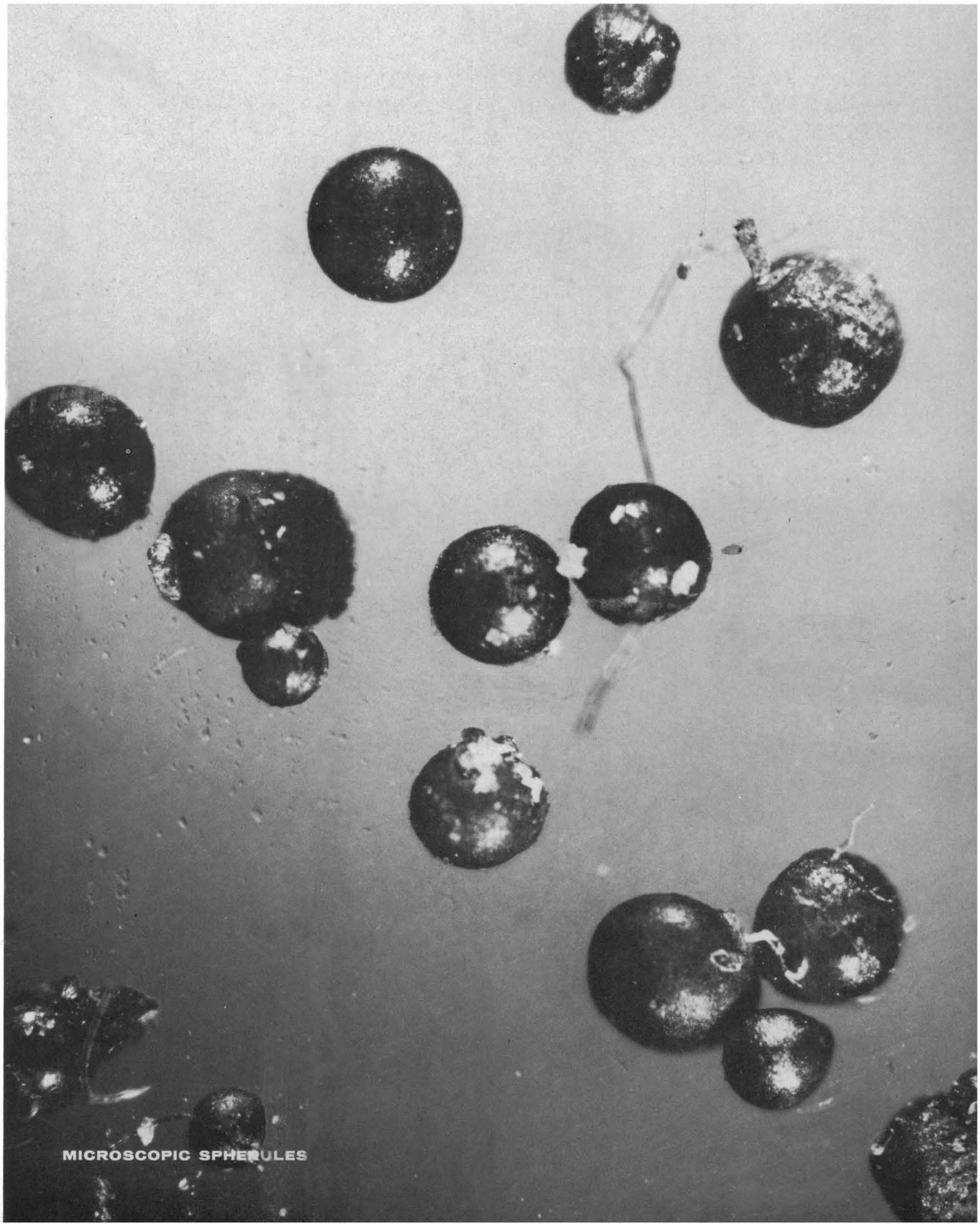
SCIENCE

19 June 1964
Vol. 144, No. 3625

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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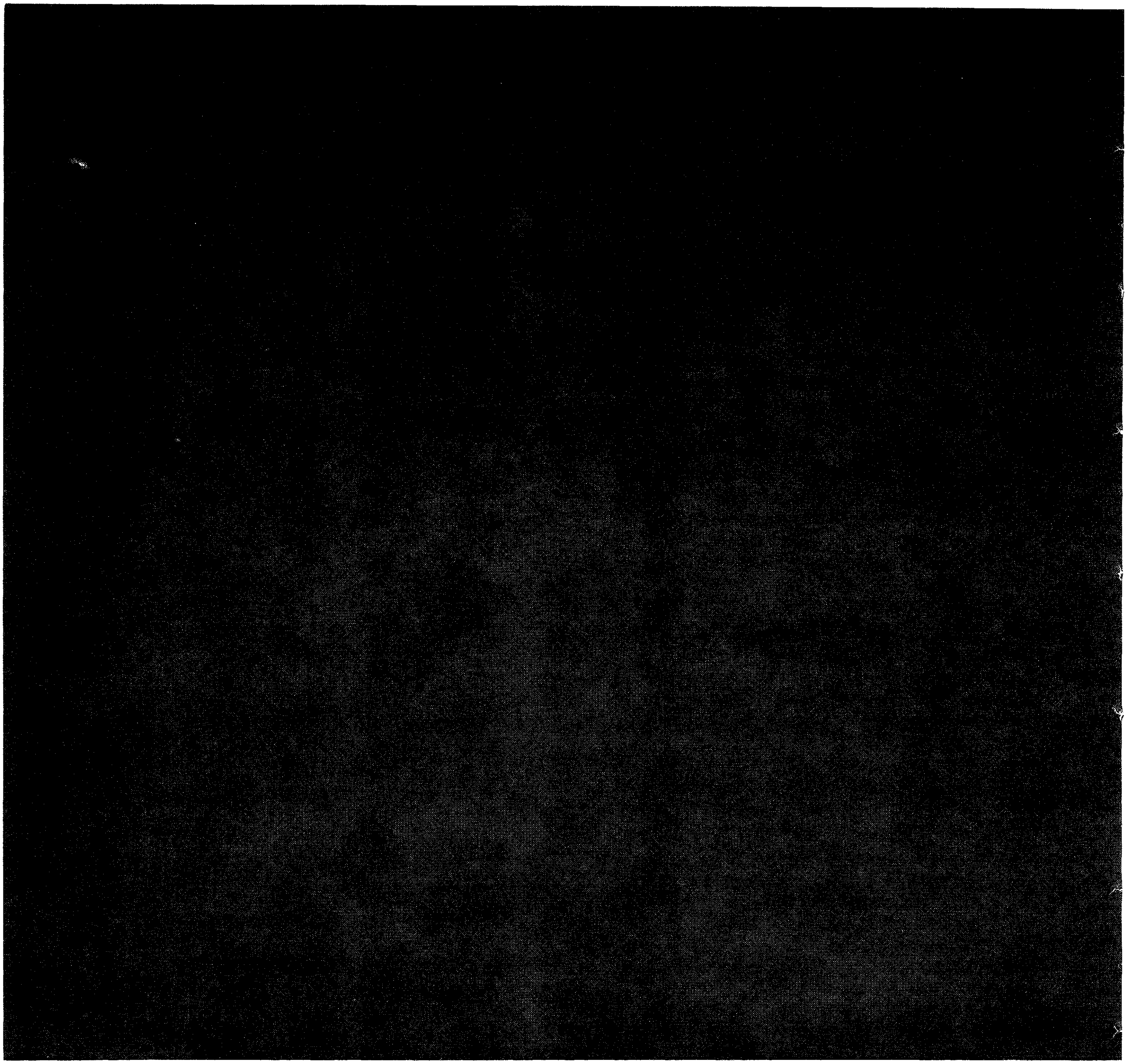
COVER

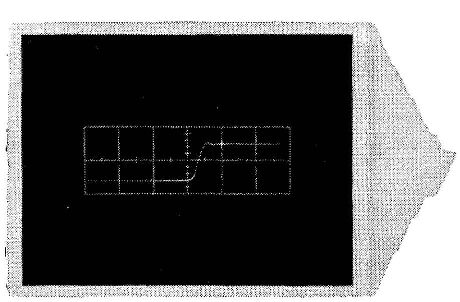
Magnetic spherules collected in a plankton net at the surface of the ocean. The spherules may have fallen shortly before collection and may be either extraterrestrial dust or contaminants from industrial activities. Diameter of the largest spherule is 0.4 mm. See page 1475. [New York Academy of Sciences]



How do you take a picture of something you can't see?

Transient oscilloscope traces in the sub-nanosecond range move too fast for the human eye. How can you study them?

Use Polaroid 10,000-speed Land film. It's fast enough to make clear, high-contrast pictures of the most fleeting traces. And the results are fast, too.



Your pictures are fully developed in 10 seconds. If you are studying sequential traces, you can click off a full roll (8 exposures) in 20 seconds. Simply let the film stay in the camera back for 2 seconds, then pull the tab, repeating the process for each exposure. Strip away the negative and you've got eight finished pictures.

The catalog name for this film is Polaroid PolaScope Type 410. It's panchromatic, responds best to blue phosphors such as P-11. The film's extreme sensitivity lets you use small camera apertures and low beam intensities too, so your trace pictures are really sharp.

Try Type 410 Land film the next time you need oscilloscope pictures. And see.

POLAROID AND POLASCOPE®

Polaroid 10,000-speed Land film.

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SCIENCE

Forty First-Rate Universities

