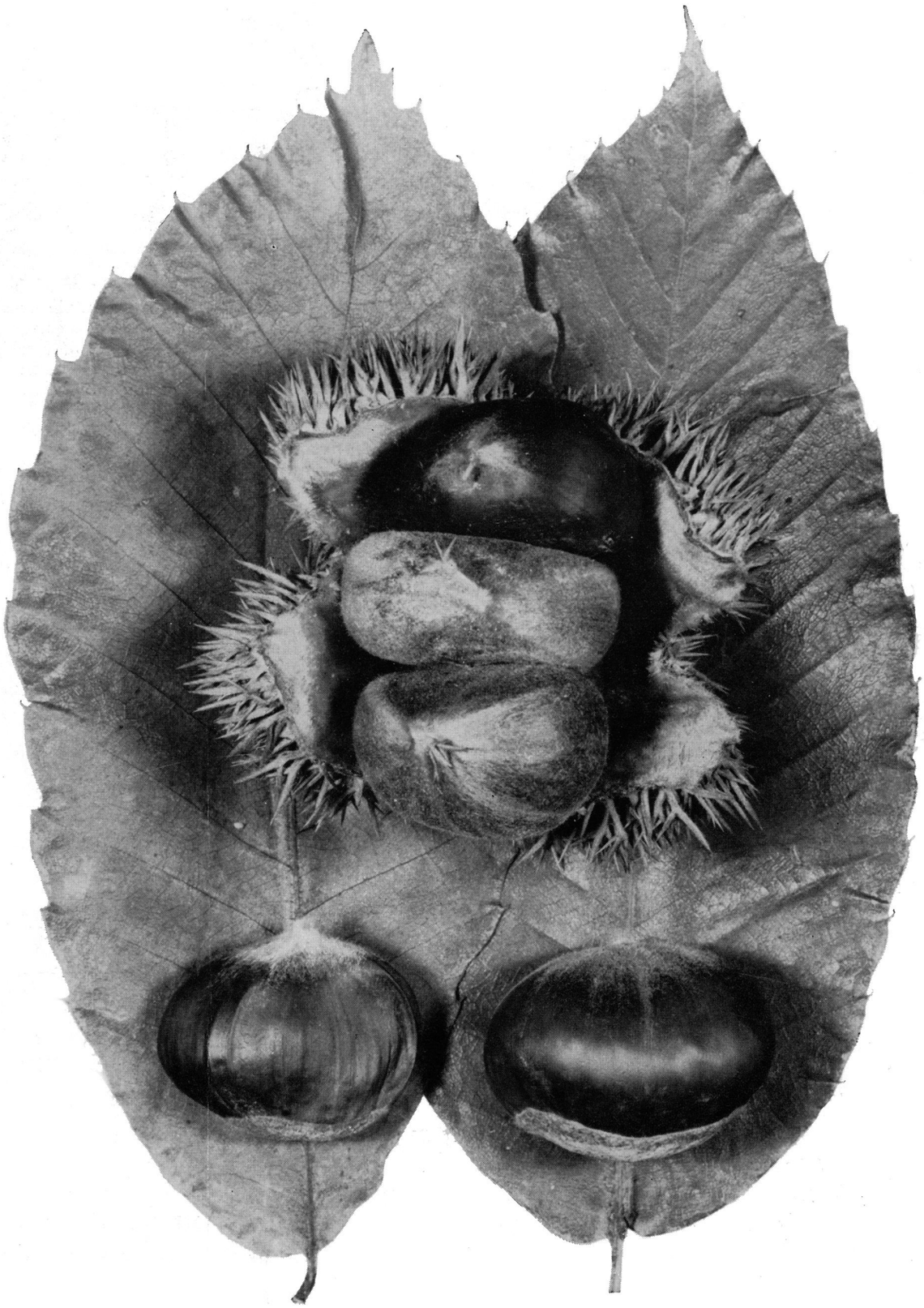
SCIENCE

25 March 1960

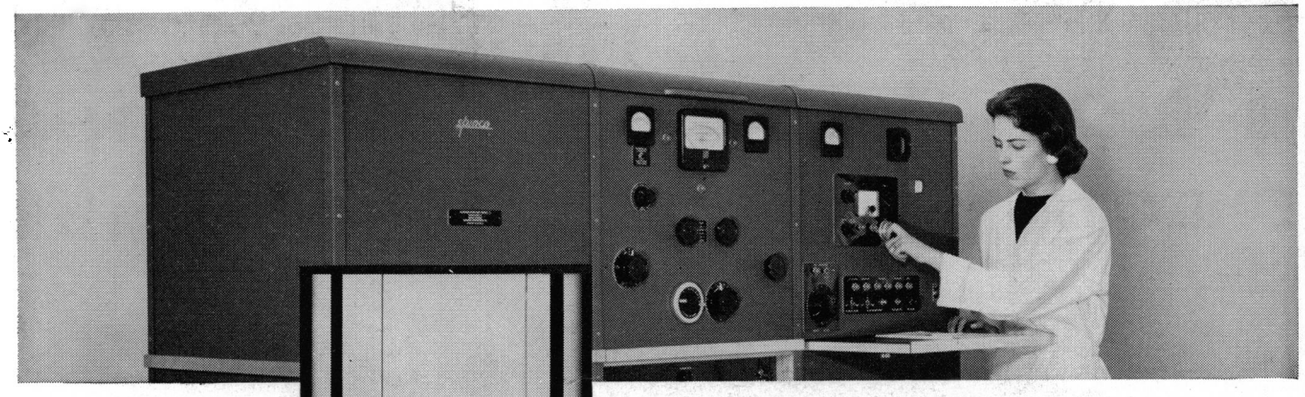
Vol. 131, No. 3404

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



New Methods Extend the Usefulness of the Ultracentrifuge

Recent studies by research scientists have further increased the uses of the Analytical Ultracentrifuge for measuring molecular weights and purity of viruses, enzymes, proteins, polymers and a variety of organic and inorganic molecules. Here are four new developments as reported in the technical literature.



Interacting Systems

Kegeles and Rao at Clark University have measured the molecular weights of chemically reacting systems in the ultracentrifuge cell using the Archibald "approach-to-equilibrium" method. Studying the enzyme system alpha-chymotrypsin, they showed it to be present in the ultracentrifuge cell as an equilibrium mixture of monomers, dimers, and trimers. This is an extension of previous work which showed that the Archibald method applies to polydisperse non-ideal solutions, as well as to monodisperse ideal solutions.

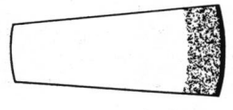
Improved Accuracy

