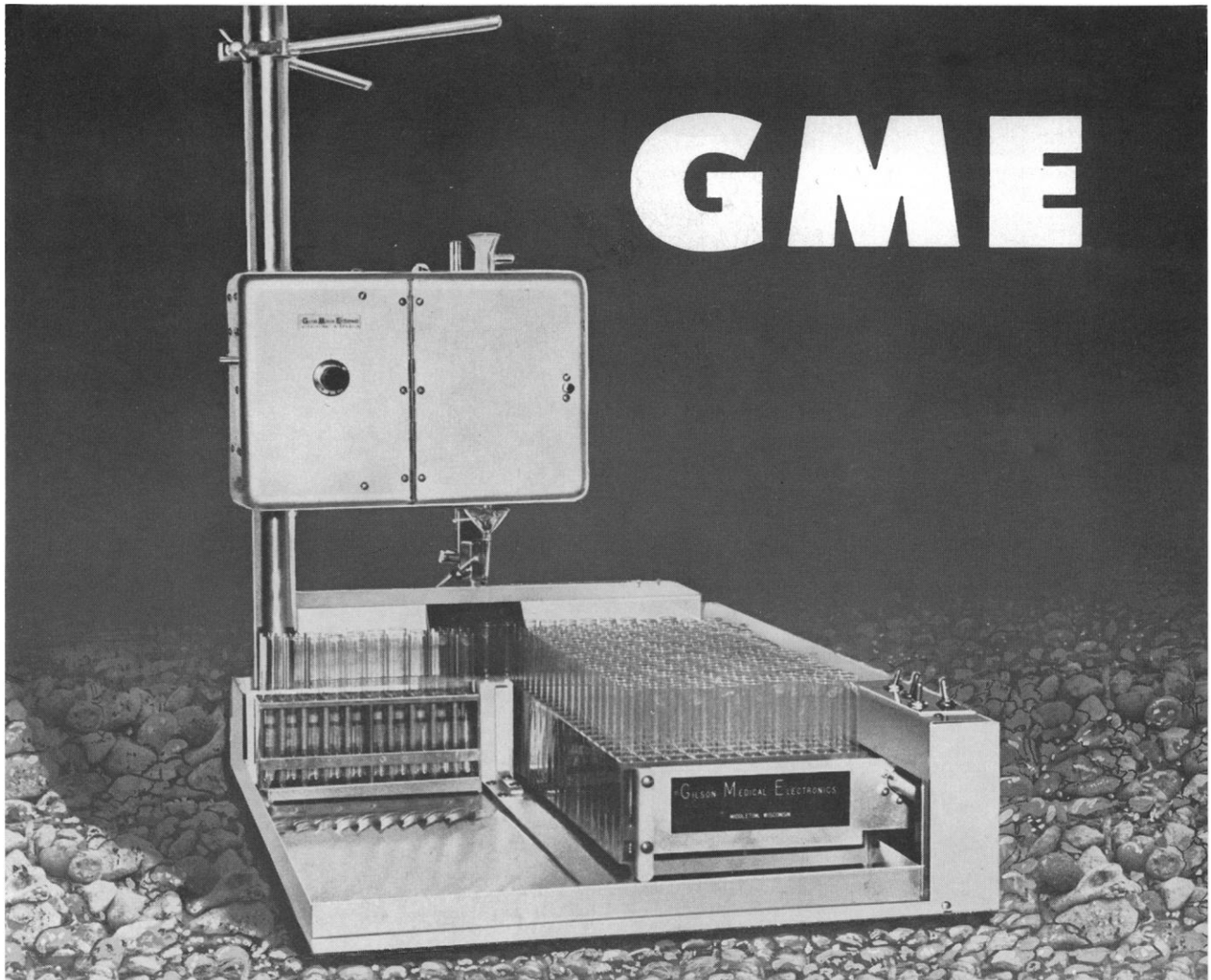
SCIENCE

9 December 1966
Vol. 154, No. 3754

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

FOSSIL BAT



TAKE OFF 10 FRACTIONS

as soon as they are collected, and 10 more, and 10 more, and 10 more ⟶ ∞. As long as empty test tubes in handsome red polypropylene racks (holding 10 each) are supplied on the right, the same may be removed from the left — with enclosed fractions, of course. Twenty (20) racks can be put in the apparatus for the period of unattended run. Write **GILSON MEDICAL ELECTRONICS,** Middleton, Wisconsin, for data on the