In 1960 President Eisenhower's Science Advisory Committee expressed the "hope that where there were only a handful of generally first-rate academic centers of science a generation ago and may be as many as fifteen or twenty today, there will be thirty or forty in another fifteen years." To aid in the realization of this hope is the precise target of the new Science Development Program of the National Science Foundation.

Grants for individual research projects and fellowships for specified individuals will no doubt continue to constitute the core of federal support for scientific research and education. But it is increasingly clear that a larger fraction of federal support should and will go to the universities as grants for the upbuilding of an area of teaching and research, a department, or the institution as a whole, rather than for specific research projects. The new grants are an example. Moreover, they differ from most previous grants in that the appropriate criterion of award is not *How good is the applicant now*? but rather *How much will this grant help the applicant institution to become truly first-rate?*

These new grants are intended to give to a relatively small number of already good universities an extra push that will help them to become very good. This is a high and difficult purpose. There will be efforts to subvert it. One temptation will be to make grants to universities that are already of top quality; their excellent staffs could make good plans for and good use of more money. But they are not the chosen target of this particular program.

A greater danger is from pressures to try to solve the problems of geographic distribution of federal funds. A disturbing example was given by the House of Representatives Appropriations Committee, which saluted this program as "one of the best methods to truly broaden the development of scientific and engineering knowledge in every part of the Nation, particularly in those areas where assistance is needed most." If *needed most* is interpreted to mean that the available funds should be spread thinly over many institutions, the program will fail.

