particle Classifier is the first machine on the market that can classify particle bands in the subsieve range with a ±2 micron accuracy (or better). It also provides an instantly adjustable separation point without manual machine changes. Merely turn a dial which controls the air flow separation system. The C-1 handles low density materials such as talc, limestone, and diatomite or high density materials such as tungsten and nickel powder.

Vortec's particle classifier is designed for small production runs, pilot plant operation, research and development, and particle size distribution analysis for production control. Its output ranges from a few grams to 750 pounds per hour. Vortec particle classifiers can also run in tandem or closed circuit with the versatile Vortec impact mill.

Vortec C-1 Particle Classifier: $5,280, including cyclone air cleaner.

2. **At left:** Attempt to obtain tungsten powder in the 7 to 8 micron range with conventional separation causes high scatter of sizes.

At right: Vortec separation provides the desired uniform particle band.

3. The Vortec M-1 Impact Mill, utilizing a single-impact to produce fresh sharp-edged surfaces, blasts materials onto tungsten carbide targets at over 600 m.p.h. Adjust the rotor speed of our unique system and you can get particle sizes from coarse grinds to an extra-fine grind in the subsieve range (—325 mesh).

The M-1 handles abrasive materials such as silicas and aluminum oxides as well as soft materials such as talc and limestone. The M-1 Impact Mill is non-clogging, easy-to-clean, and self-cooling. Output ranges up to 2,000 pounds per hour, and the end product is not affected even by drastic changes in the feed rate.

Vortec M-1 Impact Mill: $5,470.

4. These Ottawa silica particles were reduced from 100% above 600 microns to 70% below 44 microns in a single run through the M-1 mill.

For more detailed information or brochures on the C-1 and M-1, or if you require classifying or milling equipment with capacities to 50 tons per hour, write or call Mr. T. A. Partridge:

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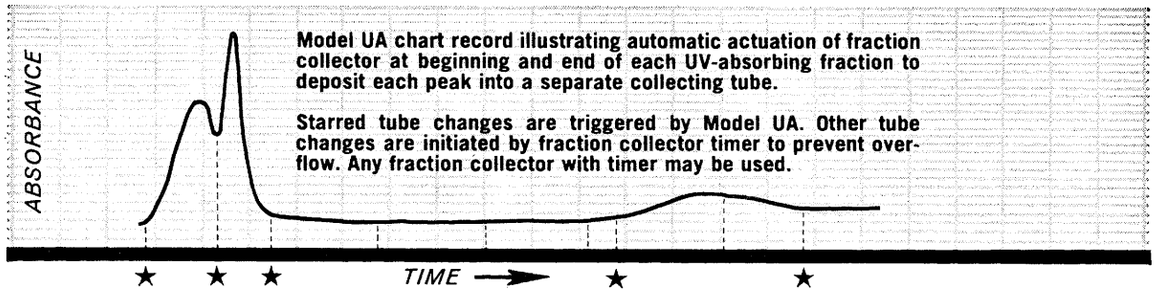
Unique design eliminates need for base line compensation.

Automatically controls a fraction collector to deposit each UV-absorbing fraction into a separate collecting tube. See graph below.

The ISCO Model UA is the only UV monitor with a bandwidth so narrow that it conforms rigorously to Beer's absorption law, and does it without changing wave lengths!

Bandwidth is so narrow* that precise quantitative results will be obtained if the flow stream absorbs *any* light at 254 mμ, regardless of the wavelength of maximum absorption. Other ultraviolet analyzers operating at a fixed wavelength have so wide a bandwidth (even though more than 95% of their light may be at 254 mμ) that they shift their maximum response to other wavelengths at higher absorbances. They can only detect the presence, not the quantity, of UV absorbing fractions.

*0.6 mμ at one thousandth peak intensity.



Model UA chart record illustrating automatic actuation of fraction collector at beginning and end of each UV-absorbing fraction to deposit each peak into a separate collecting tube.

Starred tube changes are triggered by Model UA. Other tube changes are initiated by fraction collector timer to prevent overflow. Any fraction collector with timer may be used.

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22 October 1965, Volume 150, Number 3695 **SCIENCE**

The Profits and Risks of Simplification

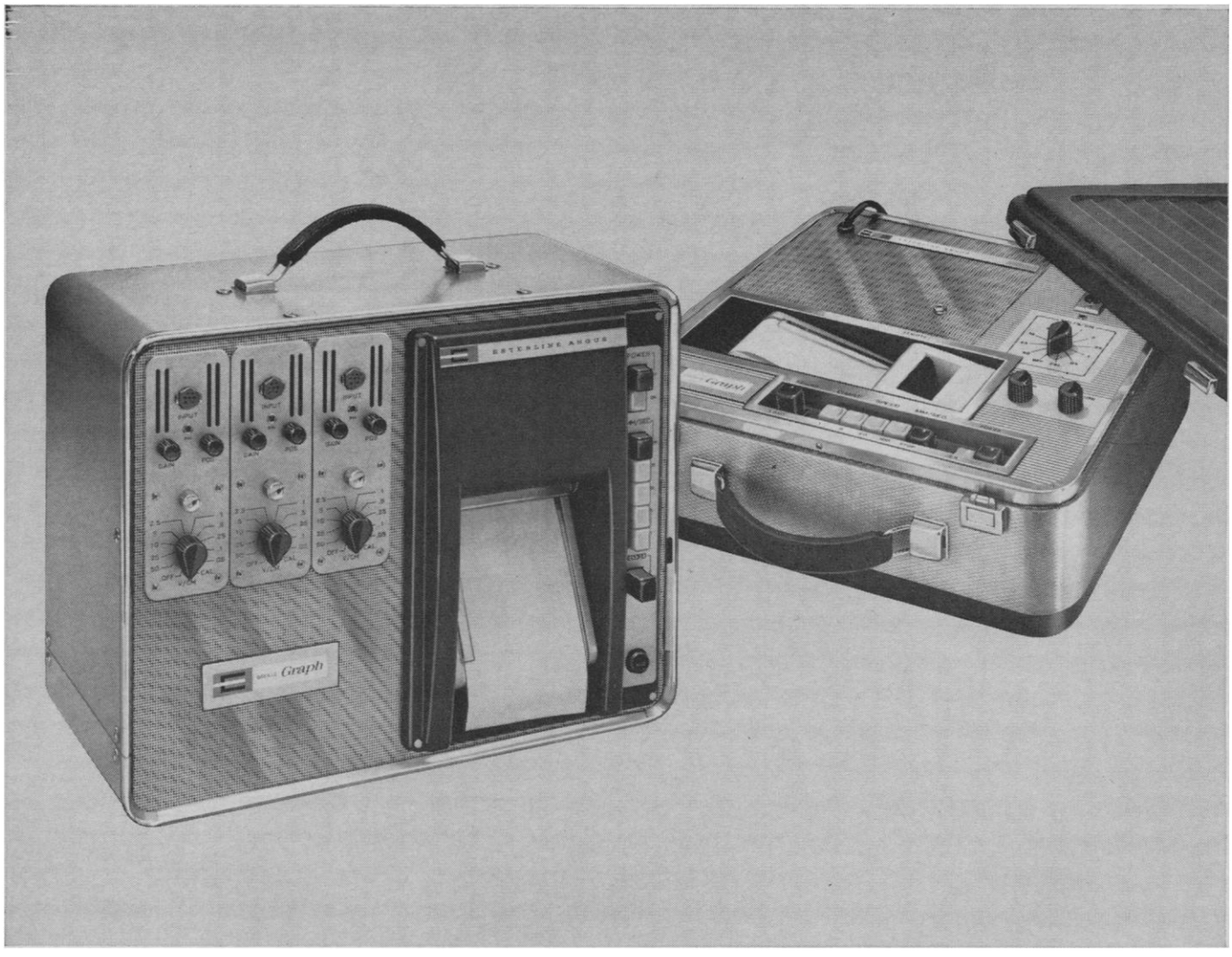
Curious circumstances trigger trains of thought. Glancing across an airplane aisle recently I read the headline "The Lure of False Doctrine." The student reading the article was evidently intrigued by this headline, for he turned repeatedly to the title page. I have no idea what was in the article but I would like to read what Bruno, Galileo, Joan of Arc, and all the other victims of organized violence, both ancient and modern, would have written under the same title. What a monstrous, melancholy medley of misunderstanding it would make. This setting of individuals and peoples on a collision course ordinarily arises from ideological conflicts growing out of uncritical acceptance of half truths. "The Rescue of the Holy Sepulcher," "Death to the Infidel," and "Workers Unite" are slogans each of which conjures up its own special nightmare.