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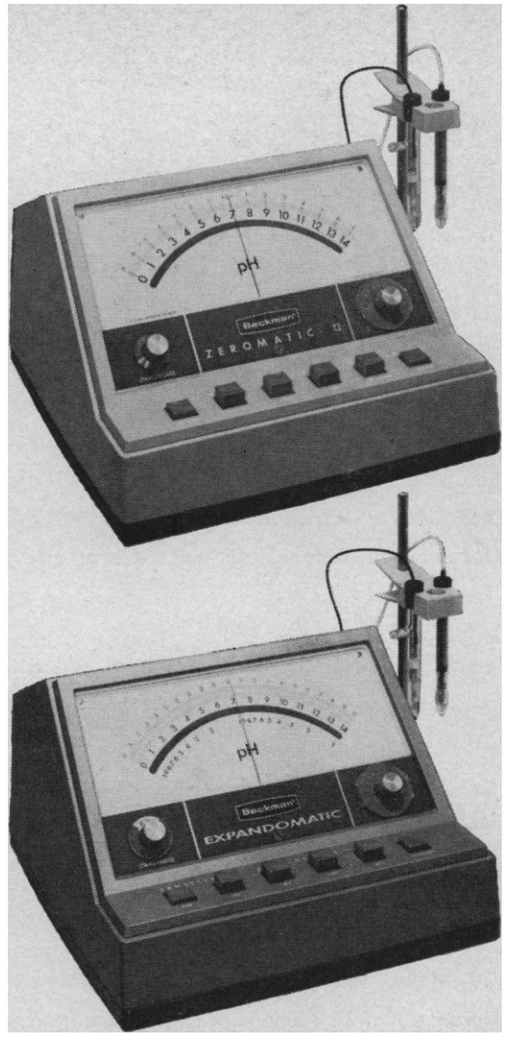

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Otherwise, these two pH meters have the same outstanding features: ±0.05 relative accuracy and ±0.015 repeatability over the full standard scale; an extra large, taut-band meter that is precise and highly readable; easy-to-use push button controls for convenient operation; a die-cast aluminum case resistant to chemicals; a continuously adjustable temperature network which covers the full 0 to 100°C temperature range; and a drift-free performance amplifier. Added to this is the unequalled background and back-up of Beckman sales and service, based on 31 years of experience in perfecting the technique of pH measurement.

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SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

he American Association for the Advancement of Science was founded in 1848 and incorporated in 874. Its objects are to further the work of scientists, to facilitate cooperation among them, to nprove the effectiveness of science in the promotion of human welfare, and to increase public under-tanding and appreciation of the importance and promise of the methods of science in human progress.

COVER

Skeleton of oldest known fossil bat, *Icaronycyeris index*, with shadowy, theoretical restoration of the wings and feet, extended as they might have been when the animal was flying in Early Eocene time 50 million years ago in Wyoming. Photograph of skeleton is not retouched, but picture of oil-shale matrix is extended by composite repetition of photos. Dorsal side, natural size. See page 1333. [Princeton University Museum of Natural History]

climate with the Lick 36-inch (91-centimeter) in the period 1900 to 1950 (before the 40-inch fell into relative disuse). There are a number of reasons for this. The 40-inch Yerkes refractor, at the time of its completion, was the world's largest telescope. Yerkes was operated as a research institution and not as a teaching institution and the staff astronomers were notably competent in making use of every non-cloudy hour. The directors of the Yerkes Observatory have been extraordinarily able astronomers with international reputations and a long record of important discoveries to their credit. There is little question, however, that the two most outstanding men in this highly selected list have been George Ellery Hale and Otto Struve. In each case, these gifted and far-seeing men established other observatories in good climates, and with revolutionary effects on American astronomy.

JOHN B. IRWIN

Carnegie Institution of Washington, Casilla 61-D, La Serena, Chile

Why Not a Draft For Applied Research?