Other programs have other purposes. This one is for universities that have the drive, the potential, and a good share of the resources they will need to try for equality with others that already rank among the top 10 or 20. For a university to qualify, the requirements are that it have well-laid plans for its own further development, that a substantial grant for 3 to 5 years will provide for the early realization of an important segment of these plans, and that the university have in sight funds for continuing the work when the grant comes to an end. Generally, universities that can reasonably enter this competition already rank between 20th and 50th or 100th, or in some such range, on the scale of academic excellence. Fortunately, the universities that can qualify are fairly well dispersed geographically. Geographic location cannot be the primary consideration, but one reason for wanting more first-rate universities is to have them in areas where none now exist. An increase from 15 to 20 or 30 or 40 will have a greater total effect on the nation's intellectual life if, without looking too far, each area or region can see, can proudly claim as its own, and can follow the leadership of a university of the first magnitude.—DAEL WOLFLE

VERSATILE NEW PACKARD RADIOCHROMATOGRAM SCANNER

FEATURES:

- **Completely automatic operation**
- **4 pi counting geometry**
- **May be quickly converted for TLC scanning**
- **Automatic shut-off of gas and power**
- **Handle chromatograms ½ to 2 inches wide and lengths to 150 ft; also accommodates thick paper (such as Whatman 3M) without damage**
- **Automatic indication of origin, solvent fronts, etc.**
- **16 scanning speeds, 8 time constants, 9 linear count ranges**
- **Analog or digital data presentation**
- **Linear and Logarithmic display**
- **Quickly demountable components for decontamination**

Packard 7200 Series Chromatogram Scanning Systems provide accurate, automatic assay of low energy beta-emitting activity deposited on paper strips or TLC glass plates. Analog data presentation is provided in Model 7201; Model 7211 provides digital display.

The new 7200 Series instruments incorporate many features designed to provide optimum detection accuracy, greater instrument utility, and time-saving user convenience. Ultra-sensitive detection is ensured by two windowless gas flow Geiger detectors arranged in 4 pi configuration to scan simultaneously both sides of a paper chromatogram. 2 pi scanning with either upper or lower detector may also be selected with a front panel switch.

Quick, precise positional resolution of activity is achieved by collimators containing slit widths of 2½, 5, 7, and 10mm. Sixteen scanning speeds may be selected by depressing push-button selector switches which are illuminated when they are actuated. A push-button cam on the detector shield permits quick separation of the collimators for fast, easy front loading of the paper strip. Because the chromatogram strip enters the detector at a constant horizontal angle, thick paper (such as Whatman 3M) may be scanned without chromatogram damage.

Collected data are presented on a Packard Model 380 Recording Ratemeter. The Ratemeter offers 8 time constants and 9 linear count ranges. The interrelated Ratemeter and Recorder may be operated in either LINEAR or LOG modes. In the Linear mode, both the Ratemeter and Recorder display cpm on a linear scale; in the Log mode, they display cpm on a logarithmic scale from 10 to 10^6 cpm. Logarithmic presentation of data permits the user to prepare a preliminary run to establish settings for a final linear run or to accurately compare peak values in a minimum of time.

A valuable feature incorporated in this system is precise maintenance of a 1:1 speed ratio between the paper being scanned and the recording chart, enabling the user to quickly compare the strip and chart for precise activity location upon completion of a run. Another time and labor saving feature provided in the 7200 Series instruments is automatic chart indication of origin, solvent fronts, and other areas of interest.

Your Packard Sales Engineer can provide complete details on these versatile new Scanning Systems.