Interestingly enough, scientists are galvanized into action by similar slogans. The crash program on the atomic bomb grew out of groundless fears that our antagonists would get the atomic bomb first. The vast sums being spent at present on a crash program for an early landing on the moon have their own somewhat obscure, psychological basis. If the moon program is really the most effective means of staving off all-out war, expensive as it is, it is still a bargain. On the other hand, the attempts which are sometimes made to sell the moon program on its scientific merits alone, in competition with other scientific uses of the money, are less convincing. The charitable conclusion is that in public affairs it is deemed necessary to oversimplify actual objectives so that the general public will best serve its own interests for the wrong reasons. This oversolicitude is probably neither necessary nor desirable.

Oversimplification also plays a conspicuous role in many scientific matters. Anyone who would start a course in valence theory by listing all the exceptions to the rules of valence before first developing the rules themselves would deserve the adverse criticism he would surely get. On the other hand, the doctrine that atoms with filled shells, such as the rare gases, are chemically inert was a simplification too well learned. People hesitated to do experiments running counter to such a self-evident truth. Equally slow to die was the dictum that coupled oscillators are always necessary to make a molecule optically active; this dictum had adherents even after the optical activity of single electrons had been clearly demonstrated. In fact, one of the greatest hindrances to scientific discovery is the necessary preliminary uprooting of the hallowed simplifications that everyone knows but that just happen to be untrue. After all, Aristotle said that it took force to keep a body moving at a steady rate. Why then should one accept the contradictory experiments of Galileo, who showed that force is necessary only when a body is to be accelerated?

If scientific progress is to be made, one must invent scientific models using those simplifications which make the best compromise between the infinite detail of reality and the present limits of tractability. It really isn't too bad that, after 250 years, Newtonian mechanics was amended by a Planck and an Einstein. Ultimate scientific rigor, like the pot of gold at the end of the rainbow, always lies over the ridge, fortunately.

—HENRY EYRING, *University of Utah, Salt Lake City*



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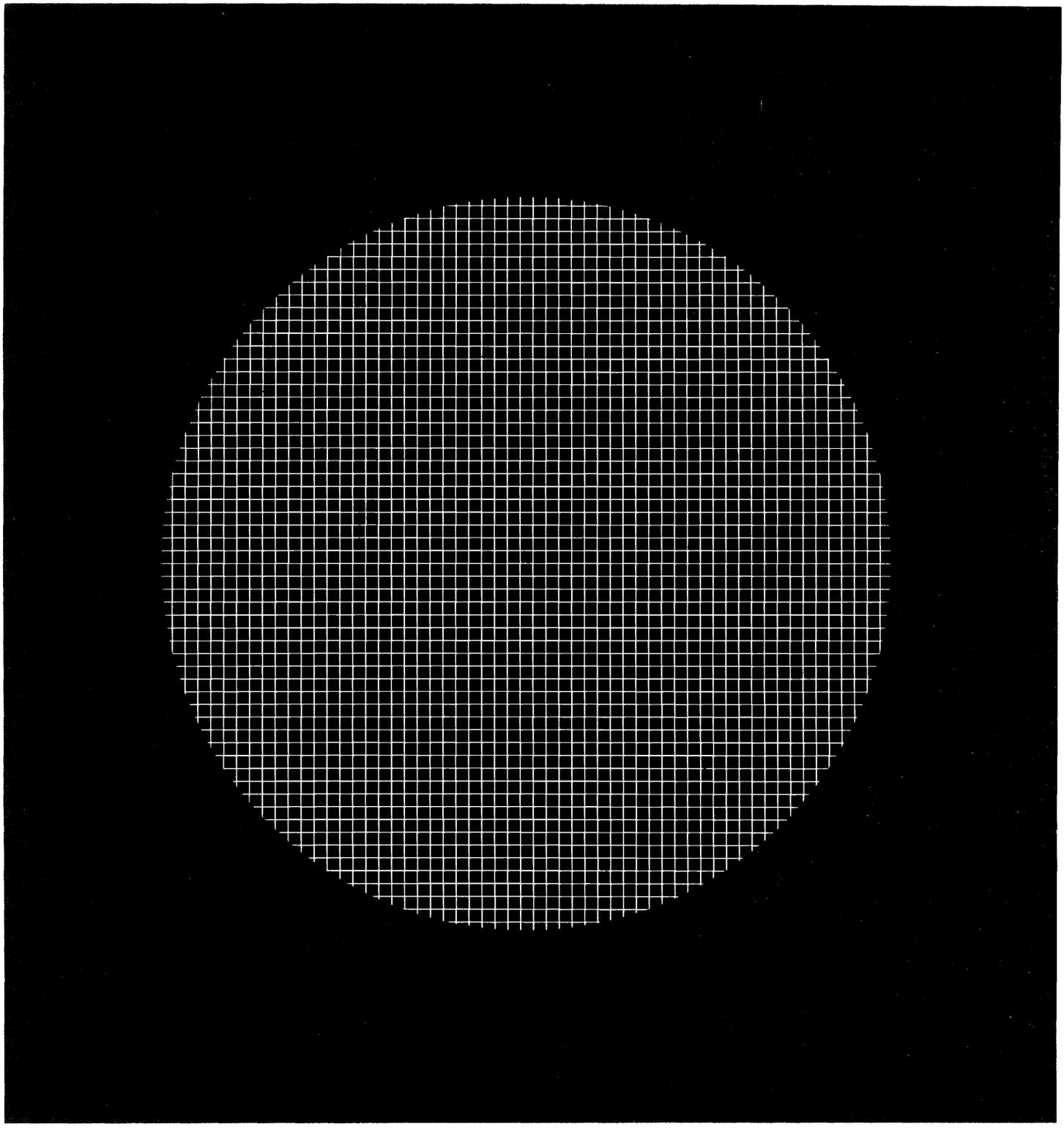