There are several reasons for supporting a special draft for young scientists, a draft in which each physical and behavioral scientist would serve for a 3-year period in a laboratory engaged in applied research. This period should begin 2 or 3 years after he obtains his final degree so that he would have enough training under his belt to make a useful contribution likely, while being young enough to be openminded, productive, and not yet fixed in a major position.

1) Such a draft would give a great impetus to a branch of research that is shunned by many scientists, yet which needs attention desperately. The problems of cancer, atherosclerosis, mental disease, dentistry, prosthesis, population control, crime, poverty, and pollution need much more than the lip service and wistful glances of the basic research scientists. Efforts by the Public Health Service to attract scientists to work actively, rather than peripherally, in such fields have been quite disappointing.

2) Such a draft would divert the strong currents now building up to draft science students from college without consideration of their future contributions to the country. An indiscriminate lottery draft for the armed forces would create far more havoc in scientific progress than my proposed "applied science draft." As it is, the present system of threatening the students in the lower segment of each college class is highly demoralizing.

Is such a scientist draft practical? Can scientists with a basic trend of mind be induced to serve their term enthusiastically? Obviously goofing off in a research laboratory for 3 years is easily done—some do this all their lives! Others will say that there simply are not enough sensible ideas around for productive research in the applied fields. This guess can be countered by pointing to the enormously productive diversion of basic scientists during World War II, when thousands of such scientists entered the applied fields of weapons, antibiotics, and war systems research.

Where would our young scientists serve their term? There are many laboratories in and near hospitals where ties could be set up between clinicians and applied scientists. The President's program for setting up huge applied health centers would fit in perfectly with this scheme. Funds from federal poverty programs could be used for the social scientists. As it is, such funds are crying for want of use and direction by such people. Many laboratories are currently in the applied, publicly-supported research field and could absorb many "draftees."

Is such a draft inequitable or impractical? No doubt it is inequitable, like all systems and life itself, but it doesn't strike me as an extreme hardship. Of course there are borderline problems where one would question whether a draftee could contribute enough to make the project worthwhile. Or questions as to whether a given research project is basic or applied. And there is the possibility that a potential scientist would study English literature instead, and thereby avoid both the military and scientific drafts. These problems do not seem too serious. No enterprise can be operated without people and boards to make decisions and rules. Isn't it time that the basic scientists stopped wishing for practical spin off from their work? I think they all know that their ivory towers are being assailed by forces which they can and must fight.

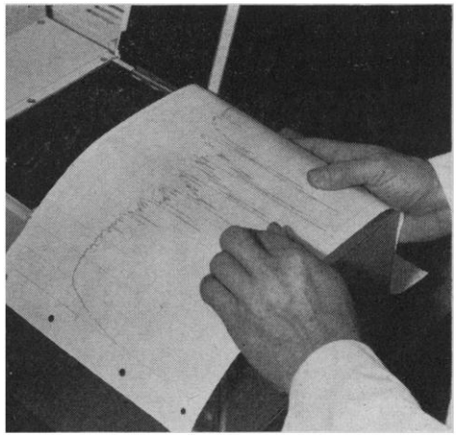
NORMAN S. RADIN

Mental Health Research Institute, University of Michigan, Ann Arbor 48104

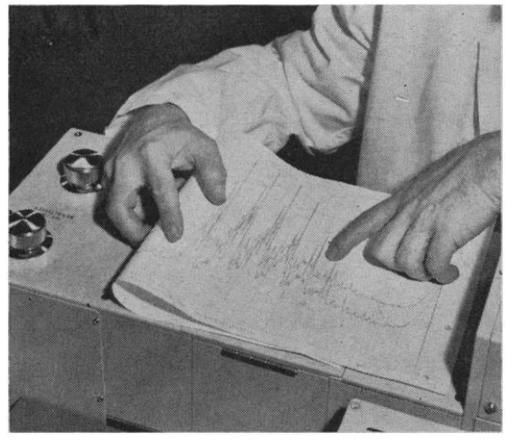
New Coleman UV-VIS-NIR spectrophotometer. So good, we'll let its charts do the talking.

New Coleman Model EPS-3T Hitachi Spectrophotometer is the first all-solid-state instrument of its kind. It's a double-beam, ratio-recording instrument that yields sophisticated data throughout the 170 to 2600 mμ range. It has 12 features not found on any other spectrophotometer under $10,000.