Trautman, at New York's Rockefeller Institute for Medical Research, showed that the accuracy of the Archibald method can be improved by more precisely locating the position of the meniscus on the ultracentrifuge photographic plate. He made a detailed study of the optical fine structure at the meniscus, and used a special optical aligning procedure with a mirror in the ultracentrifuge cell.

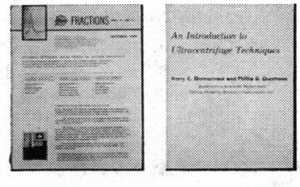
Simplified Measurements

At Stockholm's Nobel Medical Institute, Ehrenberg reports a simplified approach-to-equilibrium method which makes measurements from the schlieren curve easier. He runs the ultracentrifuge fast enough for a peak to begin forming at the meniscus so that the schlieren curve is parallel with the baseline and no extrapolation is necessary. His measurements of molecular weight and diffusion constants agree closely with those by other methods.

Rapid Equilibrium



Van Holde and Baldwin at the University of Wisconsin have used short liquid columns to achieve complete sedimentation equilibrium in a fraction of the time previously required. Using liquid columns of only 3 mm, they report equilibrium with sucrose in 3½ hours, and with a 1 mm column in only 30 minutes. In addition, the authors report that measurements during approach-to-equilibrium permit calculation of a diffusion coefficient.



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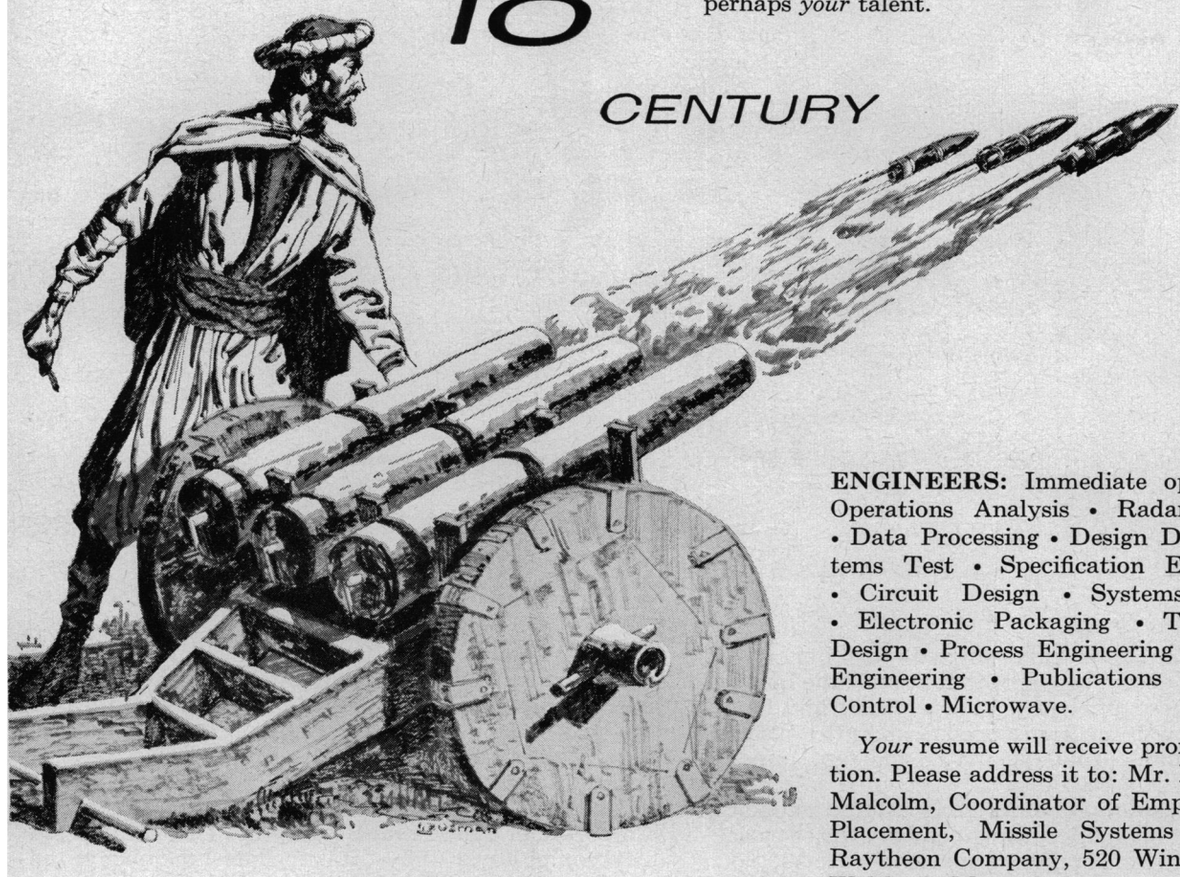