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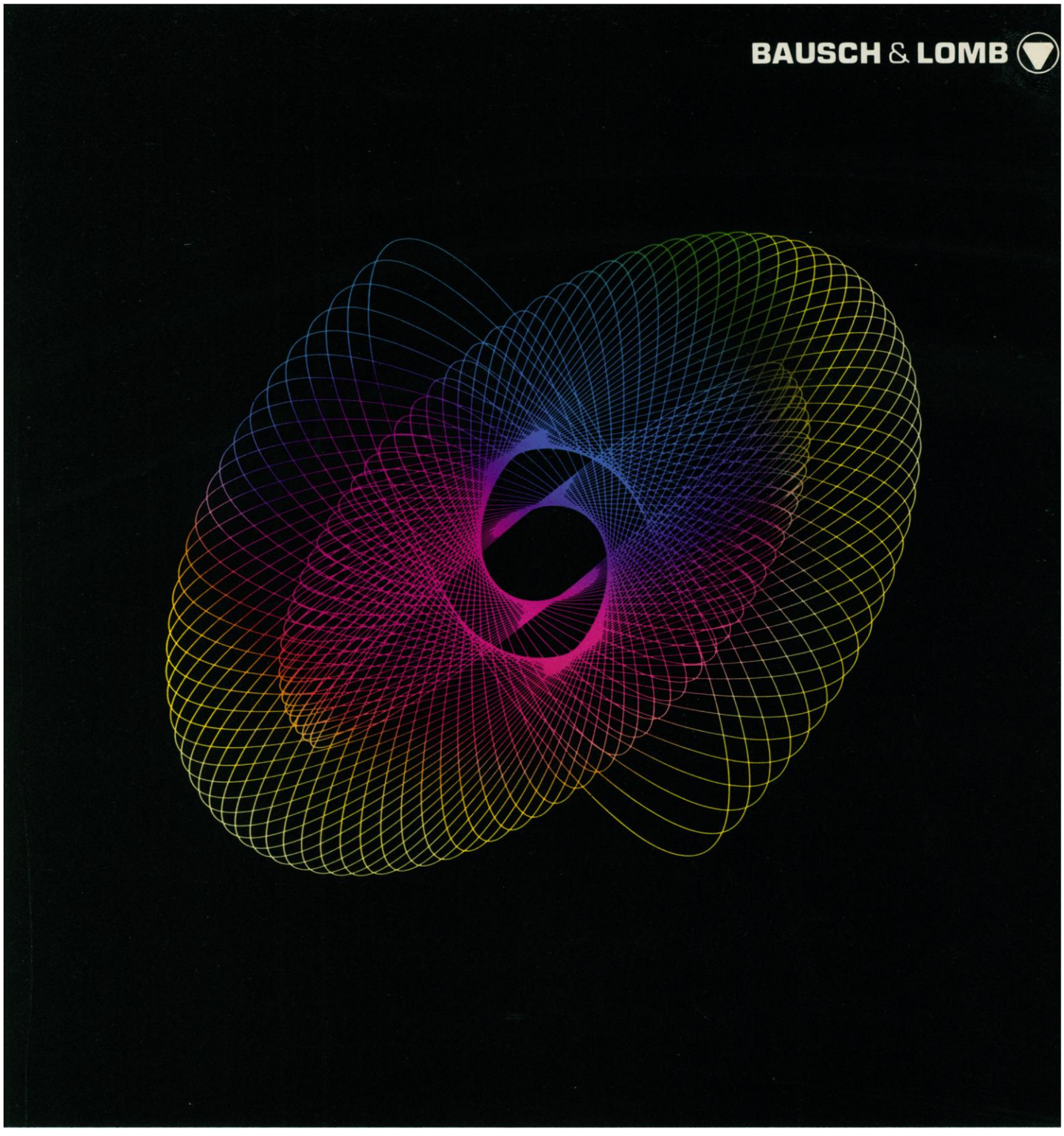

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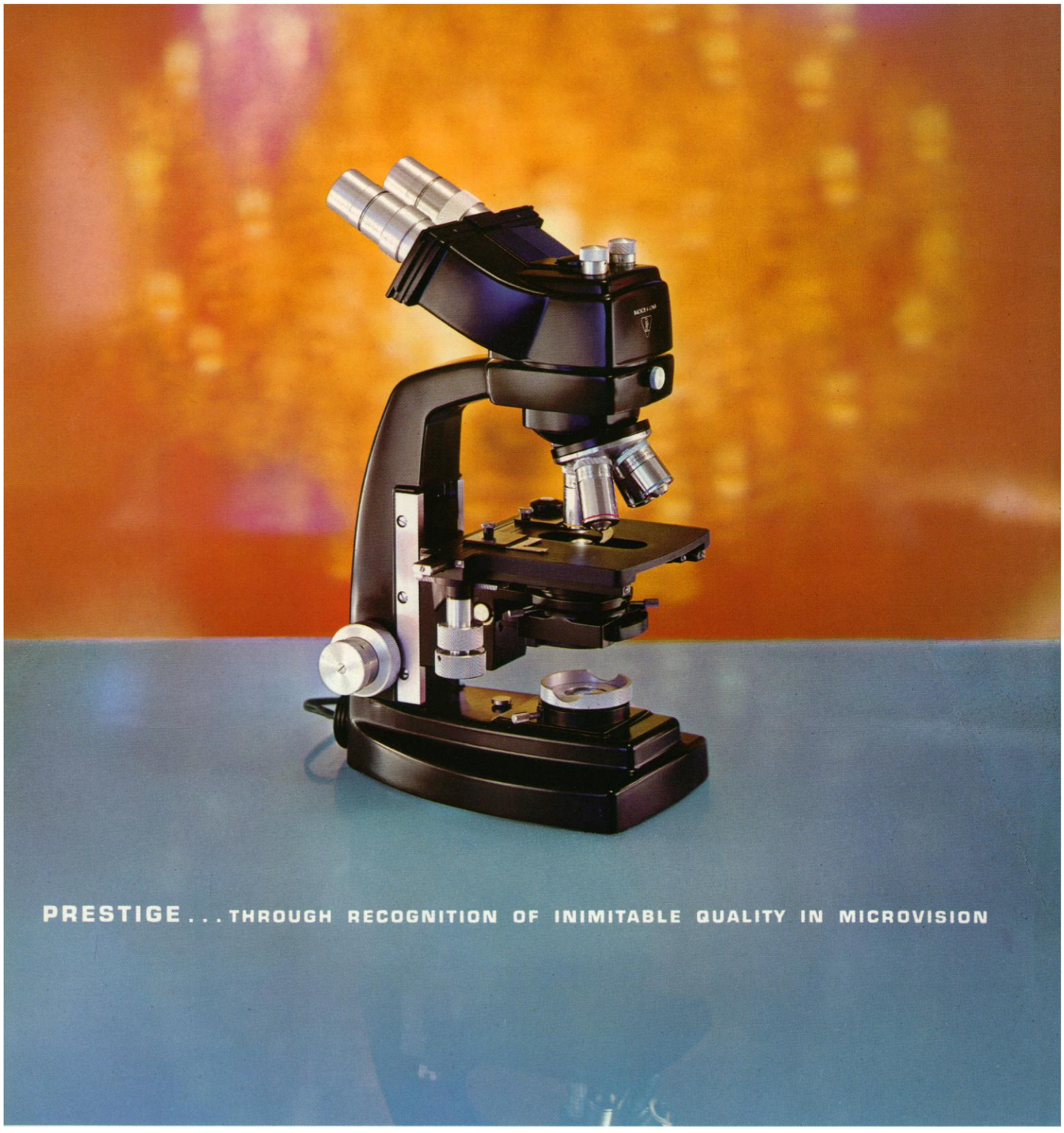

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the immature nervous system to disease. He offered a classification of developmental disorders based on two main variables, developmental stage of onset and disease agent. A classification, supported by experimental data, must precede comprehension of mental retardation, epilepsy, and other groups of diseases.

The conference was sponsored by the Jackson Laboratory. In lieu of published proceedings of the conference, a detailed checklist and bibliography of neurological mutants in the mouse will be published by the Harvard University Press, Cambridge, Massachusetts.

R. L. SIDMAN
Harvard Medical School, Boston, Massachusetts

S. H. APPEL
University of Pennsylvania Hospital, Philadelphia

J. F. FULLER
Jackson Laboratory, Bar Harbor, Maine

Electronic and Atomic Collisions

When activity in the field of atomic collision physics (along with extranuclear atomic physics generally) went into its decline three decades ago, it was widely felt that the field was completely understood in principle and that a limited number of then impossible experiments and calculations would tie up the entire matter. The 4th international conference on the physics of electronic and atomic collisions, held at Laval University in Quebec, Canada, 2–6 August 1965, disclosed that assessment to be far from adequate.

