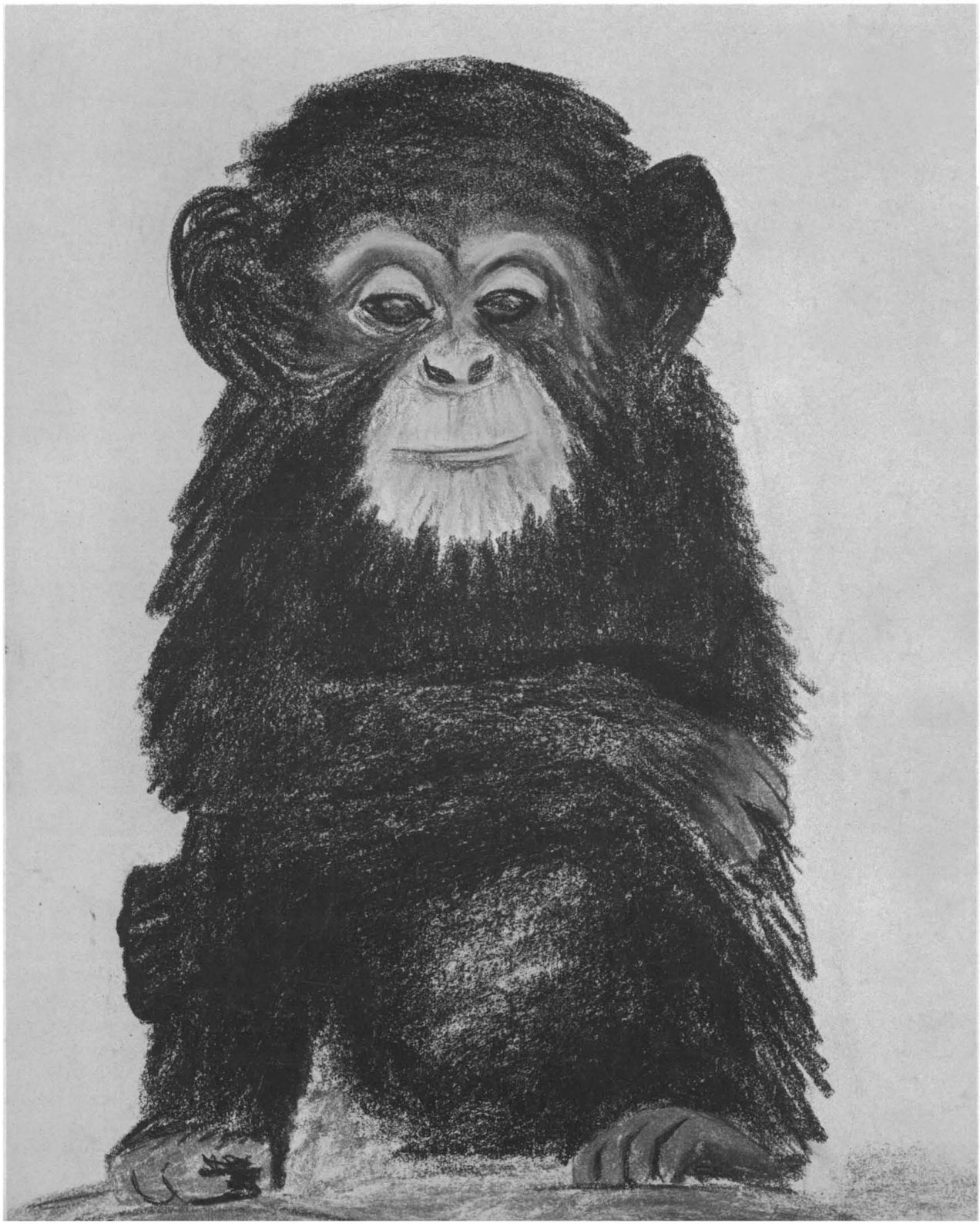
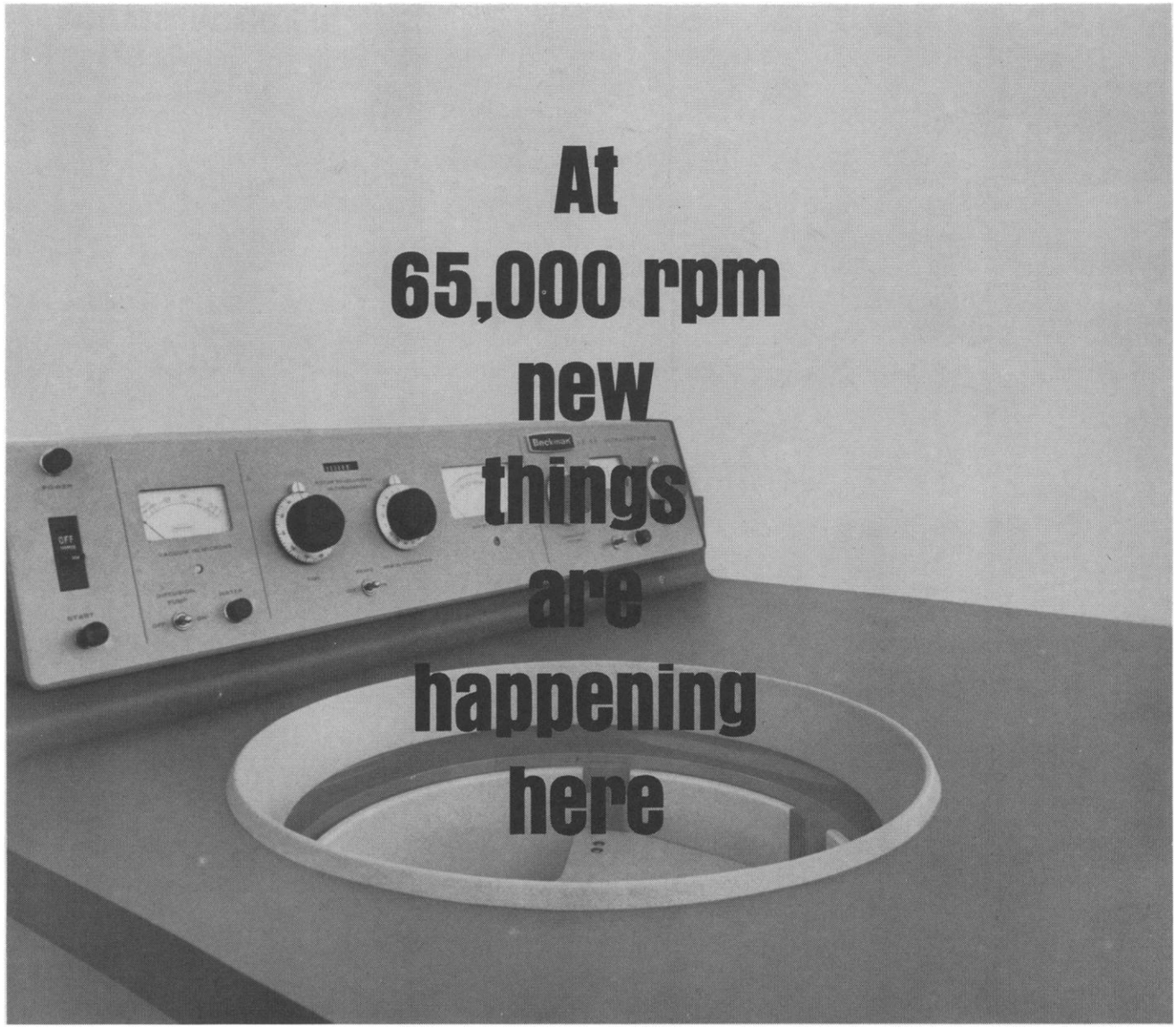
SCIENCE
10 December 1965
Vol. 150, No. 3702
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