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15WS

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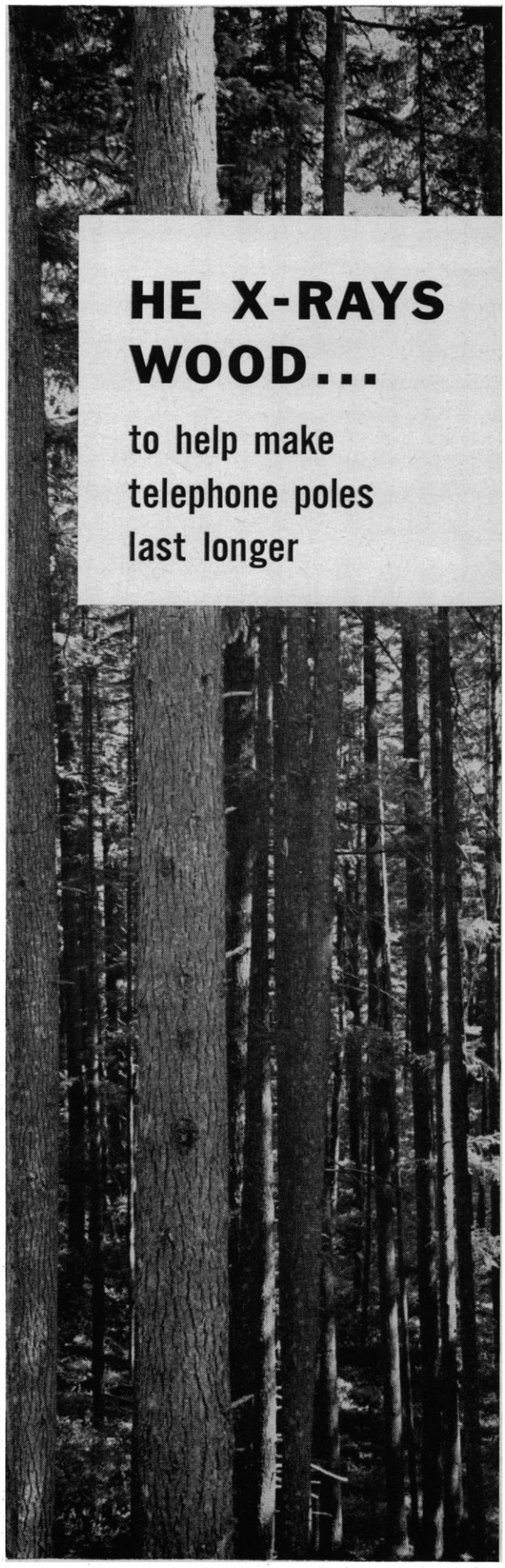
25 March 1960, Volume 131, Number 3404

