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-