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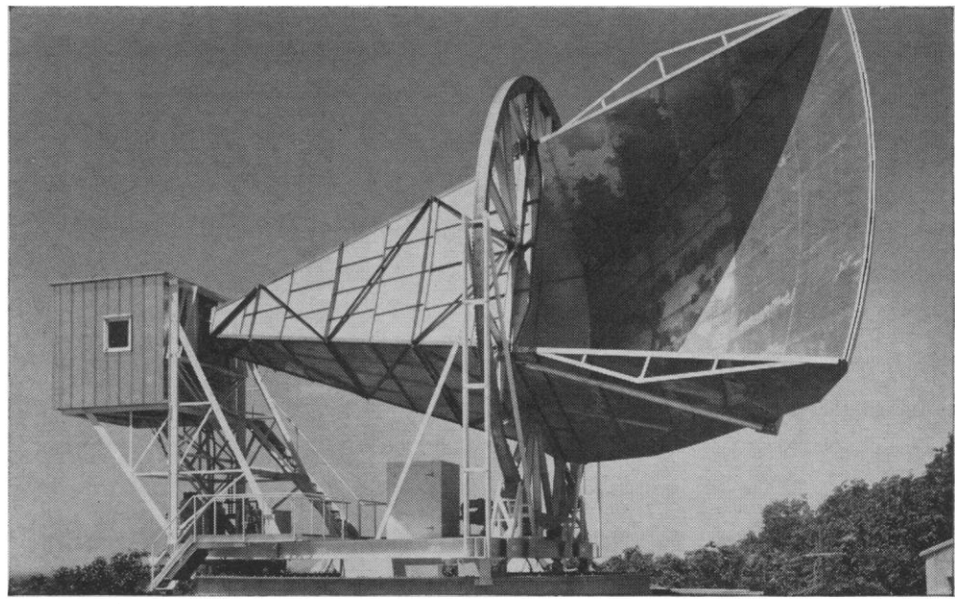
Report from

BELL LABORATORIES



Bell Laboratories' horn-reflector antenna located at Holmdel, New Jersey. It is coupled to a traveling-wave maser receiver through a waveguide switch which permits comparison of received noises and noise from a reference source.

A radio problem that may have a ten-billion-year-old solution

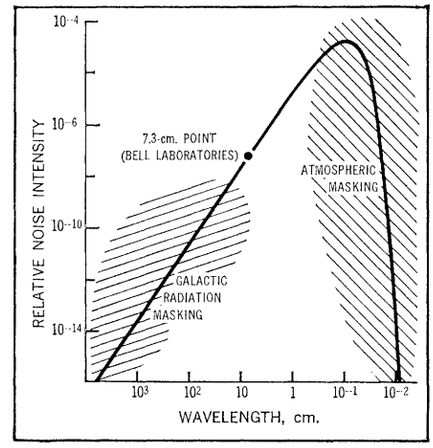
Activities in technology sometimes have surprising implications. For example, recent antenna tests conducted by Bell Telephone Laboratories at Holmdel, New Jersey, have apparently produced evidence about the early history of the universe.

In their radio communications studies, Bell Laboratories scientists had been using a horn-reflector antenna (employed on Project Echo and Telstar® experiments) to measure the radio noise emitted by Cassiopeia A, an exploded star now surrounded by fiery gas. This and other similar measurements require accurate knowledge about or elimination of noise produced by the atmosphere, the ground, and the components of the antenna system itself. Now, noise from the Earth's atmosphere can be accurately measured and the antenna is so directional that ground noise is negligible (verified through a series of tests with a mobile transmitter). The electrical joints in the antenna system and waveguide were reworked and sealed to eliminate any possible noise due to leakage. And, an extremely accurate noise-level reference source—the best produced so far—was designed and built especially for this project.

But there was some noise which could not be explained. It was stronger than that radiated by the distant fixed stars. It showed none of the patterns typical of man-made interference. Drs. A. A. Penzias and R. W. Wilson were frankly puzzled. Strangely enough, similar unexplained noise, of the same order of magnitude, had been suspected by Bell scientists during the Project Echo and Telstar experiments. At that time, though, measurement techniques were not sufficiently perfected to allow them to be certain of their suspicions.

Not far away, however, at Princeton University, an explanation was being devised without knowledge of the Bell experiments. A group under Prof. R. H. Dicke was seeking information about the relationship between gravity and the recession of distant galaxies from us and from each other. The original composition of our galaxy (inferred from spectral lines of "old" stars) and the belief—held by many astronomers—that all matter was once compressed into a vastly smaller volume than at present suggested to the group that the universe was at that time much hotter—a veritable fireball. Such a fireball would emit a characteristic "black-body" radiation which—after cooling through billions of years of expansion—would have fallen in frequency from about 10^{20} cps. to about 10^{10} cps. It would thus lie in the radio spectrum, at wavelengths of a few centimeters. This was very much like the noise which was puzzling the men at Bell Laboratories.

A mutual acquaintance saw a possible connection and put Bell in touch with Princeton. Result: the signal received at Bell Laboratories has enabled Prof. P. J. Peebles of Princeton to draw the hypothetical radiation spectrum shown in the figure. Future measurements at other wavelengths within this spectrum are planned at both Bell and Princeton to determine whether there was a primordial fireball. If so, it will be the first reliable view man has had of events 10 billion years ago.



Virtually all of the "black-body" radiation which might have come from the supposed primordial fireball is concentrated between wavelengths of 7500 cm. and 0.01 cm. However, the long-wave end of the spectrum is masked by the galactic radiation to which radio astronomers listen and the short-wave end is masked by the Earth's warm-air atmosphere. Therefore, only the portion of the curve between about 20 cm. and 1 cm. can be studied. Bell Laboratories has supplied a point at the Telstar wavelength (7.3 cm.). Bell and Princeton scientists will next look for other points along the same curve. If these points are found, they will be powerful evidence of such radiation and, in turn, of the former existence of the fireball itself.