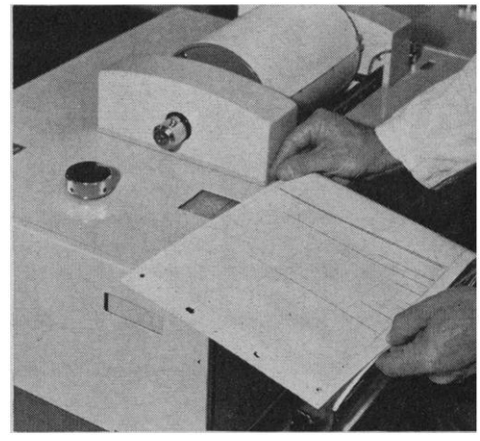
Here are some examples of its work:



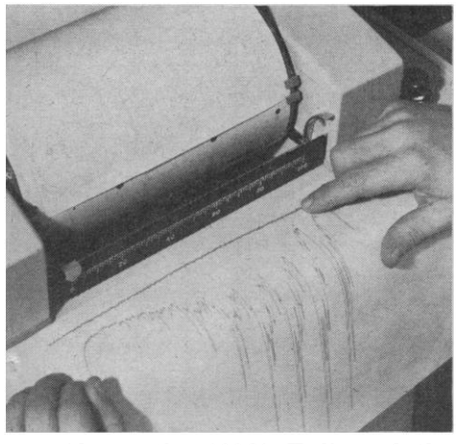
The chart above shows the remarkable resolution of Coleman Model EPS-3T. Critical adjacent peaks on the complex benzene vapor profile are clearly delineated.



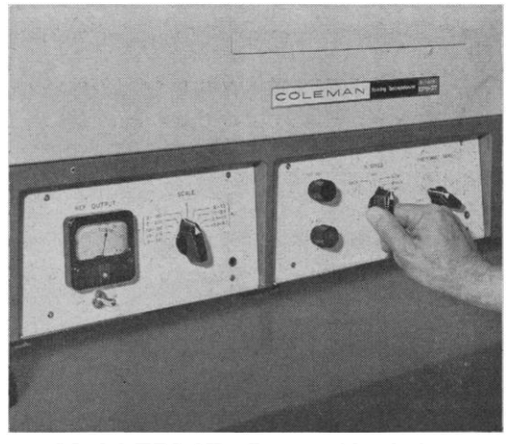
To demonstrate repeatability, the instrument overprints the same chart from the same sample. Note that chart presentations are all linear, not logarithmic.



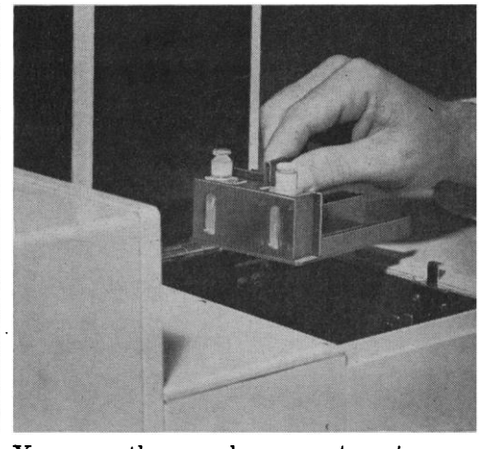
A significant mercury spike, perfectly centered at 253.7 mμ. Wavelength accuracy is not affected by changes in ambient temperature. Photometric accuracy is 0.3%T.



Above, the 100% T line of the Coleman Model EPS-3T at maximum sensitivity. The line is demonstrably flatter than that of any similar spectrophotometer.



Model EPS-3T offers a wide choice of operating parameters. Nine scale modes. Six scanning rates, from 1.5 to 60 minutes. Any member of your staff can easily operate it.



You open the sample compartment and insert cells without touching any of the controls. With this safety shuttering feature, you leave operating parameters set, while you run test, after test, after test.

Sorry, there's no room left for a picture of Model EPS-3T. But we've saved this, and a number of other pleasant surprises for you. Call Coleman for the name of the nearest dealer and a demonstration.