The "impossible" experiments have disclosed an incredible richness of phenomena in atomic and electronic collision physics, of importance to space, atmospheric, and plasma physics and to gas-phase chemistry; the computer-aided theoretical work has brought to light at least as many new problems as it has solved.

Typical of the new areas is the matter of "resonances" in scattering. As presently used, the term "resonance" refers to observation of energy-dependent structure in electron collision cross sections. This structure appears to be well fitted by the Breit-Wigner resonance formula much used in nuclear physics; moreover, theoretical calculations, especially in *e*-H scattering, have predicted the observed structure and

have shown that it is associated with the rapid energy variation of individual phase shifts.

Papers on resonances, given by P. G. Burke (England), A. Herzenberg (England), and E. Holøien (Norway), made it clear that the techniques of predicting resonances have steadily improved since 1963. In particular, a means of projecting out the coupling to the continuum, and thereby of associating the complex energy eigenvalue responsible for a resonance with a real eigenvalue computable by the Rayleigh-Ritz minimum principle, has been developed. Moreover, a variational (nonminimal) principle for the complex eigenvalues has been shown to have great promise. Thus accurate predictions of resonances in not-too-complicated electron-molecule reactions (for example, $e + H^2$ collisions) soon should be forthcoming.

The theoretical advances in resonances have been well matched by advances in experiments. Particularly striking were the new measurements on the H atom resonance reported by H. Kleinpoppen (Germany); these measurements verify and are an improvement on the earlier measurements of G. J. Schulz (U.S.A.). Also noteworthy were the studies by H. Ehrhardt and G. Meister (Germany) on the angular distribution of electrons scattered by helium in the vicinity of the resonance first predicted by Gerjuoy and Baranger (U.S.A.) and previously observed by G. J. Schulz, J. Arol Simpson, and C. E. Kuyatt (U.S.A.).

Among the other experiments which employed high-resolution electron techniques and which were particularly interesting for development of theory were those of Kuyatt, Simpson, and Mielczarek. Their electron scattering experiment displayed the vibrational level structure in H_2. In the experiments of McGowan and Fineman (U.S.A.) the ionization of H_2 curves displayed structure due to rotational excitation.

The question of resonances in electron scattering is closely related to the existence of states of atoms and molecules with excitation energies in excess of the first ionization potential (so that autoionization can occur) and to the existence of unstable, compound negative ions. Techniques to map out the energy levels of these super-excited states have been developed.

Related to the question of these super-excited states is the matter of characteristic energy losses in ionizing collisions between ions and atoms.

Such energy losses have been studied by coincidence methods in the laboratories of N. V. Fedorenko (U.S.S.R.) and E. Everhart (U.S.A.). It now appears that at small impact parameters any ionization process is correlated with the excitation of one of the characteristic energy losses and that these energy losses are evidently associated with ionization and excitation from the inner shells of the colliding heavy particles. The finding by M. E. Rudd and D. V. Lang (U.S.A.) that the energy spectrum of the electrons produced in ion-atom collisions show well-defined, sharp structure further supports the view that ionization in heavy particle collisions proceeds in part through excitation to super-excited states, followed by autoionization.

Classical (that is, nonquantum) methods for computing cross sections were discussed by a panel consisting of M. Gryzinski (Poland), A. Burgess (England), I. C. Percival (England) and L. Vriens (Netherlands) in perhaps the most spirited and controversial session of the conference. The use of classical theory to compute atomic cross sections dates back to J. J. Thomson in 1912. Recently, however, as a result of Gryzinski's demonstration that Thomson's formula for ionization of an atom by electron impact could be improved by taking into account the actual velocity distribution of the atomic electrons, the possibility of estimating atomic collision cross sections classically has attracted widespread interest. In general, the panelists thought that the remarkable successes of these classical calculations stem from the "accidents" that atomic interactions involve Coulomb forces and that scattering of a pair of otherwise isolated charged particles is independent of Planck's constant, that is, the scattering is the same whether calculated classically or quantum mechanically. Gryzinski appears to believe that atomic collision cross sections ultimately can be predicted accurately without reference to quantum concepts.

Among the outstanding of the 72 theoretical contributions was the work of F. T. Smith and R. P. Marchi (U.S.A.). They showed that the oscillations in the $He^+ + He$ charge-transfer cross sections could be accounted for in detail; indeed it should be possible to infer the $He^+ - He$ interaction potential from the oscillations observed. Also, G. F. Drukarev and Yu. M. Demkov (U.S.S.R.) contributed a very interesting and novel paper on the distribution of poles and zeros of the scattering

matrix on the imaginary axis in the complex wave number plane. The positions of these poles and zeros largely determine the energy dependence of the cross section. It was extremely regrettable that neither Drukarev nor Demkov was able to be present for the discussion of their interesting work.

Turning to but a few of the "nonresonant" experimental highlights of the conference, one can point first to recent experimentation on the free hydrogen atom. S. J. Smith (U.S.A.) reported a new measurement for electron-impact excitation of Lyman alpha which confirms the earlier results of Fite (U.S.A.) that the "best" quantum theory as of present (the close coupling approximation) is indeed in error at lower energies. H. B. Gilbody (England) has extended the energy range for charge transfer between protons and hydrogen atoms by a factor of three over previous measurements.

H. Kleinpoppen (Germany) reported some beautiful results concerning the effect of nuclear spin on polarization of optical radiation. His work goes far toward testing the predictions of Percival and Seaton made in 1958. In the experiment, atoms of Li^6, Li^7, and Na^{23} were excited by electron impact; the polarization of the first resonance line was measured as a function of electron energy. These three isotopes represent cases where the hyperfine separation compared to the level width of the excited state is small, comparable, and large, respectively. It was found that although the transitions are the same electronically, the polarization fractions near threshold were 40, 21, and 15 percent in good agreement with theoretical prediction.

The first experiment on two-photon absorption by negative ions, combining laser and crossed beam techniques, was reported by Hall, Robinson, and Branscomb (U.S.A.). Extremely elegant experiments on the interaction of electrons and ions, particularly enlightening for theory development and for plasma physics, were reported both by Dance, Harrison, and Smith (England) and by Dunn, van Zyl, and Zare (U.S.A.).

The question of the effect of internal excitation on measured cross sections in ion-neutral collisions has begun to be evaluated. Perhaps the most definitive experiments reported were those of Turner, Stebbings, and Fineman (U.S.A.). Initial ions were produced in various states of excitation, and variations of cross sections were

studied. From such studies it seems clear that much of the disagreement between different laboratories in earlier measurements originated from differences in state population of beams from different ion sources.

In the thermal energy range, the methods involving flowing pulsed, afterglow, which were devised by E. E. Ferguson and his associates (U.S.A.), were particularly impressive. Also impressive was their tabulation of a large number of measured rates for processes occurring in the upper atmosphere.

Numerous experiments delved into less well-defined problem areas relating to excitation, ionization, and heavy particle collisions. The supply of entirely unexpected observations reported is ample to keep the theoreticians hard at work for a number of years.

The conference was invited by N. V. Fedorenko to meet next in Leningrad in 1967, a proposal which was accepted with great enthusiasm.

W. L. FITE
E. GERJUOY
Department of Physics and
Space Research Coordination Center,
University of Pittsburgh,
Pittsburgh, Pennsylvania

Forthcoming Events

October

30–2. American **Speech and Hearing** Assoc., Chicago, Ill. (K. O. Johnson, 1001 Connecticut Ave., NW, Washington, D.C.)