Bell Telephone Laboratories
Research and Development Unit of the Bell System

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SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

One behavior pattern observed in young chimpanzees is clinging. It characteristically includes grasping and ventral contact with a social stimulus. The occasional posture of young chimpanzees, sitting with the arms folded across the chest while the hands grasp a contralateral limb, may be a self-directed form (huddling) of this pattern. See review of *Behavior of Nonhuman Primates*, vol. 2, page 1440. [Willa Martin, Covington, Louisiana]

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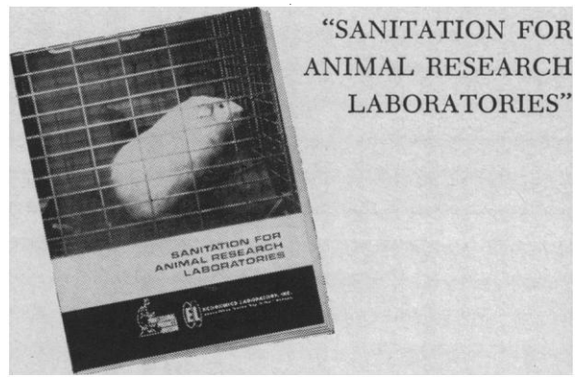

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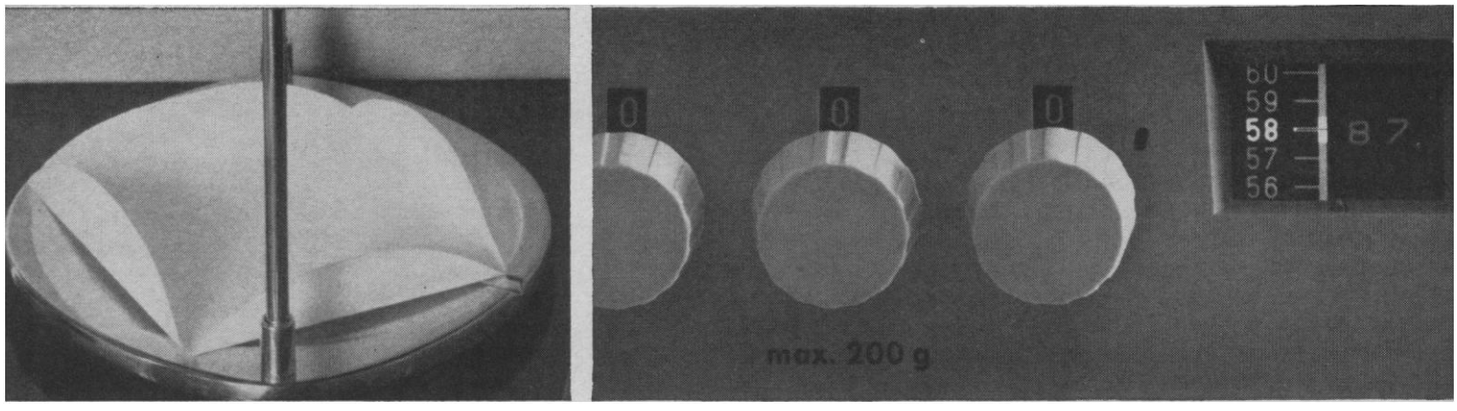
before mechanical taring – the weight of the filter paper cup on the pan would normally be 0.5887 grams after setting the micrometer.



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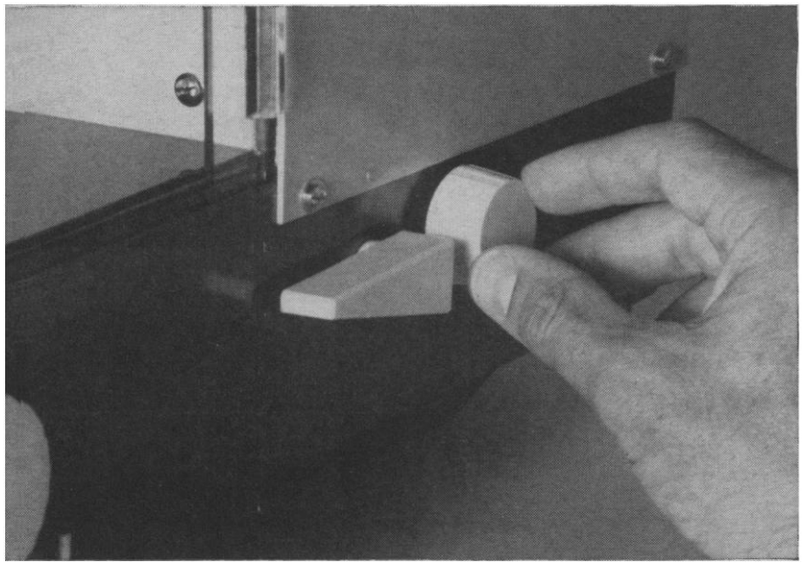

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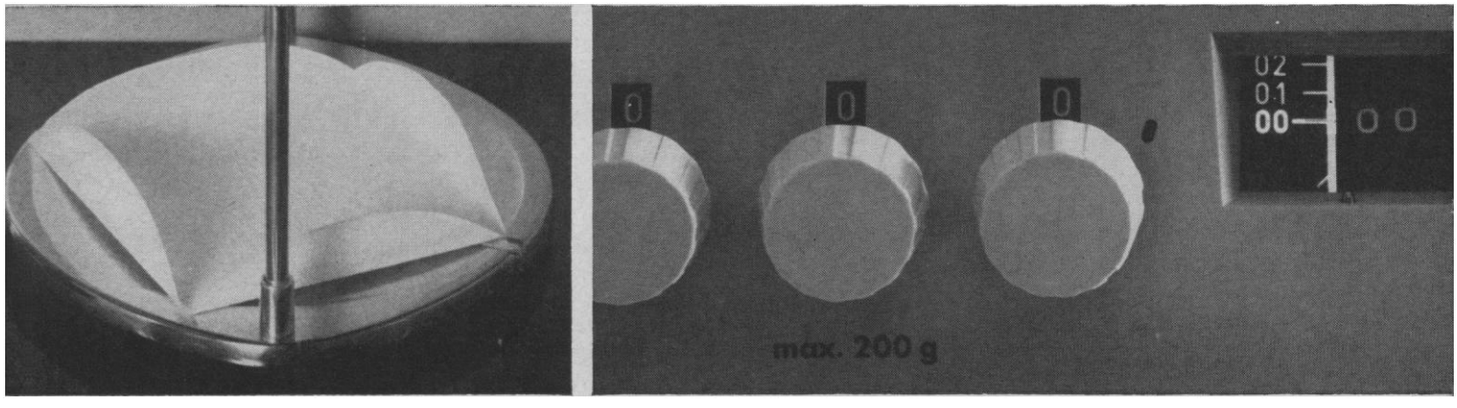