SCIENCE

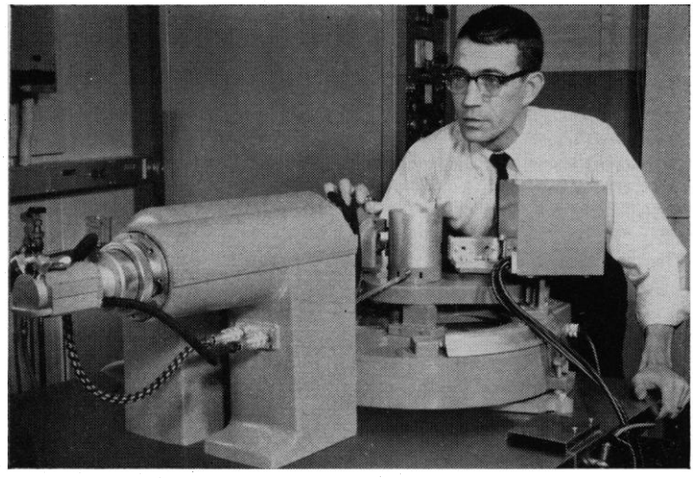
Cover

Nuts, bur, and leaves of the Chinese chestnut (*Castanea mollissima* Bl.), introduced to this country from the Orient shortly after the turn of the century. This species is resistant to chestnut blight, the fungus disease that killed the American chestnut. Widespread planting of this species, both in orchards and as a yard tree, is bringing back the chestnut to the American scene (× 1.5). [J. W. McKay and F. H. Berry]



HE X-RAYS WOOD...

to help make telephone poles last longer



Chemist Jack Wright developed the use of this X-ray fluorescence machine for testing the concentration of preservatives in wood. Here he bombards a boring from a test telephone pole with X-rays.

This Bell Labs chemist is using a fast, new technique for measuring the concentration of fungus-killing preservative in telephone poles.

A boring from a test pole is bombarded with X-rays. The preservative—pentachlorophenol—converts some of the incoming X-rays to new ones of different and characteristic wave length. These new rays are isolated and sent into a radiation counter which registers their intensity. The intensity in turn reveals the concentration of preservative.

Bell Laboratories chemists must test thousands of wood specimens annually in their research to make telephone poles last longer. Seeking a faster test, they explored the possibility of X-ray fluorescence—a technique developed originally for metallurgy. For the first time, this technique was applied to wood. Result: A wood specimen check in just two minutes—at least 15 times faster than before possible with the conventional microchemical analysis.

Bell Labs scientists must remain alert to *all* ways of improving telephone service. They must create radically new technology or improve what already exists. Here, they devised a way to speed research in one of telephony's oldest and most important arts—that of wood preservation.

Nature still grows the best telephone poles. There are over 21 million wooden poles in the Bell System. They require no painting, scraping or cleaning; can be nailed, drilled, cut, sawed and climbed like no other material. Scientific wood preservation cuts telephone costs, conserves valuable timber acres.

BELL TELEPHONE LABORATORIES

World Center of Communications Research and Development

25 March 1960, Volume 131, Number 3404 **SCIENCE**

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The Lab Coat as a Status Symbol

A neat, white, knee-length coat is universally recognized as the uniform of the scientist. The lab coat's primitive function as a utilitarian garment, protective against the dermolytic and vestidemolitive hazards of the laboratory, has bit by bit been replaced by its function as a status symbol. Just as we recognize a bishop by his mitre, or a burglar by his mask, we recognize a scientist by his lab coat. But in recent years the lab coat has become more than a mere workaday uniform. The soldier peels potatoes, cleans his rifle, and even fights his battles in his uniform; the modern scientist rarely works in his lab coat. When work is unavoidable, he will be found in his shirtsleeves, in a coarse brown smock, or in plastic. His lab coat, clean, pressed, possibly even starched, hangs safely behind the door, to be worn only when he is lecturing or greeting official visitors. Like spurs and shakos, the lab coat has been promoted to a new role; it is rapidly becoming, not merely the uniform, but indeed the *dress uniform* of the scientist.

Dress uniforms are worn solely for symbolic and ceremonial reasons, not for practical purposes. Nevertheless, their once-useful features are conscientiously preserved; an infantryman's sleeve buttons, or the spiked helmet of an uhlan, are examples. The lab coat is fraught with potentialities for such symbolic survivals. Detachable buttons were highly functional on garments subject to the vicissitudes of frequent vigorous laundering. The modern lab coat should of course be safely dry-cleaned, but the Chinese puzzles formerly used to hold the buttons in place might well be retained, and even elaborated into conspicuous ornaments—no longer detachable, of course. The utilitarian lab coat always bore stains characteristic of the work of its wearer. These could be symbolized by chevrons or flashes of suitable color; purple and red (hematoxylin and eosin) for the histologist; black and orange (sulfuric acid and bichromate) for the chemist; greenish yellow and scarlet (pus and blood) for the pathologist; blue and brown (ballpoint and coffee) for the statistician. Compact patterns of small holes or a bit of fringe on the cuff might be other symbols reminiscent of the days when lab coats were worn in the lab. Vertical as well as horizontal status could be shown by such insignia; undergraduates would wear unadorned white; graduate students might claim the right to a single, grey, grime-colored insigne; Ph.D's would wear the colors of their specialties; and Nobel prize-winners, like admirals-of-the-fleet and field marshals, would be privileged to blossom out in creations of their own tasteful design.