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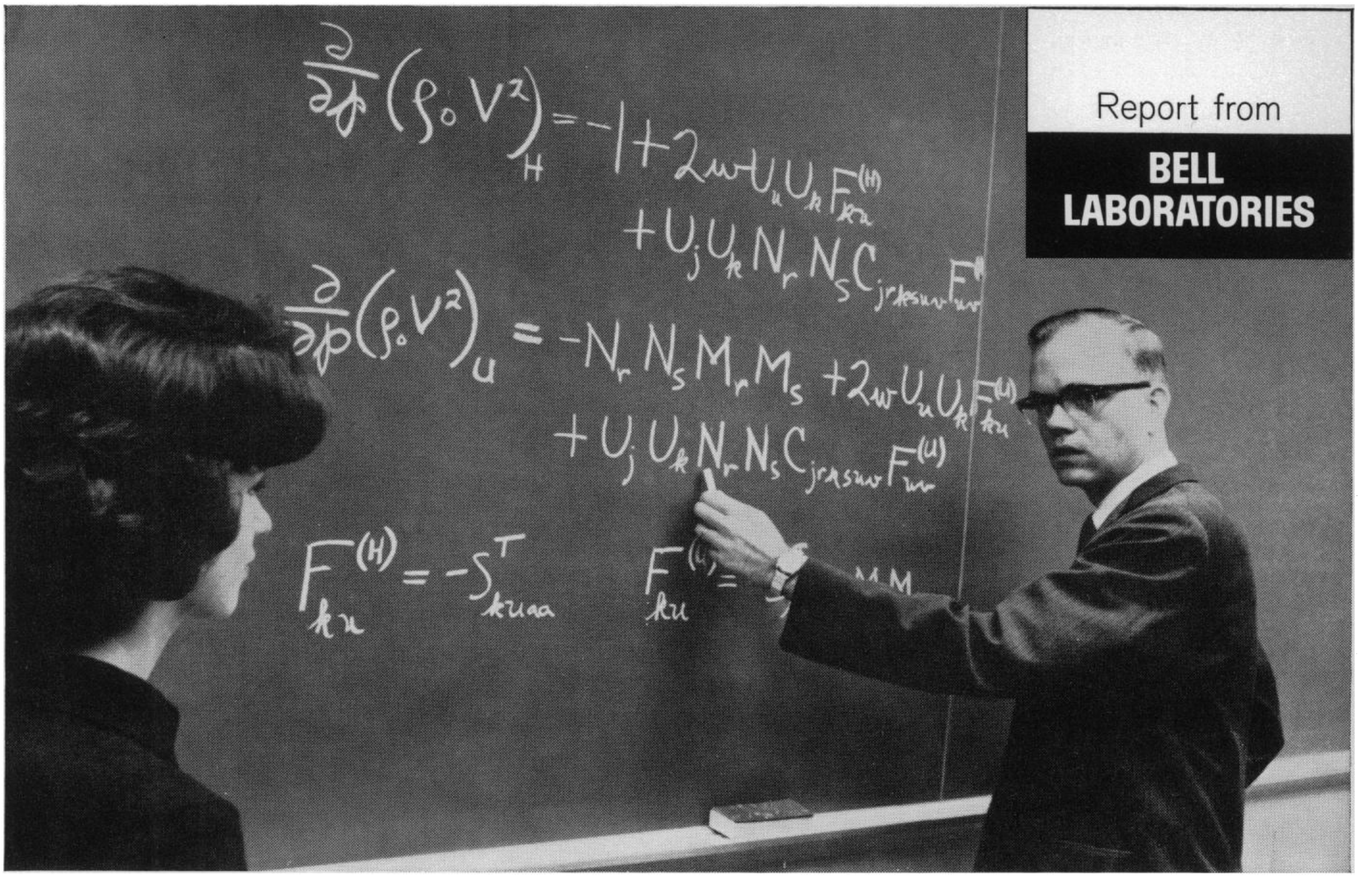

Mathematician W. S. Brown and program design trainee Mrs. L. A. Needham discuss an application of ALPAK programming to wave propagation in crystals under pressure.

ALGEBRA ON A DIGITAL COMPUTER

PHI(3,0)

NUMERATØR

	A 4	A 3	A 2	A 1	Q
−288	0	0	0	3	3
1152	0	0	0	3	4
−1896	0	0	0	3	5
1656	0	0	0	3	6
−816	0	0	0	3	7
−2	1	0	0	5	1
1	1	0	0	5	2

A portion of the printout from an ALPAK computation: each row represents a polynomial term consisting of a coefficient and five exponents; the variable names appear as column headings. The first term is thus $-288A_1^3Q^3$. *ALPAK can handle polynomials and rational functions in several variables, as well as truncated power series and systems of linear equations with rational-function coefficients.*

Much laborious manipulation of routine algebraic expressions can be eliminated by a computer programming system devised at Bell Laboratories. Called ALPAK (ALgebra PAcKage), the new system makes it possible to perform algebraic calculations on a digital computer at ten thousand times human speed.

Digital computers work with numbers, not algebraic symbols. But algebraic expressions include numbers as coefficients and exponents. For example, the term

$$3x^2y^4z^5$$

can be written in the form

3 2 4 5

where 3 is the coefficient and 2, 4, and 5 are, respectively, the exponents of x, y, and z. This numerical representation permits a computer to perform algebraic addition, subtraction, multiplication, division, substitution, and differentiation. The exponents and coefficients are reassociated with the variables at the output.

Unlike the human algebraist, the digital computer does not become weary and make mistakes. It can quickly carry to completion computations that hitherto seemed prohibitively long. For example, at the left is a printout of the result from a computation related to a telephone traffic problem. The problem involved 9 linear equations in 9 unknowns, with a total of over 800 terms. The computer running time was six minutes: the time required for a human mathematician to work the problem and check the answer would be approximately one year.