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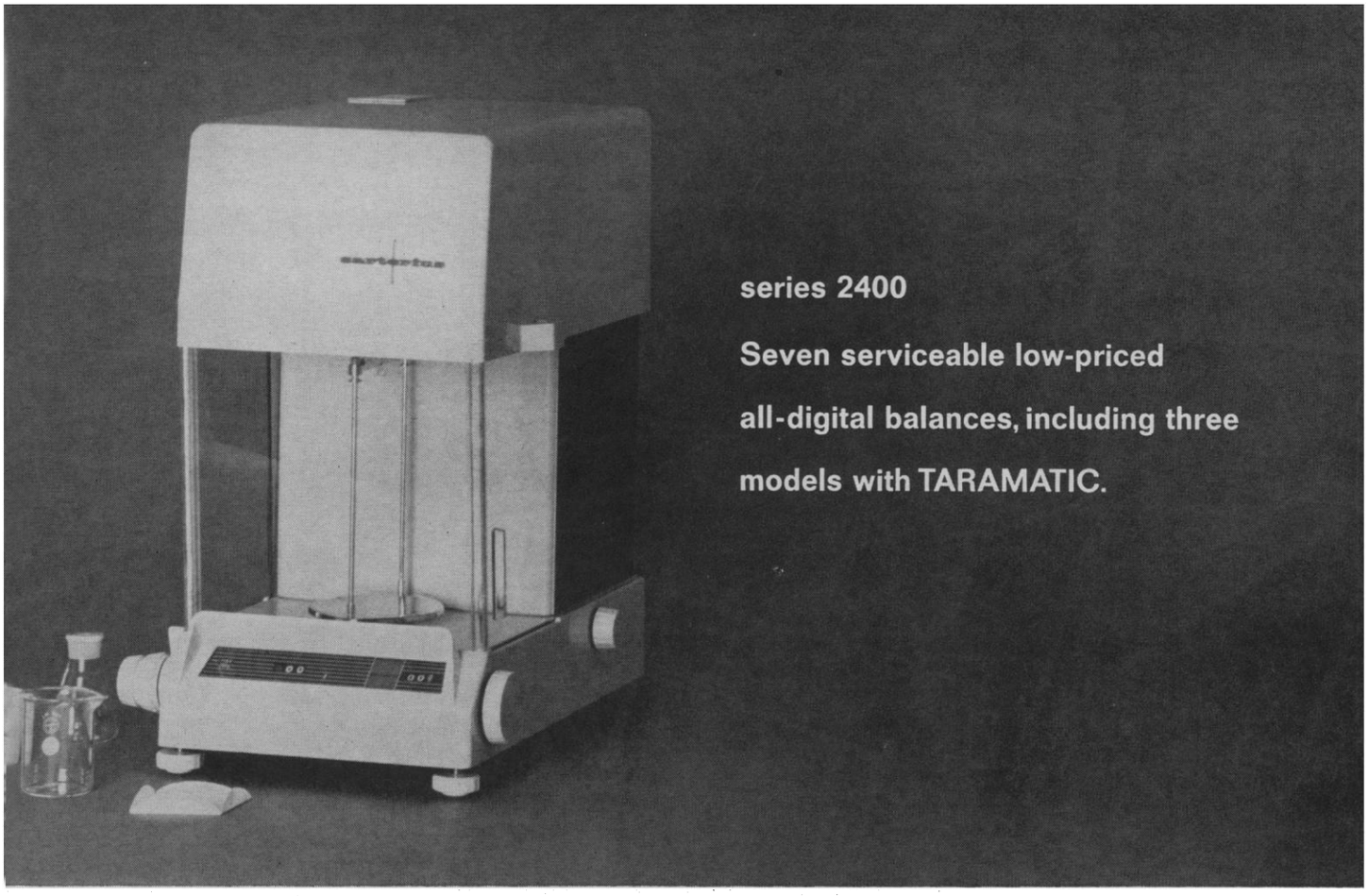

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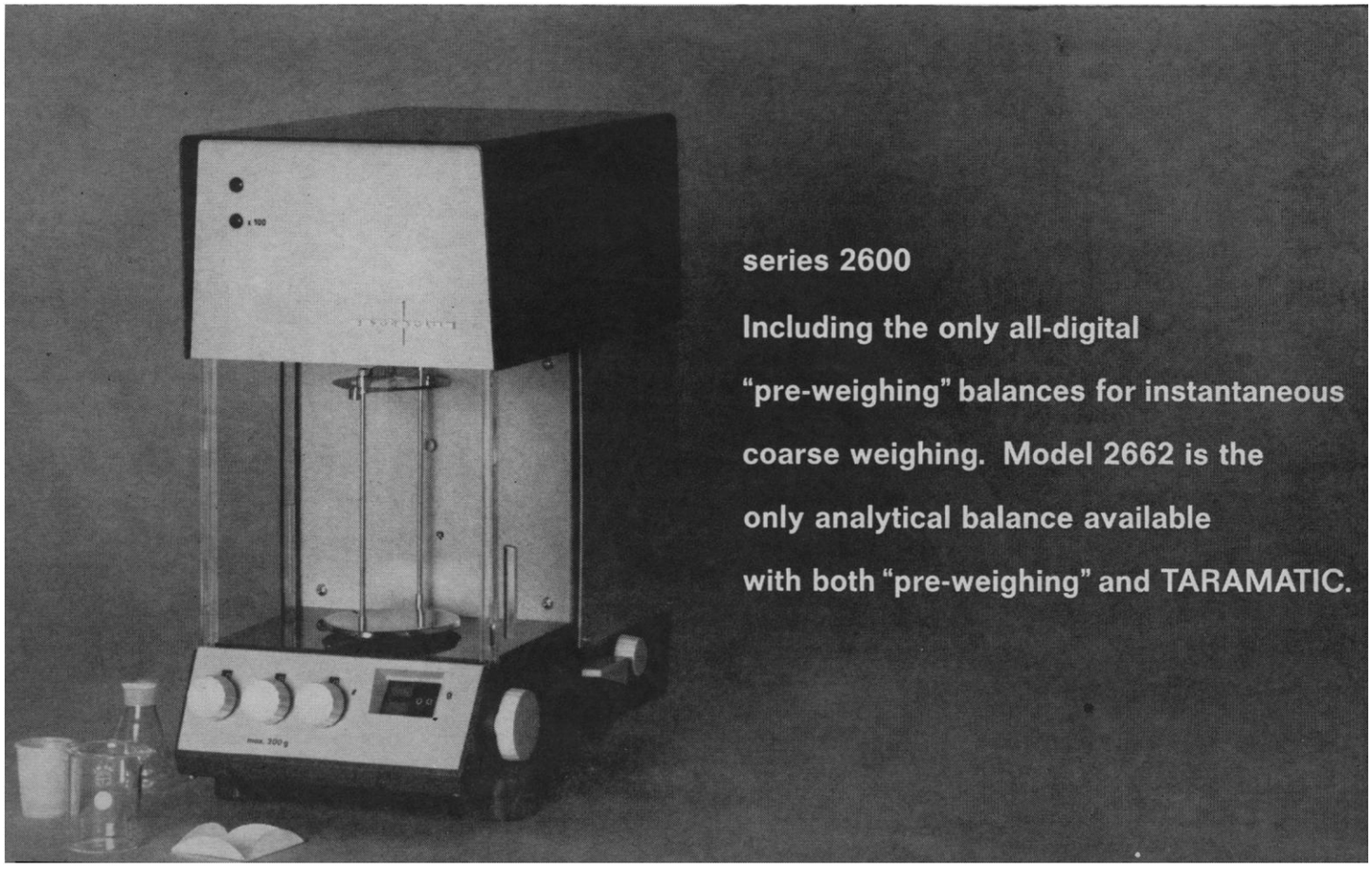