These developments cannot be pressed; they must evolve slowly, guided by tradition and respect for the past. But they should be taken seriously. Scientists have momentarily achieved a position of high prestige, but in a democratic society (as in any other) prestige without symbols is but fleeting, while symbols without prestige may endure forever.—F. E. WARBURTON, 6171 Sherbrooke West, Montreal, Canada. [Reprinted, with permission, from *The Malpighii,* the newsletter (circulation, 18) of the Malpighian Society of Montreal, Vol. 2, No. 2 (14 Jan. 1960)]

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20–22. Manned Space Stations Inst. of the Aeronautical Sciences symp., Los Angeles, Calif. (E. Levin, Rand Corp., 1700 Main St., Santa Monica, Calif.)

20–22. Medical Electronics, natl. conf., Houston, Tex. (K. O. Heintz, Humble Oil and Refining Co., Houston.)

20–22. Southwestern Inst. of Radio Engineers, 12th annual, Houston, Tex. (H. E. Childers, College of Medicine, Baylor Univ., Waco, Tex.)

20–23. National Council of Teachers of Mathematics, Ann Arbor, Mich. (M. H. Ahrendt, 1201 16 St., NW, Washington 6.)

20–24. Congress of Gastroenterology, 6th intern., Leyden and Noordwiik aan Zee, Netherlands. (C. Schreuder, 16, Lange Voorhout, The Hague, Netherlands.)

21–22. Society of Technical Writers and Editors (Technical Publishing Soc.), 7th annual, Chicago, Ill. (R. F. Ellis, American Can Co., 11th Ave. and St. Charles Rd., Maywood, Ill.)

21–23. Association of Southeastern Biologists, New Orleans, La. (H. J. Humm, Dept. of Botany, Duke Univ., Durham, N.C.)

21–28. American Soc. of Tool Engineers, annual, Detroit, Mich. (H. E. Conrad, ASTE, 10700 Puritan Ave., Detroit.)

22–23. High-Temperature Resistance and Thermal Degradation of Polymers, symp., London, England. (Symposium Sub-Committee, Plastics and Polymer Group, Soc. of Chemical Industry, 14 Belgrave Sq., London, S.W.1, England.)

24–28. American Ceramic Soc., annual, Philadelphia, Pa. (F. P. Reid, ACS, 4055 N. High St., Columbus 14, Ohio.)

25–27. American Proctologic Soc., Houston, Tex. (N. D. Nigro, 10 Peterboro, Detroit 1, Mich.)

25–27. Canadian Inst. of Mining and Metallurgy, 62nd annual, Toronto, Ontario, Canada. (Secretary-Treasurer, Room 906, Drummond Bldg., 1117 St. Catherine St., Montreal, Canada.)

25–27. International Acad. of Pathology, Memphis, Tenn. (F. K. Mostofi, Armed Forces Inst. of Pathology, Washington, D.C.)

25–28. American Assoc. of Petroleum Geologists, Atlantic City, N.J. (H. T. Morley, Pan American Petroleum Corp., Box 591, Room 1330, Tulsa 2, Okla.)

25–28. Society of Economic Paleontologists and Mineralogists, Atlantic City, N.J. (J. Imbrie, Dept. of Geology, Columbia Univ., New York, N.Y.)

25–30. American Acad. of Neurology, Miami, Fla. (Mrs. J. C. McKinley, 4307 E. 50 St., Minneapolis, Minn.)

25–30. Industrial Health, conf., Rochester, N.Y. (M. E. Fairbank, Kodak Park, Rochester 4.)

26–29. Internal Medical Assoc., Rochester, N.Y. (C. D. Bridges, 28 E. Jackson Blvd., Chicago 4.)

27. Additives and Residues in Human Foods, symp., Columbia, Mo. (T. D. Luckey, Dept. of Biochemistry, School of Medicine, Univ. of Missouri Medical Center, Columbia.)

27. International Acad. of Proctology, annual, Miami Beach, Fla. (A. J. Cantor, IAP, 147-41 Sanford Ave., Flushing 55, N.Y.)

27–29. Algae and Metropolitan Wastes, conf., Cincinnati, Ohio. (A. F. Bartach, Water Supply and Water Polution Research, Robert A. Taft Sanitary Engineering Center, Cincinnati.)

27–29. Chemical Reaction Engineering —Section on Non-Conventional Reactors, 2nd European symp., Amsterdam, Netherlands. (P. J. Hoftijzer, Centraal Laboratorium Staatsmijnen, Geleen (L.), Netherlands.)

27–30. American Meteorological Soc., general meeting with American Geophysical Union, Washington, D.C. (K. C. Spengler, AMS, 45 Beacon St., Boston 8, Mass.)

28–30. American Assoc. of Pathologists and Bacteriologists, Memphis, Tenn. (R. L. Holman, Dept. of Pathology, Louisiana State Univ., School of Medicine, New Orleans.)

28–30. American Soc. of Human Genetics, Memphis, Tenn. (W. J. Schull, Dept. of Human Genetics, Univ. of Michigan, 1133 E. Catherine St., Ann Arbor.)