31–4. American Soc. of **Agronomy**, 57th annual, Columbus, Ohio. (ASA, 677 South Segoe Rd., Madison, Wis. 53711)

31–5. Society of **Motion Picture and Television Engineers**, 98th technical conf., Montreal, P.Q., Canada. (SMPTE, 9 E. 41 St., New York 10017)

31–5. American Soc. for **Testing and Materials**, 5th Pacific area natl., Seattle, Wash. (H. H. Hamilton, ASTM, 1916 Race St., Philadelphia, Pa. 19103)

November

1–3. Development of the **Lung**, Ciba Foundation symp., London, England. (Ciba, 41 Portland Pl., London, W.1)

1–3. American **Physical** Soc., southeastern section, Charlottesville, Va. (H. Carr, Auburn Univ., Auburn, Ala.)

1–3. **Industrial Static Power Conversion**, conf., Philadelphia, Pa. (L. W. Morton, General Electric Co., Bldg. #2, Schenectady 5, N.Y.)

1–3. Information Processing in **Sight Sensory Systems**, California Inst. of Technology, Pasadena. (E. D. Johnson, 208 Booth Computing Center, California Inst. of Technology, Pasadena 91109)

1–3. **Systems**, intern. meeting, Chicago,

Ill. (R. L. Irwin, Systems and Procedures Assoc., 7890 Brookside Dr., Cleveland, Ohio 44138)

1–4. American Soc. of **Agronomy**, Columbus, Ohio. (M. Stelly, ASA, 677 S. Segoe Rd., Madison, Wis. 53711)

1–4. **Radioactive Pharmaceuticals**, symp., Gatlinburg, Tenn. (Chairman's Office, Medical Div., Oak Ridge Inst. of Nuclear Studies, Oak Ridge, Tenn. 37831)

1–5. American **Dietetic** Assoc., 48th annual, Cleveland, Ohio. (ADA, 620 North Michigan Ave., Chicago, Ill. 60611)

The following meetings will be held under the **U.S.–Japan Cooperative Science Program** for November. Information is available from N. P. Neureiter, Office of International Activities, National Science Foundation, Washington, D.C.

1–5. **Congenital Malformations and Cancer**, planning meeting, Tokyo, Japan.

4–5. **Range of Deviation among Cancer Cells**, conf., Kyoto, Japan.

15–18. **Bulk Sampling**, seminar, Tokyo, Japan.

1–7. **Military Medicine and Pharmacy**, 18th intern. congr., Bangkok, Thailand. (J. Voncken, Intern. Committee of Military Medicine and Pharmacy, 79, rue Saint-Laurent, Liege, Belgium)

2–4. New England **Research and Engineering** Meeting (NEREM), Boston, Mass. (IEEE Boston Office, 313 Washington, Newton, Mass.)

2–4. **Space Electronics**, intern. symp., Inst. of Electrical and Electronics Engineers, Miami Beach, Fla. (A. J. Wood, Office of Information, Public Information Div., Patrick Air Force Base, Fla.)

2–5. Use of the **Baboon as an Experimental Animal**, 2nd intern. symp., San Antonio, Tex. (L. R. Smith, Southwest Foundation for Research and Education, P.O. Box 2296, San Antonio 78206)

2–6. American Soc. of **Oral Surgeons**, annual, Denver, Colo. (G. A. Malecki, ASOS, 919 North Michigan Ave., Chicago, Ill.)

3–4. **Automation**, conf., Oslo, Norway. (Studieselsmapet Forkninsveien, Oslo 3)

3–4. American College of **Clinical Pharmacology and Chemotherapy**, Chicago, Ill. (D. E. Hutcheon, The College, 7 E. 82 St., New York 10028)

3–5. **Data Processing**, intern. fall conf., Dallas, Tex. (Conference Registrar, P.O. Box 2665, Dallas 75221)

3–5. **Diffraction**, 23rd Pittsburgh conf., Pittsburgh, Pa. (B. R. Banerjee, Crucible Steel Co., 234 Atwood, Pittsburgh 15213)

3–5. Society of **Engineering Science**, 3rd technical, Univ. of California, Davis. (A. C. Eringen, School of Aeronautics, Astronautics and Engineering Sciences, Purdue Univ., Lafayette, Ind. 47907)

3–5. American Soc. of **Tropical Medicine and Hygiene**, New Orleans, La. (G. M. Jeffrey, P.O. Box 295, Kensington, Md.)

3–6. **Acoustical** Soc. of America, St. Louis, Mo. (W. Waterfall, American Inst. of Physics, 335 E. 45 St., New York 10017)

3–8. French Soc. of **Orthopedics and Traumatology**, 40th annual, Paris. (D. P. Masse, FSOT, Pavillon Ollier, Hôpital Cochin, 27 rue du Faubourg Saint-Jacques, Paris 14e)

3–12. Intergovernmental **Oceanographic** Commission, 4th session, Paris, France. (Office of Oceanography, UNESCO, Pl. de Fontenoy, Paris 7e)

4–5. **Operations Research** Soc. of America, Houston, Tex. (N. E. Miller III, Mt. Royal and Guilford Aves., Baltimore, Md. 21202)

4–5. **Rheumatology**, Czechoslovak-Polish meeting, Prague, Czechoslovakia. (F. Lenoch, Na Slupi 4, Prague 2)

4–6. American Soc. of **Cytology**, 13th annual scientific, New York, N.Y. (W. R. Lang, 1012 Walnut St., Philadelphia, Pa. 19107)

4–6. Society of **Economic Geologists**, Kansas City, Mo. (J. O. Kalliokoski, Dept. of Geology, Princeton Univ., Princeton, N.J. 98540)

4–6. **Geological** Soc. of America, Kansas City, Mo. (R. C. Becker, GSA, 231 E. 46 St., New York 10017)

4–6. National Assoc. of **Geology Teachers**, Kansas City, Mo. (M. B. Rosalsky, Dept. of Geology, City College of New York, New York 10031)

4–6. Southwestern **Medical** Assoc., 47th annual, El Paso, Tex. (S. Heinemann, 310 N. Stanton, El Paso)

4–6. **Paleontological** Soc., Kansas City, Mo. (R. L. Langenheim, Jr., Dept. of Geology, Univ. of Illinois, Urbana)

5–6. **Cancer of the Gastrointestinal Tract**, 10th annual clinical conf., Univ. of Texas M. D. Anderson Hospital and Tumor Clinic, Houston. (R. L. Clark, M. D. Anderson Hospital and Tumor Inst., Univ. of Texas, Houston 25)

5–6. Society for **Psychosomatic Research**, London, England. (C. J. Lucas, Student Health Centre, 17 Gordon St., London W.C.1)

5–7. American **Translators** Assoc., natl. conv., Washington, D.C. (Suite 2157, 630 Fifth Ave., New York 10020)

6–7. American Soc. for **Colposcopy and Colpomicroscopy**, annual, New York, N.Y. (D. Schildwaechter, 4219 Chester Ave., Philadelphia, Pa.)