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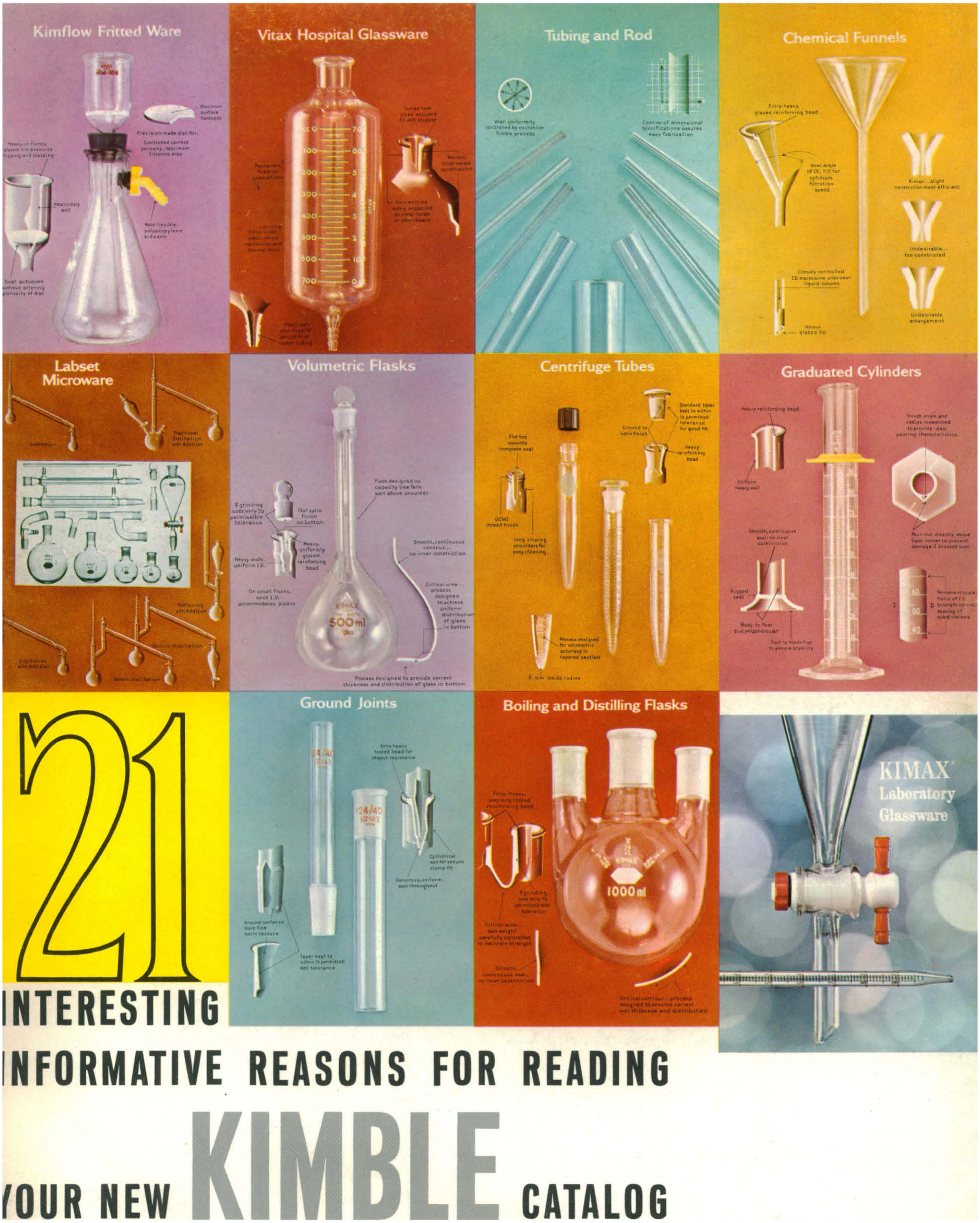
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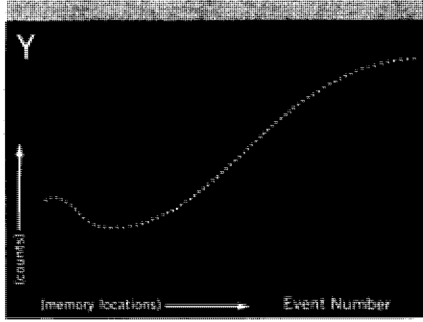
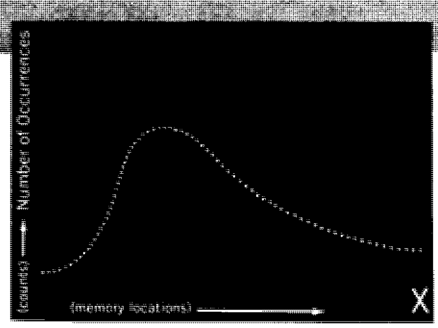
HISTOGRAMS — A technique for determining the statistical variability of input data. Now accomplished with integrated MNEMOTRON digital computer systems.





TYPICAL FIELDS OF APPLICATION

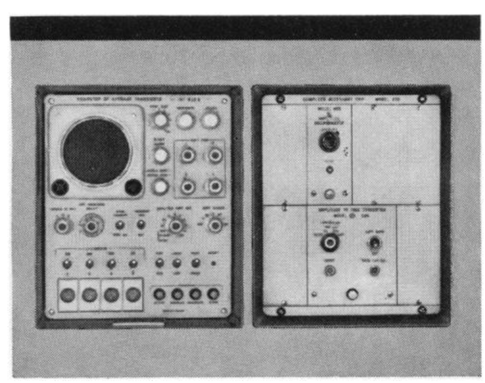
- **NEUROPHYSIOLOGY**
  Interspike intervals, action potential firing rates, amplitudes of nerve firings, etc.
- **CARDIOLOGY**
  R-R intervals, P-R-T amplitude distributions, etc.
- **ELECTROENCEPHALOGRAPHY**
  Amplitude distributions of evoked responses, latency distributions, wave intervals, etc.
- **BEHAVIORAL PSYCHOLOGY**
  Reaction time distributions, learning time curves, etc.
- **CELL BIOLOGY**
  Spontaneous firing rates, action potential amplitude distributions, etc.

Automated histograms permit detection and quantification of pattern changes over a complete range of information. The investigator need no longer limit himself to confined, and therefore biased, samples in order to be able to effectively interpret his data. Previously, interpretation required tedious, time-consuming manual processing of strip-chart or film records. However, recent advances in digital computer techniques now provide for on-line data reduction and immediate analysis of bioelectric phenomena. Thus, the researcher can quickly obtain statistical information in a condensed and easily comprehensible form.