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An Adage AMBILOG™ 200 system is in use at the University of Virginia School of Medicine as an intensive-care patient monitor following complex operations such as open-heart surgery.

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At the U.S. Navy Underwater Sound Laboratory, New London, Ct., an AMBILOG 200 system calculates power spectral density functions of sonar signals to obtain norms for sea noises.

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SEISMIC RESEARCH

The California Institute of Technology's Kresge Seismological Laboratory and The Institute of Geophysics and Planetary Physics of the University of California (San Diego) are using AMBILOG 200 computers in research programs aimed at recognizing underground nuclear explosions by distinguishing their tremors from other seismic events.

The Caltech system acquires and processes seismic signals read from a multi-channel FM analog tape unit and filtered through a Butterworth array. Time records written in VELA format are decoded. The computer performs time-domain digital filtering for accomplishing waveform pattern recognition. Digitized raw data and processed results are recorded on a magnetic tape, with provision made for "quick look" and analog playback.

The Institute of Geophysics and Planetary Physics' system has been processing seismic signals on line — sensor outputs are fed directly to the computer — at the Tonto Forest Seismological Observatory. Data from multi-channel inputs is multiplexed, edited (scaled, offset and monitored), digitized, and formatted for tape recording. The machine is also programmed to produce Fourier transformations of selected signals.

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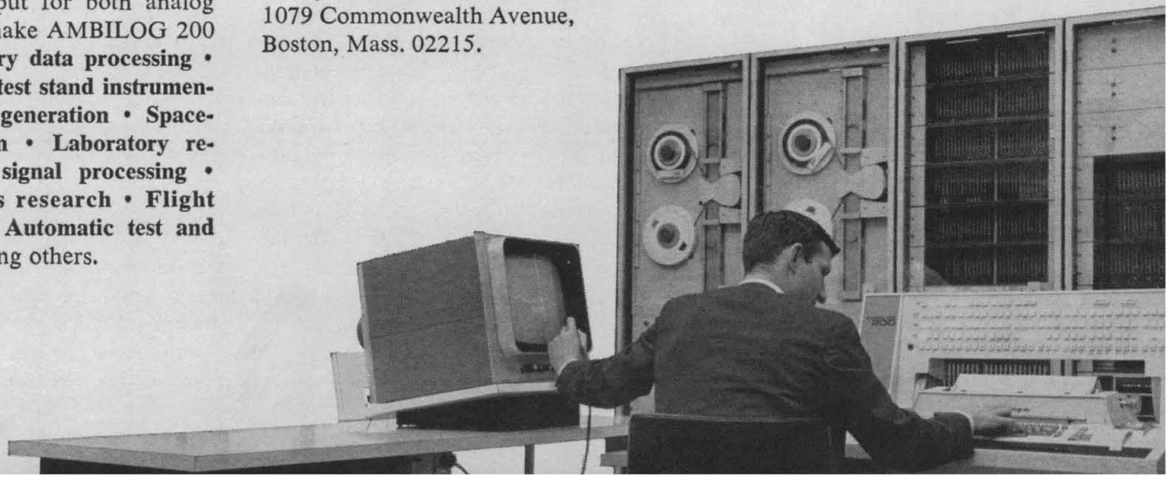


only nine lines. Much of the literature published today is obscure and ungrammatical, and these faults will only be corrected when the rules of grammar are applied and clarity of expression is set high on the list of standards by which a manuscript is judged.

Forscher omits to mention that the referee has a responsibility to the author, who is entitled in this highly competitive age to prompt consideration of his manuscript. If a referee is too busy or too lazy to fulfill his obligations within a reasonable time, he should not be entrusted with the responsibility. . . .

If it is the editor's responsibility to make the final decision about publication, it should also be his responsibility to weigh the advice of his referees. He need transmit to the author only those comments that he deems necessary for the improvement of the manuscript or for justifying its rejection; this he can do without disclosing the referees' names.

PETER H. WRIGHT
Indiana University Medical Center, 1100 West Michigan Street, Indianapolis

Forscher's suggestion that verbatim comments from the referee be accompanied by his name appears to offer one way to curb the tendency of some referees to make unsupported judgments such as "naive," "superficial," or, in an extreme case, "stupid."

Moreover, communication of the author with the referee could in some instances prove to be mutually beneficial.

BARBARA J. POWELL
759 Day Street, Galesburg, Illinois

Competence in the Universities

With regard to the Reuss subcommittee's inquiry into the relation between federal support for basic research and the quality of university science teaching (News and Comment, 22 Oct., p. 464), I offer the following observation: Having completed some 20-odd undergraduate and graduate courses in botany and genetics at four institutions (Washington University, the University of Michigan, Claremont Graduate School, and the University of California at Berkeley) during the pre- and post-Sputnik era, I have encountered teaching ranging from excellent to very poor. In every case the good-to-excellent teachers were those who were actively engaged in significant basic research, whereas the poor teachers were also ineffectual as researchers. Thus my experience does not bear out the assumption that teaching and basic research are antagonistic duties of the university scientist. One might better regard poor teaching as simply one more aspect of professional incompetence.

KAREN A. GRANT
135 East Seventh Street, Claremont, California

Antiunion

In the issue of 15 October (p. 292) there is a letter headed "No antineoplastic effects." Now, what can *ăn-tĭn'ē-ō-plas'tĭk* mean? I get it! It means *anti-neoplastic*.

Why is the hyphen so avoided? The dashed little dash makes for clarity. How can one pronounce and divine the meaning of *picornaviruses* without hyphens? It's easy when you write it right: *pico-RNA-viruses*. That does for many another inelegant formulation born out of the modern, hasty need for neologisms and nonce words.