6–7. International College of **Dentists**, Las Vegas, Nev. (H. O. Westerdahl, 4829 Minnetonka Blvd., Minneapolis, Minn. 55416)

6–20. International Federation of **Thermalism and Climatism**, Israel. (A. Schirmer, Fédération Intern. du Thermalisme et du Climatisme, Stadtbachstr. 12, Baden, Switzerland)

7. American College of **Dentists**, Las Vegas, Nev. (O. W. Brandhorst, 4236 Lindell Blvd., St. Louis, Mo.)

7–9. American **Science Film** Assoc., annual, Washington, D.C. (ASFA, 1319 F St., NW, Washington 20004)

7–10. **Automation**, British conf., Eastbourne, England. (Inst. of Production Engineers, 10 Chesterfield St., Mayfair, London, W.1)

7–11. American Soc. of **Mechanical Engineers**, winter annual mtg., Chicago, Ill. (ASME, 345 East 47 St., New York)

7–12. **Anatomical Pathology**, 5th Latin American congr., Lima, Peru. (J. J. Andujar, P.O. Box 118, Fort Worth, Tex.)

7–13. **Paediatrics**, 11th intern. congr., Tokyo, Japan. (K. Nakamura, Dept. of Pediatrics, Univ. of Tokyo, P.O. Box 18, Hongo, Tokyo)

7–14. **Vienna Univ. of Technology**, 150th anniversary celebration, Vienna, Austria. (Technische Hochschule, Gusshausstr. 23, Vienna 4)

8–9. **Engineering in the Practice of Medicine**, Philadelphia, Pa. (S. Rosen,

Dept. of Medicine, Hahnemann Medical College, 230 N. Broad St., Philadelphia 19102)

8–11. American **Dental** Assoc., Las Vegas, Nev. (H. Hillenbrand, 222 E. Superior St., Chicago, Ill. 60611)

8–11. **Insecticide and Fungicide**, 3rd British conf., Brighton, England. (Secretary, 140 Bensham Lane, Thornton Heath, Surrey, England)

8–11. **Nutrition**, Western Hemisphere congr., Chicago, Ill. (Dept. of Foods and Nutrition, American Medical Assoc., 535 North Dearborn, Chicago 60610)

8–11. **Quality Control**, intern. congr., Tokyo, Japan. (Union of Japanese Scientists and Engineers, c/o Sakata Bldg., 3 Muromachi 4-chome, Nihombashi, Chuo-ku, Tokyo)

8–13. Austrian **Medical** Congr., 19th annual, Vienna. (M. Schnardt, Osterreichische Arztekammer, Referat für Arztliche Fortbildung, Weihburggasse 10–12, Vienna I)

9–12. **Seismic Models**, symp., Prague, Czechoslovakia. (V. Karnik and J. Vanek, Inst. of Geophysics, Czechoslovak Acad. of Sciences, Bocni II, Prague 13-Sporilov)

9–13. Asociación Médica de Puerto Rico, Santurce. (J. A. Ramirez, 13–5 Fernandez Juncos Ave., Santurce)

10–11. Power Applications of **Controllable Semiconductor Devices**, conf., London, England. (Secretary, Inst. of Electrical Engineers, Savoy Pl., London, W.C.2)

10–12. American Soc. for **Cell Biology**, 5th, Philadelphia, Pa. (M. J. Moses, Box 2982, Duke Univ. Medical Center, Durham, N.C. 27706)

10–12. **Engineering in Medicine and Biology**, 18th annual conf., Philadelphia, Pa. (H. P. Schwan, Moore School of Electrical Engineering, Univ. of Pennsylvania, Philadelphia 19104)

10–12. **Isotope Techniques in the Hydrologic Cycle**, symp., Univ. of Illinois, Urbana. (G. E. Stout, Meteorology Section, Illinois State Water Survey, Univ. of Illinois, Urbana)

10–13. **Respiratory Therapy**, 2nd New England conf., Boston, Mass. (D. Crocker, Children's Hospital Medical Center, 300 Longwood Ave., Boston 15)

10–20. Development of **Petroleum Resources of Asia and the Far East**, 3rd symp., Tokyo, Japan. (S. Santitham, Rajadamnern Ave., Bangkok, Thailand)

11–12. **Kentucky** Acad. of Science, Univ. of Kentucky, Lexington. (D. M. Lindsay, Georgetown College, Georgetown, Ky.)

11–13. **Gerontological** Soc., 18th annual, Los Angeles, Calif. (W. D. Obrist, Dept. of Psychiatry, Duke Univ. Medical Center, Durham, N.C. 27706)

11–13. Bases for **Nuclear Spin-Parity** Assignments, conf., Gatlinburg, Tenn. (F. K. McGowan, Oak Ridge Natl. Laboratory, P.O. Box X, Oak Ridge, Tenn. 37831)

12–13. **Clinical Pathology of Infancy**, Assoc. of Clinical Scientists, Washington, D.C. (F. W. Sunderman, 1833 DeLancey Pl., Philadelphia, Pa. 19103)

12–13. Society for **Industrial and Applied Mathematics**, western regional, Seattle, Wash. (B. H. Colvin, Boeing Scientific Research Laboratories, P.O. Box 3981, Seattle)

12–14. Association of **Clinical Scientists**, Washington, D.C. (R. MacFate, 300 N. State St., No. 5322, Chicago, Ill. 60610)

12–15. **Neutrality of Medicine**, 2nd intern. congr., Paris, France. (R. Ellenboger, Ministère des Anciens Combattants et Victimes de Guerre, 37, rue de Bellechasse, Paris 7e)

14–15. National Medical Foundation for **Eye Care**, Chicago, Ill. (L. A. Zupan, Room 6, 1100 17th St., NW, Washington, D.C.)

14–16. Hedrologicum Conlegium, Intern. Soc. for the Study of **Diseases of the Colon and Rectum**, 2nd congr., Tokyo, Japan. (J. F. Montague, 104 E. 40 St., New York 10016)

14–17. Southern **Medical** Assoc., Washington, D.C. (R. F. Butts, 2601 Highland Ave., Birmingham 5, Ala.)

14–18. Mexican **Dental** Assoc., 1st intern. congr., Mexico City. (R. Espinosa de la Sierra, Asociación Dental Mexicana, Sinaloa no. 9, Mexico 7, D.F.)

14–18. **Dental**, Pacific intern. conf., Honolulu, Hawaii. (W. A. Wakai, 291 Alexander Young Bldg., Honolulu 96813)

14–18. Society of **Exploration Geophysicists**, 35th annual intern., Dallas, Tex. (Dallas Geophysical Soc., Dallas)

14–19. American Acad. of **Ophthalmology and Otolaryngology**, Chicago, Ill. (W. L. Benedict, 15 Second St., SW, Rochester, Minn.)

14–21. **Air Pollution**, 1st world congr., Buenos Aires, Argentina. (D. D. Torti, Asociación Argentina Contra la Contaminación del Aire, Sarmiento 680, Buenos Aires)

15–16. **Hypervelocity Techniques**, 4th symp., Tullahoma, Tenn. (J. Lukasiewicz, vonKarman Gas Dynamics Facility, ARO, Inc., Arnold Air Force Station, Tenn. 37706)

15–16. **Science** conf., 4th annual, Belfer Graduate School of Science, Yeshiva Univ., New York, N.Y. (A. Gelbart, Belfer Graduate School of Science, Amsterdam Ave. and 186th St., New York 10033)

15–17. Association of **Military Surgeons** of the U.S., Washington, D.C. (F. E. Wilson, 1500 Massachusetts Ave., NW, Washington, D.C.)

15–18. **Aircraft Design and Technology**, Los Angeles, Calif. (American Inst. of Aeronautics and Astronautics, 1290 Sixth Ave., New York 10019)

15–18. **Information Problems in the Drug Industry**, conf., Philadelphia, Pa. (C. P. Butcher, Graduate School of Library Science, Drexel Inst. of Technology, 32nd and Chestnut Sts., Philadelphia 19104)

15–18. American **Nuclear** Soc./Atomic Industrial Forum, winter meeting, Washington, D.C. (O. J. DuTemple, American Nuclear Soc., 244 E. Ogden Ave., Hinsdale, Ill. 60521)

15–19. **Animal Care Panel**, 16th annual, Philadelphia, Pa. (H. P. Schneider, Hahnemann Medical College, 230 N. Broad St., Philadelphia 19102)

15–19. **Gulf and Caribbean Fisheries** Inst., 18th annual session, Miami, Fla. (Executive Secretary, 1 Rickenbacker Causeway, Miami 33149)

15–19. **Magnetism and Magnetic Materials**, San Francisco, Calif. (W. D. Doyle, Franklin Inst. Laboratories, Philadelphia, Pa.)