Results may be represented in diverse forms of amplitude or time interval histograms. In the case of amplitude histograms, counts proportional to the amplitude of the input signal are deposited in a memory location — or, a count is deposited in a memory location whose number is proportional to the amplitude of the signal. In the case of time interval histograms, counts proportional to the time interval of the input signal are deposited in a memory location — or, a count is deposited in a memory location whose number is proportional to the signal time interval. Hence, the investigator is supplied with a distribution curve of the signal source and can easily determine preferential amplitudes or time intervals.

Variables reflected by X or Y may be:

- Time interval between successive events.
- Time latency of stimulated responses.
- Time that a signal dwells above a preset level.
- Time of occurrence of specific events after stimulation.
- Time duration of an event.
- Amplitude of successive events.
- Amplitude of signal at specific points in time.
- Amplitude of signal peaks.
- Amplitude of signal after fixed delay from stimulation.



Our application engineers are available for consultation concerning specific applications.

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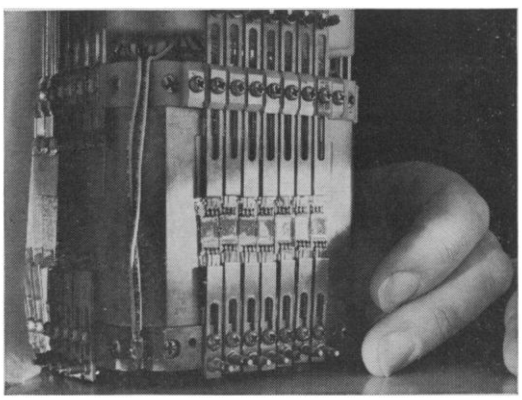
Other offices in principal cities throughout the world

A **Kodak** advertisement which recognizes that all are laymen, except in some small respect or other

For new highs in detectivity at the 4.3μ CO_2 band: Off-the-shelf KODAK EKTRON Detectors, Type E (which stands for evaporated PbSe), now hit 1 to 2 x 10^{10} cm/watt-sec$^{1/2}$ in D★ at 1500 cycles, whether at –196°C, –78°C, or as warm as –45°C. This degree of temperature independence is news. Send for pamphlet on KODAK EKTRON Detectors to Eastman Kodak Company, Apparatus and Optical Division, Rochester, N. Y. 14650. Those willing to pay a bit more than the prices quoted therein can have D★'s at 1500 cycles *higher* than 2 x 10^{10}. They might even reach 10^{11} if they will let us make them a sharp-cutting filter.

For a simplified explanation of "detectivity" and of what we're testing here:



By appropriate witchcraft entailing more than deposition of lead selenide on small rectangles of substrate, each rectangle becomes an EKTRON Detector if it passes a battery of tests. These measure how the PbSe changes electrical resistance in response to a change in radiant energy falling on it.

Of course, one doesn't just turn on the infrared the way one turns on the porch light. One thinks frequencies. One interrupts the infrared at a certain frequency and looks for this frequency of voltage fluctuation across the detector. Except that it generally has to be done up in the sky in some space vehicle, where one can't turn up the infrared source to make the signal plainer. One can't always be sure when the amplifier happens to hum at the right frequency that the infrared is doing it. There is always a certain amount of random electronic activity in the detector. The smaller the detector, the less this random activity gets averaged out and therefore the noisier it appears. On the other hand, the more power per unit area in the infrared signal, the better the signal stands out against the noise. The sharper the tuning to the frequency, the less noise will happen by chance to fall within the narrow frequency range.

This plodding line of thought leads to a definition of "detectivity" as "the signal-to-noise ratio at a given radiation wavelength and chopping frequency with an amplifier bandwidth of one cycle/sec for a photodetector of one square centimeter sensitive area when irradiated by one watt of flux." The brotherhood calls it D★.

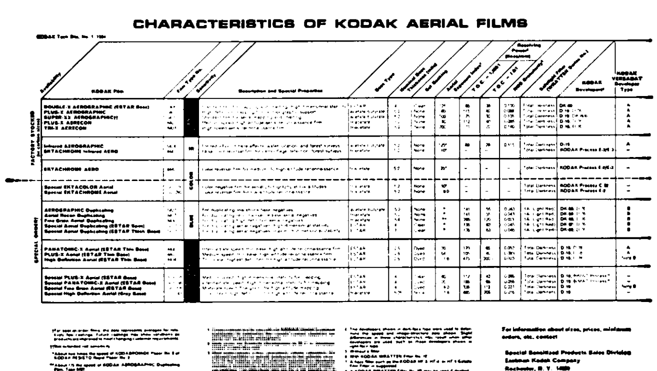
Unlike other lead selenide depositions we hear about, ours stay put even in the high vacuum of space or the evacuated chamber of the dewar that cools it. Among the various photoconductive substances that infraredmen have to juggle in their minds, lead selenide finds favor as the best compromise between high detectivity and relative independence of the interrupting frequency to rather high levels.

For fundamental studies of energy transfer in the living cell: To make the acetylpyridine analogs of DPN and TPN by enzymatic exchange reaction in pig-brain preparation, it is smart to order the 3-acetylpyridine from an EASTMAN Organic Chemicals distributor or from Distillation Products Industries, Rochester, N. Y. 14603 (Division of Eastman Kodak Company). Though we insist on calling it *Methyl 3-Pyridyl Ketone* (EASTMAN 9172), ours comes fractionally distilled in vacuum. The molecular biologist who recently persuaded us to make it and put it up that way says he likes it.

For idle curiosity about the self-image of molecular biologists: Despite days when a molecular biologist might well prefer to keep busy setting up an attractive-looking vacuum pump to purify a reagent than to sit preparing his mind for flashes of penetrating insight, it is best not to dwell on this.