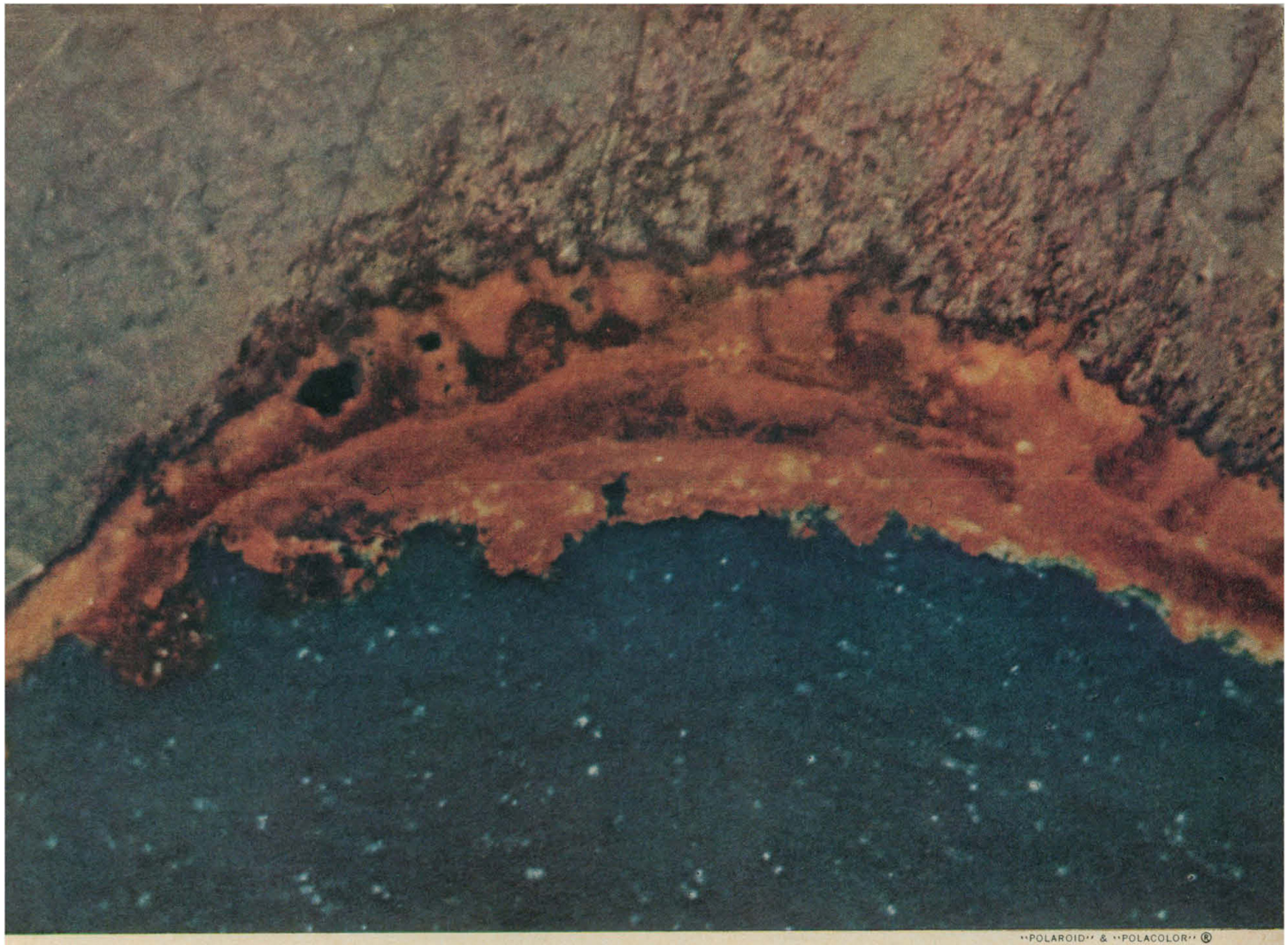
There ought to be a law: Dash it! As for acronyms: To hell with them.

MORRIS LEIDER
New York University Medical Center, 562 First Avenue, New York 10016

Erratum

The 22 October issue presents the wildly improbable coincidence of containing both a letter about parapsychology and "spontaneous cases" (p. 436) *and* a "spontaneous case." For on page 463, as part of my comments on the 1965 Nobel Laureates in Medicine or Physiology, there appears the phrase "The operator 'loses'. . .," though what I had actually written was "The operator 'closes'. . . ." Now since I happen to have some doubts about the validity of the operator concept, doubts that I certainly would not consciously have wished to introduce on this happy occasion [though I did voice them earlier in *Science* **144**, 816 (1964)], this strange error can be explained only as a Freudian slip by a member of the editorial staff of *Science* acting under the telekinetic influence of an author's psyche.

GUNTHER S. STENT
Department of Molecular Biology, University of California, Berkeley



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Future Administrators

Under a grant from the Ford Foundation, the American Council on Education is in the second year of a 5-year program of providing internships in academic administration to selected faculty members who would like to sample the administrative life. Next fall "fifty persons judged to have high potential for successful careers in academic administration in colleges and universities will be selected for administrative internships in fifty host institutions."

Traditionally, it has not been quite respectable to aspire openly to a position in college or university administration. The assistant professor who is good in his field usually thinks of a professorship in a major university as the top rung on his ladder. Later on, some change their minds; many a scholar who knows that his best work is behind him or that he will never quite achieve as much in his own field as he once hoped has successfully traded the known satisfactions of a largely self-directed life of teaching and research for the frustrations and uncertainties and also the rewards and larger scope of an administrative position. Some have combined eminence in their own fields with high talents as educational philosophers and leaders.

Unfortunately, there are not enough such men and women to provide all of the presidents, provosts, deans, directors, and other administrators needed by the wide range of institutions involved in education beyond the high school level—community and junior colleges, liberal arts and teacher-training and other specialized colleges, great universities and lesser ones—and to direct the variety of new responsibilities that have been assumed or accepted by the universities—sponsored research, international cooperation, and public service duties.

Some of these posts will be filled by persons who defy the academic mores by frankly aspiring to administrative careers, for it seems—although not altogether happily—that a new breed will grow in number, the men who hope and prepare for administrative posts as devotedly as the lieutenant who hopes to become a general, the businessman who wants to become company president, or the school teacher who aspires to a superintendency. These persons are likely to be considered academic climbers and looked on with suspicion by many of their colleagues, but they exist.

For some of them and also for some who follow the more traditional route, a year spent in close association with an established administrator may provide a valuable opportunity for self-appraisal in a new role and an opportunity to be tried out, with no permanent commitment on either side. It may well be that none of the interns in this program will become Harpers, or Elliotts, or Conants. But a number of men in their 30's and 40's will learn some of the problems, the temptations, the frustrations, and the constructive opportunities to be found in administrative responsibility. Some will be repelled or will demonstrate their ineptness. Others will find satisfaction and will impress their preceptors as good candidates for future administrative appointments.