15–19. World Federation for **Mental Health**, 18th annual, Bangkok, Thailand.

(F. Cloutier, 1, rue Gevray, Geneva, Switzerland)

15–19. Disposal of **Radioactive Wastes** into the Sea and Fresh Waters, symp., Vienna, Austria. (Intern. Atomic Energy Agency, 11 Kärntnerring, Vienna I)

15–20. **Productivity, Technology, and Change**, conf., London, England. (British Productivity Council, Vintry House, Queen St. Pl., London, E.C.4)

16–18. **Physics of Failure in Electronics**, 4th annual symp., Chicago, Ill. (M. Goldberg, IIT Research Inst., 10 W. 35 St., Chicago 60616)

16–18. **Spacecraft Sterilization Technology**, 1st natl. conf., California Inst. of Technology, Pasadena. (Office of Space Science and Applications, NASA, 400 Maryland Ave., SW, Washington, D.C.)

17–19. Eastern **Analytical** Symp., New York, N.Y. (M. E. McGoldrick, Armco Steel Corp., P.O. Box 1697, Baltimore, Md. 21203)

17–19. **Micrography**, intern. congr., Tokyo, Japan. (Mrs. J. Lang, 2501 Hudson Rd., St. Paul, Minn. 55119)

17–20. Canadian **Cardiovascular** Soc., Winnipeg, Man. (J. B. Armstrong, 1130 Bay St., Toronto 5, Ont.)

17–20. **Hyperbaric Oxygenation**, 3rd intern. conf., Duke Univ. Medical Center, Durham, N.C. (I. W. Brown, Jr., Dept. of Surgery, Duke Univ. Medical Center, Durham)

18. Society of Military **Otolaryngologists**, Chicago, Ill. (G. R. Hart, Box 223, U.S. Naval Hospital, Philadelphia, Pa.)

18–19. **Computational Methods in Crystallography**, conf., London, England. (Meetings Officer, Inst. of Physics and the Physical Soc., 47 Belgrave Sq., London, S.W.1)

18–19. **Electronics**, Mid-America conf., Kansas City, Mo. (W. Wiley, Bonzer Inc., 11111 W. 59th Terrace, Shawnee, Kan.)

18–21. American **Anthropological** Assoc., Denver, Colo. (S. T. Boggs, 1530 P St., NW, Washington, D.C. 20005)

18–24. **Tropical Oceanography**, intern. conf., Miami Beach, Fla. (F. F. Koczy, Inst. of Marine Science, Univ. of Miami, Miami 33149)

20–21. American **Folklore** Soc., Denver, Colo. (T. P. Coffin, Box 5, Bennett Hall, Univ. of Pennsylvania, Philadelphia 19104)

21–26. **Orthopedics and Traumatology**, 6th Latin American congr., Lima, Peru. (G. de Velasco Polo, Zacatecas 117, Mexico 7, D.F.)

22–24. **Electromagnetic Sensing of Earth** by Satellites, intern. symp., Coral Gables, Fla. (R. Zirkind, Polytechnic Inst. of Brooklyn, Graduate Center, Farmingdale, L.I., N.Y.)

22–26. **Nuclear Electronics**, conf., Bombay, India. (K. Zybylski, Div. of Scientific and Technical Information, Intern. Atomic Energy Agency, 11 Kärntnerring, Vienna, Austria)

22–26. **Plutonium**, intern. conf., London, England. (Inst. of Metals, 17 Belgrave Sq., London, S.W.1)

22–3. **Volcanology**, intern. symp., Auckland and Wellington, New Zealand. (J. Healy, Dept. of Scientific and Industrial Research, Rotorua, New Zealand)

24–29. American College of **Apothecaries**, Inc., Miami Beach, Fla. (R. E. Abrams, Hamilton Court Hotel, 39th and Chestnut St., Philadelphia, Pa. 19104)

NEW BOOKS

(Continued from page 479)

gions, Descriptive and Deductive. J. C. Boileau Grant and J. V. Basmajian. Williams and Wilkins, Baltimore, ed. 7, 1965. 795 pp. Illus. $13.50.

Handbook of Human Embryology. R. W. Haines and A. Mohiuddin, Williams and Wilkins, Baltimore, ed. 3, 1965. 239 pp. Illus. $7.

Papers on Bacterial Viruses. Selected by Gunther S. Stent. Little, Brown, Boston, Mass., ed. 2, 1965. 447 pp. Illus. Paper, $5. Thirty papers.

The Pharmacological Basis of Therapeutics. Louis S. Goodman and Alfred Gilman, Eds. Macmillan, New York, ed. 3, 1965. 1805 pp. Illus. $22.50.

Sensory Restriction: Effects on Behavior. Duane P. Schultz. Academic Press, New York, 1965. 224 pp. Illus. $7.50.

Studies on the Piriform Lobe. F. Valverde. Harvard Univ. Press, Cambridge, Mass., 1965. 143 pp. Illus. $7.50.

General

Analytical Philosophy of History. Arthur C. Danto. Cambridge Univ. Press, New York, 1965. 330 pp. Illus. $10.

Aspects of Scientific Explanation: And Other Essays in the Philosophy of Science. Carl G. Hempel. Free Press, New York, 1965. 515 pp. Illus. $12.50.

Biology—or Oblivion: Lessons from the Ultimate Science. Brian Hocking. Schenkman, Cambridge, Mass., 1965. 128 pp. Illus. $2.95.

The Dawn of European Civilization: The Dark Ages. David Talbot Rice, Ed. McGraw-Hill, New York, 1965. 360 pp. Illus. $28.50. The contributors are David Oates, R. H. Pinder-Wilson, Sirarpie der Nersessian, Cyril Mango, J. M. Hussey, Tamara Talbot Rice, Donald Bullough, William Culican, Peter Lasko, David Wilson, Charles Thomas, Philip Grierson, and Denys Hay.

Drinking in French Culture. Roland Sadoun, Giorgio Lolli, and Milton Silverman. Rutgers Center of Alcohol Studies, New Brunswick, N.J., 1965. 151 pp. $6. Monographs of the Rutgers Center of Alcohol Studies, edited by Mark Keller.

Employment and Earnings Statistics for States and Areas, 1939–64. U.S. Dept. of Labor, Washington, D.C., 1965 (order from Superintendent of Documents, Washington, D.C.), 696 pp. Paper, $4.

Freedom of the Individual. Stuart Hampshire. Harper and Row, New York, 1965. 112 pp. $3.95.

Genetics and Prehistory. The Rede Lecture, 1965. Sir Gavin de Beer. Cambridge Univ. Press, New York, 1965. 38 pp. Illus. Paper, $1.

A Guide to Fortran IV. Seymour V. Pollack. Columbia Univ. Press, New York, 1965. 270 pp. Illus. $5.

A History of Marginal Utility Theory. Emil Kauder. Princeton Univ. Press, Princeton, N.J., 1965. 270 pp. Illus. $6.50.

A History of the Concept of Valency to 1930. W. G. Palmer. Cambridge Univ. Press, New York, 1965. 185 pp. Illus. $8.