28–30. Current Concepts in Medicine, 2nd intern. symp., Philadelphia, Pa. (M. J. Schwartz, Deborah Hospital, 901 Walnut St., Philadelphia 7.)

28–30. Midwestern Psychological Assoc., Columbus, Ohio. (I. E. Farber, Dept. of Psychology, State Univ. of Iowa, Iowa City.)

29. Parenteral Drug Assoc., Philadelphia, Pa. (H. E. Boyden, PDA, 4865 Stenton Ave., Philadelphia 44.)

29–30. Thermonuclear Processes, conv., London, England. (Institution of Electrical Engineers, Savoy Pl., London, W.C.2.)

30. Idaho Acad. of Science, annual, Po-

catello. (A. E. Taylor, Graduate Div., Idaho State College, Pocatello.)

30–2. Society for American Archaeology, Salt Lake City, Utah. (D. A. Baerreis, Sterling Hall, Univ. of Wisconsin, Madison 6.)

May

1–2. American Soc. for Clinical Investigation, Atlantic City, N.J. (S. J. Farber, New York University College of Medicine, 550 First Ave., New York 16)

1–5. American Assoc. of Cereal Chemists, Chicago, Ill. (J. W. Pence, Western Utilization Research and Development Div., 800 Buchanan St., Albany 10, N.Y.)

1–5. Electrochemical Soc., Chicago, Ill. (H. B. Linford, ES, 1860 Broadway, New York 23)

1–5. Society of American Bacteriologists, 60th annual, Philadelphia, Pa. (D. M. Cleary, Box 354, Upper Darby, Pa.)

2. American Federation for Clinical Research, Atlantic City, N.J. (J. E. Bryan, 250 W. 57 St., New York 19)

2–3. Reactions between Complex Nuclei, 2nd conf., Gatlinburg, Tenn. (R. S. Livingston, Oak Ridge Natl. Laboratory, Oak Ridge, Tenn.)

2–4. Aeronautical Electronics, conf., Dayton, Ohio. (L. G. Cumming, IRE, 1 E. 79 St., New York 21)

2–5. Flight Test Symp., natl., San Diego, Calif. (H. S. Kindler, Instrument Soc. of America, 313 Sixth Ave., Pittsburgh 22, Pa.)

2–11. International Cancer Cytology conf., Mexico, D.F., Mexico. (Office of Intern. Conferences, Department of State, Washington 25)

2–11. Pan American Medical Assoc., cong., Mexico City, Mexico. (J. J. Eller, 745 Fifth Ave., New York 22)

3–4. Association of American Physicians, Atlantic City, N.J. (P. B. Beeson, Yale Univ. School of Medicine, New Haven 11, Conn.)

3–4. Conference of Veterinarians, annual, Philadelphia, Pa. (W. H. Rhodes, School of Veterinary Medicine, Univ. of Pennsylvania, Philadelphia 4)

3–5. Society of Pediatric Research, Swampscott, Mass. (C. D. West, Children's Hospital, Cincinnati 29, Ohio)

3–6. Fuel Element Fabrication, symp., Vienna, Austria. (Intern. Atomic Energy Agency, 11 Kärntner Ring, Vienna)

5–6. American Pediatric Soc., annual, Swampscott, Mass. (A. C. McGuinness, 2800 Quebec St., NW, Washington 8)

5–8. Wilson Ornithological Soc., Gatlinburg, Tenn. (A. M. Bagg, Farm St., Dover, Mass.)

6–7. Population Assoc. of America, annual, Washington, D.C. (K. B. Mayer, Dept. or Sociology and Anthropology, Brown Univ., Providence 12, R.I.)

6–7. South Dakota Acad. of Science, 45th annual, Brookings. (J. M. Winter, Dept. of Botany, Univ. of South Dakota, Vermillion)

6–8. International Cong. of Phlebology, 1st, Chambéry, France. (J. Marmasse, 3, rue de la République, Orléans (Loiret), France)

6–9. American Psychoanalytic Assoc., annual, Atlantic City, N.J. (Mrs. H. Fischer, 36 W. 44 St., New York 36)

(See issue of 18 March for comprehensive list)

Letters

Measuring Eye Movements

With reference to the report entitled "Photoelectric technique for measuring eye movements," by William M. Smith and Peter J. Warter, Jr. [*Science* **130**, 1248 (1959)], I wish to make the following observations. To record eye movement is an endeavor with a long history in neuro-otological research and clinical investigations. The first such effort was made as early as 1881 by Hogyes. In the otolaryngology department of the University of Illinois College of Medicine in Chicago, the photoelectric principle of picking up and recording nystagmus (rhythmic involuntary eye movements) was first applied in 1950. The idea discussed in the article mentioned above is almost identical with the method we have been using for the last 9 years.