This program is worth watching, not only in terms of its own objectives but also, if it works well, as a possible model for selecting and training some of the growing number of science administrators who are needed on campuses, in industry, and in government. Here too there is a problem of finding the men and women who can contribute most effectively, and with personal satisfaction, by transferring from the laboratory to the administrative office.—DAEL WOLFLE

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ethane as his counting gas in order to introduce twice the amount of carbon into a liter-atmosphere of sample gas; counting 24 liter-atmospheres of ethane for 6 days allows him to measure, without isotopic enrichment, samples 60,000 years old. Unfortunately a very small amount of sample contamination is very significant in this range and may make statistical calculations of range purely academic. Badly needed for evaluating contamination is a series of samples extending from around 20,000 years, where C^{14} ages should be reliable, back to 75,000 years or beyond.

Finally, Oeschger (Bern) described a very small gas counter having a volume of 40 cm^3, designed to analyze CO_2 extracted from glacial ice. Even with so small a detector almost one ton of ice must be melted to yield sufficient CO_2 for radiocarbon measurement.

In the field of natural tritium measurement, it is often necessary to enrich the H^3 prior to counting in order to attain adequate sensitivity. Customarily this has been done by water electrolysis, one installation of which was described by Cameron and Payne (International Atomic Energy Agency, Vienna). Enrichment using thermal diffusion has lately been considered; the conference heard reports on this technique from Sellschop (South Africa) and von Buttlar and Wiik (Darmstadt). Enrichment by use of a gas chromatographic column was described by Smith and Ahktar (Tennessee) but is not as yet applicable to natural levels.

Isotopic enrichment is often unnecessary where bomb-produced tritium is sufficiently abundant. In this case proportional counting has been used without enrichment. Von Buttlar, Wohlfahrt, and Farzine (Darmstadt) generate hydrogen from natural waters and use it to hydrogenate inactive ethylene to ethane, which they count. Lal (Bombay) described a process to produce tritiated methane from water in one stage. His reactor is loaded with sample water, zinc metal, and inactive CO_2 gas; the net reaction is $CO_2 + 2H_2O + 4Zn \rightarrow 4ZnO + CH_4$. This same reaction can be used for C^{14} measurements, in which case the CO_2 is sample-derived and the water is inactive.

The conferees considered the question of the best half-life to use in reporting C^{14} ages to the journal *Radiocarbon*. A similar discussion was held during the 1962 Cambridge Conference as a result of three new measurements of half-life (*1*) that showed the accepted value of 5568 years to be low by 3 percent. Majority opinion in both the Cambridge (*2*) and Pullman (*3*) conferences was for retaining the old value for the sake of uniformity in publication while at the same time suggesting a correction factor of 1.03 to be applied for greater accuracy.

One of the highlights for many was the all-day field trip which provided a change of pace in the middle of the conference week. The itinerary included the Palouse hills of Pleistocene loess deposits, the channeled scablands where Pleistocene flood waters have exposed and scoured Tertiary basalt flows of the Columbia Plateau, and the Marmes Rock Shelter at the confluence of the Palouse and Snake Rivers. The latter has been excavated by Washington State University archeologists who have exhumed several human skeletons antedating the Mazama ash fall of 6500 years ago. Guides for the field trip were Richard Daugherty in archeology, Roald Fryxell in geology, and James Crosby in geohydrology.

EDWIN A. OLSON
Whitworth College, Spokane, Washington
R. M. CHATTERS
Washington State University, Pullman

References

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2. H. Godwin, *Nature* **195**, 984 (1962).
3. F. Johnson, *Science* **149**, 1325 (1965).

Forthcoming Events

December

20–21. **Molecular Transport and Rate Phenomena**, 32nd annual chemical engineering symp., Stanford Univ., Stanford, Calif. (A. Acrivos, Dept. of Chemical Engineering, Stanford Univ., Stanford, Calif.)

20–21. **Nuclear Medicine**, 2nd natl. congr., Tel Aviv, Israel. (P. Czerniak, Israel Atomic Commission, Soreq Nuclear Research Center, Doar Yavne)

20–22. British **Biophysical** Soc., 20th winter meeting, London, England. (R. E. Burge, Physics Dept., Queen Elizabeth College, Campden Hill Rd., London W.8)

20–22. American **Physical** Soc., Los Angeles, Calif. (W. Whaling, California Inst. of Technology, Pasadena 91109)

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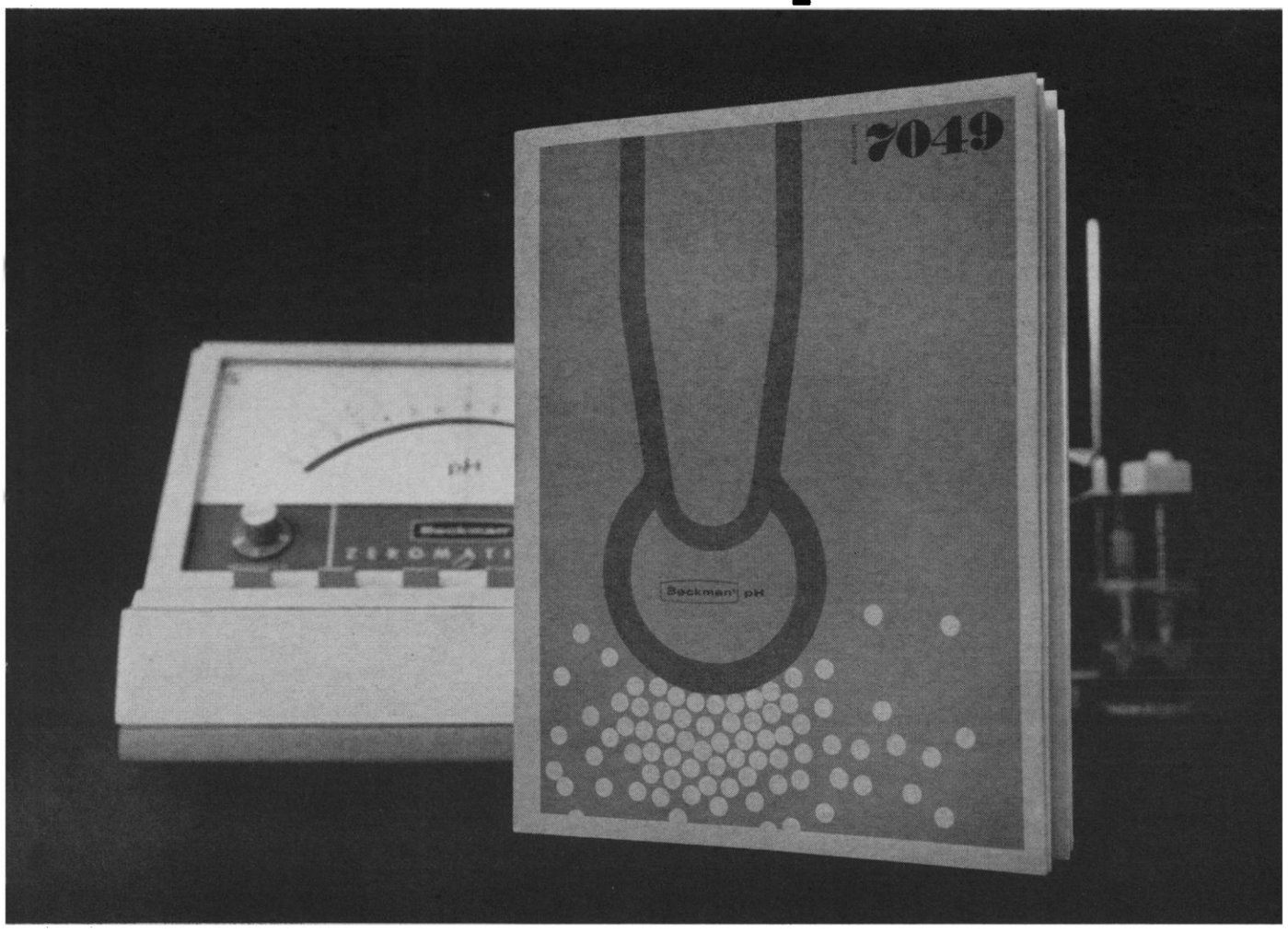