A properly adjusted molecular biologist on a good day will aim his insights, for example, on the effects of replacing an $-NH_2$ group with a $-CH_3$ in diphosphopyridine nucleotide (DPN). Perhaps a glimmer of new light can be shed on how DPN or that other respiratory coenzyme, triphosphopyridine nucleotide (TPN), passes along electrons from one molecule to another at one of the long train of steps whereby a slice of apple pie and a chunk of porterhouse and some fresh air keep us alive to work another day.

For people who have to make decisions about aerial film: If you do not already have the information which a hand magnifier will reveal below, you and we have been communicating poorly. Hang on to that magnifier while you demand a full-sized version from Eastman Kodak Company, Special Sensitized Products Division, Rochester, N. Y. 14650.



For people who might make decisions from aerial film: Almost every issue of *Photogrammetric Engineering* published by the American Society of Photogrammetry, 44 Leesburg Pike, Falls Church, Va., contains new developments on the deployment of aerial film to "look down with wisdom" in the interests of sciences and useful arts of a peaceful nature. Anybody who has toyed with the thought that aerial photography might be of assistance should ask his librarian for a pile of this too little known periodical.

for a wide gamut of experimental problems. An interesting observation concerned the retention of a conditioned response despite repeated blocking of the cerebral circulation within 20 seconds after the conditioning trial.

Other speakers included C. Beyer (Mexico City), B. Grafstein (New York), P. Rudomin, J. Garcia Ramos (Mexico City), and S. P. Grossman (Iowa).

This symposium, the second in a series on neurobiology, is held alternately in Mexico and the United States. It was supported by a grant from the Office of Naval Research, U.S. Navy, and by local funds from the Neurological Sciences Foundation (Phoenix). Proceedings will be published soon as a special supplement of the *Boletin del Instituto de Estudios Médicos y Biológicos, México.*

E. Eidelberg
A. S. Schwartz, J. Harris
Barrow Neurological Institute of St. Joseph's Hospital, Phoenix, Arizona

Forthcoming Events

July

1–4. National Soc. of Professional **Engineers**, annual, Asheville, N.C. (K. E. Trombley, NSPE, 2029 K St., NW, Washington, D.C.)

1–4. British **Tuberculosis** Assoc., St. Andrews, Scotland. (BTA, 59 Portland Place, London, W.1, England)

2–3. **Spectrochemical Analysis**, limits of detection, conf., Exeter, England, Institute of Physics and the Physical Society, 47 Belgrave Sq., London, S.W.1, England)

2–4. Scandinavian, **Dental** Congr., Helsinki, Finland. (N. Anderson, Bergmansg. 11 D, Helsinki)

2–5. Northwest **Proctologic** Soc., Banff, Canada. (F. C. Swartzlander, Greyhound Bldg., Calgary, Canada)

2–8. **Nuclear Physics**, intern. congr., Paris, France. (The Congress, B.P. No. 14, Orsay, Seine-et-Oise, France)

5–10. American **Physical Therapy** Assoc., annual conf., Denver, Colo. (H. J. Hislop, 1790 Broadway, New York, N.Y.)

6–8. **Electron-Beam Processes** for Microelectronics, symp., Malvern, Worcester, England. (Information Officer, Royal Radar Establishment, St. Andrews Rd., Malvern)

6–9. **Learning and Associated Phenomena in Invertebrates**, Cambridge, England. (D. Davenport, Dept. of Biological Sciences, Univ. of California, Santa Barbara)

6–9. **Signal Processing** in Radar and Sonar Directional Systems, Birmingham, England. (British Institution of Radio Engineers, 9 Bedford Sq., London, W.C.1)

6–10. **Magnetic Recording**, intern conf., London, England. (Secretariat, the Conference, c/o Inst. of Electrical Engineers, Savoy Pl., London, W.C.2)

6–10. Theoretical and Applied **Mathematical Programming**, intern. symp., London, England. (M. Kinnaird, Operational Research Soc., 64 Cannon St., London, E.C.4)

6–10. Physics of **Non-crystalline Solids**, intern congr. Delft, Netherlands, (J. A. Prins, Lab. Technische Natuurkunde T.H. Delft)

6–11. **Magnetohydrodynamic Electrical Power** Production, Paris France. (European Nuclear Energy Agency, 38 Blvd. Suchet, Paris 16e)

6–12. **Sanitary Engineering**, 9th inter-American congr., Bogotá, Colombia. (J. A. Jove, Inter-American Assoc. of Sanitary Engineering, Centro Simón Bolívar, Edificio Sur, 6° piso, Caracas, Venezuela)

7–10. **American Dental Soc. of Europe**, annual, Brighton, England. (A. E. F. Sturridge, 35 Harley St., London, W.1, England)

7–11. European **Orthodontic** Soc., 40th congr., Athens, Greece. (H. N. Haralabakis, Akadimias St. 31, Athens 135)

8–10. **Sulfur Allotropes**, Univ. of California, Berkeley. (B. Meyer, Latimer Hall, Univ. of California, Berkeley)

8–11. International Soc. of **Gastroenterology**, 6th intern. congr., Medellin, Colombia. (J. L. A. Roth, 419 S. 19 St., Philadelphia, Pa.)