Through clinical experience our method was gradually and repeatedly improved. Several reports have been presented before national and international societies, and publications in the United States and foreign countries have carried descriptions of the instrument and the technique. Our present model is an advanced nystagmus-recording device. It is applicable not only in vestibular research (concerned with the sense of equilibrium) but also in everyday clinical evaluation of the function of the sense organ of balance.

NICHOLAS TOROK
Department of Otolaryngology, University of Illinois College of Medicine, Chicago

The interesting work of Torok and his colleagues in the field of nystagmography (*1*, *2*) unfortunately was unknown to us until it was called to our attention by his letter to *Science*. Our coverage of the literature obviously was incomplete.

We do not accept as accurate Torok's assertion that the idea discussed in our report in *Science* is "almost identical" with the method he and his associates have used in their work. There is a similarity in one specific sense—namely, both techniques of measurement utilize the fact of differential reflectance of the iris and sclera of the eye. According to the descriptions in the articles cited (*1*, *2*), a rectangular pattern of light is cast upon the eye in such a way that part falls upon the iris and part falls upon the sclera. As the eye moves, therefore, the total amount of light reflected from the eye varies. This variation in total reflectance is detected by two photovoltaic cells in series mounted immediately in front of

the eye. The signal subsequently is amplified to drive a pen recorder. In our technique we do not measure directly the total light reflected from the eye but derive a measure of total light from an optical image of a part of the eye. We do this by casting an image of a small part of the eye on a surface which contains a small slit oriented parallel to the horizontal meridian of the eye (for measuring horizontal eye movements). As the eye moves horizontally and the light-dark field of this image formed by the iris and sclera plays across the slit, the total amount of light passing through the slit varies and is detected by the photomultiplier tube located immediately behind the slit. Thus, the optical arrangements of the two systems are, in a sense, the inverse of each other.

That there are gross and important differences between the two systems is evident from the fact that the device used by Torok and his associates cannot be used for tracking large-scale movements of the eye which are correlated with stimulus movement. In our experiments it is essential that the device used for measuring eye movements should not impair normal visual observation by the subject during the course of measurement. The device described in (*1*) and (*2*) is placed directly in front of the subject's eye and seriously limits, if it does not prevent, visual observation by the subject during measurement. In fact, the device employed by Torok and his associates is designed to preclude the possibility of normal vision during measurement, since such vision would interfere with the phenomenon being measured ["The subject must not be presented with a light spot or any image upon which he can fixate, since fixation and undue light tend to minimize or suppress nystagmus" (*1*)]. In our technique the subject has an unobstructed lateral view of at least 90 degrees of the visual field. One could use our system for measuring nystagmus of all types, of course, but it was not designed with this purpose in mind. Finally, it would appear that the principles of design in our system make possible much greater sensitivity and precision of measurement, a difference of considerable importance.

We appreciate Torok's bringing to our attention the work being done by him and his associates in the clinical study of nystagmus.

WILLIAM M. SMITH
Department of Psychology, Dartmouth College, Hanover, New Hampshire
PETER J. WARTER, JR.
Department of Electrical Engineering, Princeton University, Princeton, New Jersey

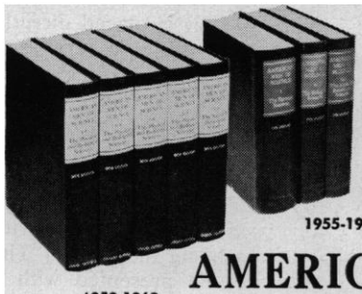
References

1. N. Torok, V. Guillemin, Jr., J. M. Barnothy, *Ann. Otol. Rhinol. & Laryngol.* **60**, 917 (1951).
2. V. Guillemin, Jr., and N. Torok, *Laryngoscope* **68**, 120 (1958).

Teaching and Research

The editorial entitled "Small colleges and small minds" [*Science* **131**, 71 (8 Jan. 1960)] emphasized clearly and concisely a serious weakness among a majority of our fine small colleges which demands correction in the immediate future. The issue is of such great significance that it needs to be called to the attention of every president of a small college and to that of the heads of his science departments.

That the larger colleges and universities do not have a monopoly on students with ability, curiosity, and desire is often overlooked. Nor can these larger institutions be relied upon to supply all the academicians to meet our expanding needs. Our small colleges must do more than they have to meet this challenge. If they so far fail to provide inspiration, challenges, and opportunities that their students do not know the thrill and satisfaction to be gained from original in-



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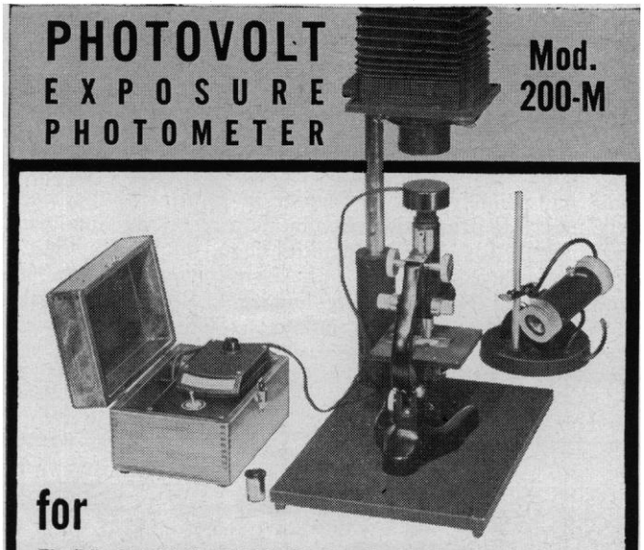