The Student and the New Math: For

Elementary School Parents and Others. Jerome T. Murray. Regnery, Chicago, Ill., 1965. 716 pp. Illus. $4.95.

Yearbook of Physical Anthropology, 1963. Jack Kelso, Gabriel W. Lasker, and Sheilagh T. Brooks, Eds. Published for the American Assoc. of Physical Anthropologists by Instituto de Investigaciones Históricas, Universidad Nacional Autónoma de México and Instituto Nacional de Antropología e Historia, México, D.F., 1965 (available from Instituto Nacional de Antropología e Historia, Córdoba 45, México 7, D.F.). 310 pp. Illus. Paper. Yearbook of Physical Anthropology Series, vol. 11.

Yearbook of the National Institute of Sciences of India, 1965. Natl. Institute of Sciences of India, New Delhi, 1965. 245 pp. R. 15.

Mathematics, Physical Sciences, and Engineering

Advances in Astronomy and Astrophysics. vol. 3. Zdeněk Kopal, Ed. Academic Press, New York, 1965. 401 pp. Illus. $14. Five papers: "The abundance of elements in the solar atmosphere" by Lawrence H. Aller; "Determination of the elements of eclipsing variables from Fourier transforms of their light curves" by Masatoshi Kitamura; "Internal structure of the stars and apsidal motions" by Zdeněk Kopal; "Special analysis of solar flares" by Zdeněk Švestka; and "Survey of modern cosmology" by Ya. B. Zeldovich.

Annual Review of Astronomy and Astrophysics. vol. 3. Leo Goldberg, Armin J. Deutsch, and David Layzer, Eds. Annual Reviews, Palo Alto, Calif., 1965. 446 pp. Illus. $8.50. Thirteen papers: "Clustering of galaxies" by G. O. Abell; "Absolute spectral energy distributions in stars" by J. B. Oke; "The energy balance and dynamics of the interstellar medium" by F. D. Kahn and J. E. Dyson; "Spectral line broadening" by Henri Van Regemorter; "The system of astronomical constants" by G. M. Clemence; "Theory of stellar orbits in the galaxy" by A. Ollongren; "Model atmospheres" by Jean-Claude Pecker; "Chemical evidence bearing on the origin of the solar system" by Hans E. Suess; "Some observational aspects of stellar evolution" by Olin J. Eggen; "Radio radiation from the galactic nuclear region" by Bernard F. Burke; "Cosmic magnetobremsstrahlung (synchrotron radiation)" by V. L. Ginzburg and S. I. Syrovatskii; "Spectra of comets and their interpretation" by Claude Arpigny; and "Radar astronomy" by Gordon H. Pettengill and Irwin I. Shapiro.

Contemporary Algebra: First Course. John R. Mayor and Marie S. Wilcox. Prentice-Hall, Englewood Cliffs, N.J., 1965. 480 pp. Illus. $4.96.

Coulomb Excitation. L. C. Biedenharn and P. J. Brussaard. Oxford Univ. Press, New York, 1965. 340 pp. Illus. Paper, $6.40. Oxford Library of the Physical Sciences.

Dissociation Constants of Organic Bases in Aqueous Solution. D. D. Perrin. Butterworth, Washington, D.C., 1965. 474 pp. Illus. $28.

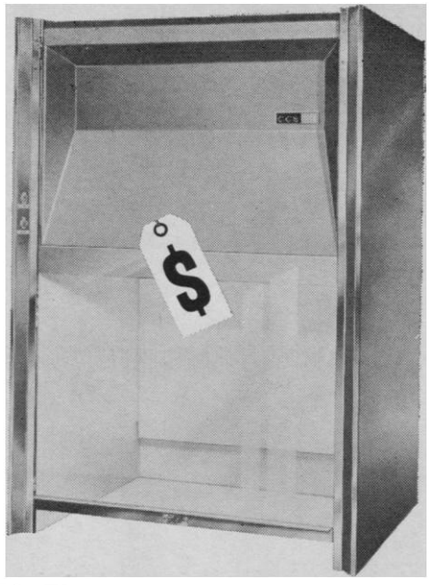
(Continued from page 468)

standards. California led the way in prescribing such standards, and other states were beginning to follow suit.

The journey through Congress of this year's Clean Air Act Amendments bill (which included the vehicle-emission standards) was relatively easy, even though some members objected to the provisions for research on disposal of solid wastes as an ill-advised federal venture into the garbage business. Success was assured (it may never have been much in doubt) after the straightening out of a mix-up which caused the Administration some embarrassment. This concerned its position on fixing standards for exhaust emission. HEW had appeared to support strongly the Muskie subcommittee's recommendations for standards; but then James M. Quigley, an assistant secretary of HEW, testified in April that the emission control methods to be used by the automobile manufacturers to meet California's requirements should be evaluated before being applied nationally. This surprising testimony produced headlines such as "LBJ Scuttles Smog-Control Bill," and some observers were quick to suggest that President Johnson, the master of consensus, was snuggling up to the car manufacturers for political purposes. The turn-about defied logical explanation, and the Administration was soon back to an endorsement of the Muskie proposals.

In time, Congress may have to return again to the problem of automobile exhaust emissions. V. G. MacKenzie, the assistant surgeon general in charge of PHS's air pollution division, indicated recently that the application of controls on carbon monoxide and hydrocarbon emission to automobile engines of the kind now in use is no better than a holding action. By 1980 the number of automobiles will have so increased that, without controls, pollution from exhaust emissions will have grown worse. Moreover, for certain emissions, such as oxides of nitrogen, no technical means of control are yet available, MacKenzie said.

PHS is continuing its research on the control of pollutants resulting from fuel combustion. Meanwhile, MacKenzie and others already wonder whether the ultimate solution may not be to abandon the spark ignition engine and develop a radically different automobile propulsion system. Greater use of mass transit would help, too.



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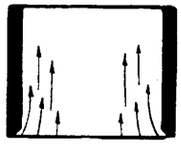
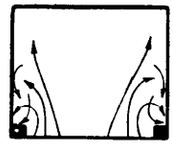


Fig. 2 other



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Automobile exhaust emissions are, of course, only one source of air contamination in the rapidly growing urban areas. Sulfur oxides, principally from the burning of coal and fuel oil, also are major pollutants, and there are others. The mounting public concern over air pollution is easily understandable. Not everyone goes down to the river, to be repelled by the water's burden of indigestible wastes. But inhabitants of the increasingly numerous cities afflicted by smog become quickly offended. Poor visibility, smarting eyes, and the nagging thought that continuous exposure to contaminated air may bring on a chronic illness make ready converts to the antipollution cause.

Through the Clean Air Act of 1963 and this year's amendments, Congress has tried to give the federal government a meaningful role while, at the same time, holding to the philosophy that air pollution control is primarily a state and local responsibility. Eventual stringent controls seem assured, whether imposed by the states and localities or by a Congress grown impatient at a laggard performance in the statehouses and city halls.—LUTHER J. CARTER

Announcements

The Division of Mathematics of the National Academy of Sciences–National Research Council has established the **Committee on Support of Research in the Mathematical Sciences**. The committee's duties include preparing studies of current research in mathematical sciences and of mathematics education at the undergraduate, graduate, and postdoctoral levels; of current levels and forms of support of mathematical research by federal and private agencies; and an indication of support needed in the immediate future to maintain the present state of mathematical activity.

Lipman Bers, of Columbia University, is chairman. The other members are:

T. W. Anderson, Columbia University

R. H. Bing, University of Wisconsin

H. W. Bode, Bell Telephone Laboratories

R. P. Dilworth, California Institute of Technology

G. E. Forsythe, Stanford University

Mark Kac, Rockefeller University

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F. J. Weyl, Office of Naval Research