8–16. **Entomology**, 12th intern. congr., London, England. (P. Freeman, British Museum of Natural History, Cromwell Rd., London, S.W.7)

10–11. Rocky Mountain **Cancer** Conf., Denver, Colo. (N. P. Isbell, 1809 E. 18 Ave., Denver 80218)

10–15. **Pleistocene Geomorphology**, symp., Exeter, England. (T. H. Elkins, Royal Geographical Soc., Kensington Gore, London, S.W.7)

12–15. **Solid Propulsion**, NASA meeting, Philadelphia, Pa. (W. H. Hunter, Office of Program Development, Washington, D.C. 10025)

12–16. **Gastroenterology**, 9th Pan American congr., Bogotá, Colombia. (C. A. Estape, Soriano 877, Montevideo, Uruguay)

13–15. Problems of **Capillary Permeability** in Health and Disease, Univ. of Michigan 1964 summer symp., Ann Arbor, Mich. (M. M. Dewey, Dept. of Anatomy, Univ. of Michigan, Ann Arbor)

13–15. **Data Processing and Acquisition in Biology and Medicine**, conf., Rochester, N.Y. (K. Enslein, 42 East Ave., Rochester 14604)

13–17. **Canadian Teachers'** Federation, Lac Beauport, P.Q., Canada. (G. Nason, 444 MacLaren St., Ottawa, Ont., Canada)

13–17. Chemistry of **Carbohydrates**, intern. symp., Münster, Germany. (F. Micheel, Organisch-Chemisches Institut, Universität, Hindenburgplatz 55, Münster)

13–17. International Assoc. for **Child Psychiatry** and Allied Professions, London, England. (F. H. Stone, Royal Hospital for Sick Children, 70 University Ave., Glasgow, W.2 Scotland)

13–18. **Instrumental Analytical Chemistry**, 3rd annual symp., Bethlehem, Pa. (A. J. Diefenderfer, Dept. of Chemistry, Lehigh Univ., Bethlehem)

13–18. Latin Federation of **Medical Electro-Radiological Socs.**, 6th congr., Brussels, Belgium. (Secretariat, 256 Chaussee de Wavre, Heverle-Louvain, Belgium)

14–17. **Rarefied Gas Dynamics**, 4th intern. symp., Toronto, Ont., Canada. (G. N. Patterson, Inst. of Aerophysics, Univ. of Toronto, Toronto 5)

14–17. **Regional Science** Assoc., 4th congr., Ghent, Belgium. (W. Isard, Univ. of Pennsylvania, Philadelphia 19104)

14–17. **Western Resources** Conf., Boulder, Colo. (Bureau of Continuation Education, 352 Chemistry Bldg., Univ. of Colorado, Boulder)

14–19. **Sociology**, 7th Latin American congr., Bogotá, Colombia. (C. E. Angulo, Facultad de Sociologia, Universidad Nacional de Colombia, Bogotá)

15–19. **Pleistocene Geomorphology**, symp., Cambridge, England. (T. H. Elkins, Royal Geographical Soc., Kensington Gore, London, S.W.7, England)

16–24. **British Medical Assoc.**, annual, Manchester, England. (D. Gullick, BMA, Tavistock Sq., London, W.C.1, England)

16–24. **Organic Photochemistry**, intern. symp., Strasbourg, France. (G. S. Hammond, Gates and Crellin Laboratories of Chemistry, California Inst. of Technology, Pasadena)

18–22. International Union of **Biological Sciences**, 15th general, Prague, Czechoslovakia. (G. L. Stebbins, Dept. of Genetics, Univ. of California, Davis)

19–24. American **Veterinary Medical** Assoc., 101st annual, Chicago, Ill. (AVMA, 600 South Michigan Ave., Chicago 5)

19–25. **Polarography**, 3rd intern. congr., Southampton, England. (D. A. Pantony, Dept. of Metallurgy, Royal School of Mines, Prince Consort Rd., London, S.W.1, England)

19–26. Comparative **Endocrinology**, 4th intern. symp., Paris, France. (L. Gallien, Laboratoire d'Embryologie, Faculte des Sciences de Paris, 9 quai St.-Bernard, Paris 5e)

20–22. **Magnetic Resonance** in Biological Systems, Boston, Mass. (R. G. Shulman, Bell Telephone Laboratories, Murray Hill, N.J.)

20–23. New Mexico Acad. of **General Practice**, Ruidoso. (H. L. Douglas, Box 767, Tatum, N.M.)

20–24. International **Diabetes** Federation, 5th congr., Toronto, Ont., Canada. (H. Best, Organizing Council, 477 Mt. Pleasant Rd., Toronto 7)

20–24. **Nuclear Radiation** Effects, technical conf., Seattle, Wash. (Inst. of Electrical and Electronics Engineers, Box A, Lenox Hill Station, New York, N.Y.)

20–24. **Organic Reaction Mechanism**, intern. symp. Cork, Ireland. (General Secretary, Chemical Soc., Burlington House, London, W.1, England)

20–24. **Semiconductor Physics**, intern. conf., Paris, France. (M. Balkanski, Laboratoire de Physique, Ecole Normale Supérieure, 24, rue Lhomond, Paris 5e)

20–25. **Catalysis**, 3rd intern. conf., Amsterdam, Netherlands. (D. M. Brouwer, c/o Badhuisweg 3, P.O. Box 3003, Amsterdam-N, Netherlands)

21–23. Physiology and Experimental Psychology of **Color Vision**, Ciba Foundation symp., London, England. (Ciba Foundation, 41 Portland Pl., London, W.1)

21–24. American **Malacological** Union, New Orleans, La. (M. C. Teskey, Rt. 2, Box 318, Marinette, Wis.)