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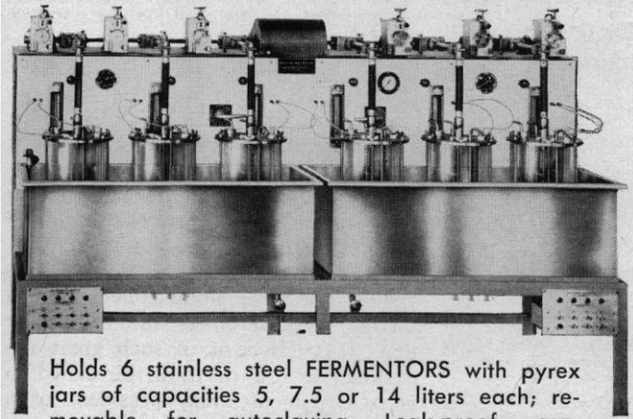

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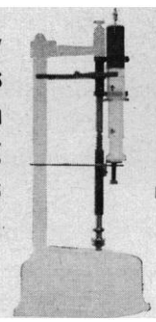

Syringe Driver

ECONOMICAL • CONVENIENT

Speed and syringe choice give wide range of delivery rates

Delivers small quantities of liquids at accurately controlled rates

This instrument has clinical applications in anaesthesia, surgery, gynecology, radiology and neuropsychiatry. It is particularly useful for administering small volumes of injectable drugs which are to be given over a period of time.

A threaded shaft, carrying a syringe holder and a pusher, is mounted in place of the regular drum spindle of the Bird Kymograph. The kymograph rotates the shaft and operates the pusher.

Any Luer syringe, from 5 ml to 50 ml capacity may be used. The kymograph drive provides a choice of five speeds. The combination of syringe and drive speed choice allows a wide range of delivery rates.

Request Syringe Driver and Retractor Bulletin for table of delivery rates and catalog numbers

SYRINGE RETRACTOR

Similar to the Bird Syringe Driver, but is designed for withdrawing samples of liquids at accurately controlled rates.

PHIPPS & BIRD, INC.

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vestigative efforts, the nation will lose many potential scientists to careers which offer greater material gain but less benefit to society.

I am not suggesting that all science instructors in small colleges who have never done any significant research should immediately seek to become investigators. I do urge, however, that new appointments to science faculties be based upon a candidate's enthusiasm and ability for both teaching and research. Again, promotions should be based on contributions of the candidate in both areas of endeavor.

The nation can ill afford to have its college students, especially those interested in the sciences, exposed to the teachings of a department that is sterile in research. To cite one example of a critical situation, the basic medical science departments of most of the nation's 85 medical schools are desperately seeking qualified and dedicated candidates for their excellent doctoral programs. Many more such candidates would be available now if the seeds of research interest had been effectively sown by the science faculties in our small colleges.

The inertia and resistance to research seen in some small colleges seems to emanate from those who fear the competition for promotion and prestige which might arise if active research programs were encouraged. Might not this type of healthy competition, if it should arise, prove stimulating to faculty activity in general?

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The editorial of 8 January stirred me to write this note.

I believe *Science* could do a greater service if it took up its cudgel on behalf of those who find it well-nigh impossible to do good research and good teaching at the same time. I give a reference here: St. Matthew 6: 24.

As an AAAS fellow, I like to believe I have some research ability. I have never been able to be fair to both teaching and research at the same time. I will go farther and say I can count on my fingers those who have been, to my knowledge. I have seen teaching slighted for research *ad nauseam*.

Teaching should be more than a "meal ticket for researchers." Let us give up pollyanna hogwash and be honest.

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Meteorology as a Field of Study

To the excellent points already made by John Day in his case for meteorology as a study with broad cultural benefits for college students [*Science* **130**, 1600 (1959)] we might add the factor of continuous international cooperation.

Because of the need for international exchange of weather observations and other information on an hour-to-hour basis in the years since the first international meteorological meeting, held in 1853 at Brussels under Maury's leadership, meteorologists have developed a high level of international cooperation. This has borne fruit in the establishment of ties of understanding and mutual respect among these workers in atmospheric science. Students who must study the atmosphere by analyzing observational reports from many distant places gain broadened horizons and an interest in affairs far beyond the college campus.

Thus, an additional factor commends atmospheric science not only as a field of major study but also as a field of minor study for all students, including liberal arts majors.

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