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26–31. **American Assoc. for the Advancement of Science**, annual, Berkeley, Calif. (R. L. Taylor, AAAS, 1515 Massachusetts Ave., NW, Washington, D.C. 20005)

In addition to the 20 sections of the Association and five AAAS committees, the following organizations have arranged sessions at the AAAS annual meeting 26–31 December at Berkeley:

Mathematics

American Mathematical Soc. (R. S. Pierce, Univ. of Washington, Seattle)

Association for Computing Machinery. (H. D. Huskey, Univ. of California, Berkeley)

National Council of Teachers of Mathematics. (J. D. Gates, 1201 16 St., NW, Washington, D.C.)

Society for Industrial and Applied Mathematics. (J. H. Griesmer, IBM, Yorktown Heights, N.Y.)

Physics

American Astronautical Soc. (P. B. Richards, General Precision, Little Falls, N.J.)

Chemistry

American Chemical Soc., California Section. (R. L. LeTourneau, Chevron Research Co., Richmond, Calif.)

Astronomy

American Astronomical Soc. (G. C. McVittie, Univ. of Illinois, Urbana)

Geology and Geography

Association of American Geographers. (M. Mikesell, Univ. of Chicago, Chicago, Ill.)

National Geographic Soc. (R. Gray, 17th & M Sts., NW, Washington, D.C.)

National Speleological Soc. (G. W. Moore, U.S. Geological Survey, Menlo Park, Calif.)

Zoological Sciences

American Fisheries Soc. (H. K. Chadwick, California Dept. of Fish and Game, Sacramento)

American Soc. of Zoologists. (A. G. Richards, Univ. of Minnesota, St. Paul)

Animal Behavior Soc. (E. M. Banks, Univ. of Illinois, Urbana)

Herpetologists' League. (F. B. Turner, Univ. of California, Los Angeles)

Society of Systematic Zoology. (J. G. Rozen, Jr., American Museum of Natural History, New York, N.Y.)

Zoological and Botanical Sciences

American Soc. of Naturalists. (C. Hubbs, Scripps Inst. of Oceanography, La Jolla, Calif.)

Ecological Soc. of America. (G. M. Woodwell, Brookhaven Natl. Laboratory, Upton, L.I., N.Y.)

Western Soc. of Naturalists. (J. M. Craig, San Jose State College, San Jose, Calif.)

Psychology

Western Psychological Assoc. (G. A. Mendelsohn, Univ. of California, Berkeley)

Social and Economic Sciences

American Economic Assoc. (R. R. Nelson, RAND Corp., Santa Monica, Calif.)

American Political Science Assoc. (J. F. Triska, Stanford Univ., Stanford, Calif.)

American Soc. of Criminology. (C. Newman, Univ. of Louisville, Louisville, Ky.)

American Sociological Assoc. (W. Form, Michigan State Univ., East Lansing)

Metric Assoc. (R. Fischelis, Ohio Northern Univ., Ada)

National Inst. of Social and Behavioral Science. (D. P. Ray, 863 Benjamin Franklin Station, Washington, D.C.)

Population Assoc. of America. (E. S. Lee, Univ. of Pennsylvania, Philadelphia)

Society for the Scientific Study of Religion. (C. Y. Glock, Univ. of California, Berkeley)

History and Philosophy of Science

Philosophy of Science Assoc. (C. W. Churchman, Univ. of California, Berkeley)

Society for General Systems Research. (H. Thal-Larsen, Univ. of California, Berkeley)

Science Courses for Baccalaureate Education Project. (V. L. Parsegian, Rensselaer Polytechnic Inst., Troy, N.Y.)

Medical Sciences

Alpha Epsilon Delta. (M. L. Moore, 7 Brookside Circle, Bronxville, N.Y.)

American Assoc. of Bioanalysts, Western Region. (M. Menesini, 1287 Rudgear Rd., Walnut Creek, Calif.)

American Physiological Soc. (R. M. Iverson, Univ. of Miami, Coral Gables, Fla.)

American Soc. for Microbiology, Northern California–Hawaiian Branch. (K. J. Taylor, Cutter Laboratories, Berkeley, Calif.)

California Veterinary Medical Assoc. (A. G. Edward, Univ. of California, Davis)

Society for Experimental Biology and Medicine, Pacific Coast Section. (E. L. Dobson, Donner Laboratories, Univ. of California, Berkeley)

Education

Commission on Science Education. (J. R. Mayor, AAAS, 1515 Massachusetts Ave., NW, Washington, D.C. 20005)

American Nature Study Soc. (H. E. Weaver, Univ. of Illinois, Urbana)

National Assoc. for Research in Science Teaching. (F. B. Dutton, Michigan State Univ., East Lansing)

National Assoc. of Biology Teachers. (H. K. Wong, Menlo-Atherton High School, Atherton, Calif.)

National Science Teachers Assoc. (A. F. Eiss, 1201 16 St., NW, Washington, D.C.)

Information and Communication

National Assoc. of Science Writers. (L. S. Zahn, Hill and Knowlton Inc., 150 E. 42 St., New York, N.Y.)

Society of Technical Writers and Publishers. (G. Marx, Illinois Inst. of Technology, Chicago)

Statistics

BIO: Biomedical Information-Processing Organization. (M. Woodbury, New York Univ. Medical Center, New York, N.Y.)