Brochure SB-306

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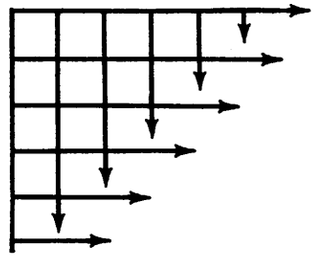

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on 18¼" x 22½" sheets of filter paper (Chromatography may be done in second dimension). Many complex mixtures can be rapidly resolved by electrophoresis in one dimension on papers up to 4 feet long.

Developed in the Laboratory of Cellular Physiology and Metabolism, National Heart Institute, National Institutes of Health, Bethesda, Maryland. Special thanks are due to Dr. William J. Dreyer, whose co-operation and suggestions are gratefully acknowledged by Gilson Medical Electronics.

- ★ Easy loading with folding rack
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★ **Safety features:**

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SCIENCE

Choosing Graduate Fellows

Since 1952, 18,000 fellowships have been awarded under the National Science Foundation's Graduate Fellowship Program (and another 8000 under the Cooperative Fellowship Program). As many scientists know from participating in the selection process, the Office of Scientific Personnel of the National Academy of Sciences–National Research Council annually convenes panels of scientists who review the applicants' test scores and college grades and the ratings and information supplied by faculty members or other sponsors. The panels sort the applicants into several quality groups, and the NSF then awards fellowships, going down the quality ladder as far as available funds allow. How well has this process worked? Lindsey R. Harmon has recently answered that question in a summary* of 14 years of study and review of the process of selection, the predictive value of various kinds of information concerning candidates, and the results of the whole effort.

Analysis of the panelists' ratings indicates that they have made their judgments with satisfactory reliability and have been consistent over the years in the bases used in judging candidates. A related finding was that panelists are not biased in rating candidates in scientific fields other than their own. Applicants appeared to be neither helped nor hurt by having interests close to or remote from the center of interest of the panel which evaluated their applications.

Performance in graduate school provides one means of validating the selection process, but it is later performance as scientists that provides the more interesting measure of the effectiveness of selection. The awardees have done better in graduate school than the nonawardees; on the average, they received their doctorates more than a year earlier. About 4 months of this difference can be attributed to their superior ability, and about 7 months to the fellowship itself—or to the fellowship plus abilities not measured in the selection process.

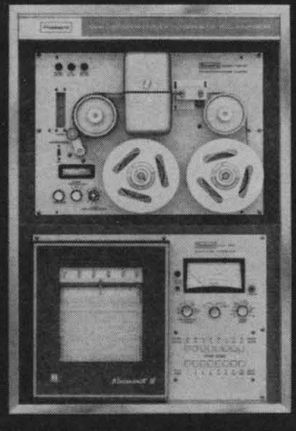
After completing graduate school the awardees continued to do better than the nonawardees, but the validity correlations were substantially lower. The difficulty comes largely from the lack of reliable measures of successful scientific work. Positions, opportunities, and types of work differ. Work judged at one time may seem of greater or less importance than it will later. Nevertheless, modest but encouraging correlations were obtained between the judgments of the selection panels and the composite of a variety of measures and judgments of the effectiveness of the awardees as young scientists several years later.

It is also possible to judge the effectiveness of the selection by asking what would have happened if fellowships had been awarded by lot to a random group of applicants. The recipients would have done substantially better than the average graduate student, for even the nonawardees were a select group; the competition for NSF fellowships is known to be keen, and that fact deters many who might have applied. Nevertheless, those actually selected outperformed the hypothetical random group. The selection process has worked.

Perhaps the predictions could be improved if satisfactory measures of creativity or other variables that are thought to be important could be developed. With present methods, however, it does not seem likely that the validity of selection can be increased much. The hundreds of scientists who have reviewed some 70,000 applications for graduate fellowships (plus some 30,000 applications for cooperative fellowships) can take satisfaction in having done a good job.—DAEL WOLFLE

* *Fourteen Years of Research on Fellowships Selection*, National Academy of Sciences–National Research Council, Washington, D.C., 1966. $1.50.

EVERY PACKARD RADIOCHROMATOGRAM SCANNER COUNTS PAPER STRIPS AND TLC PLATES



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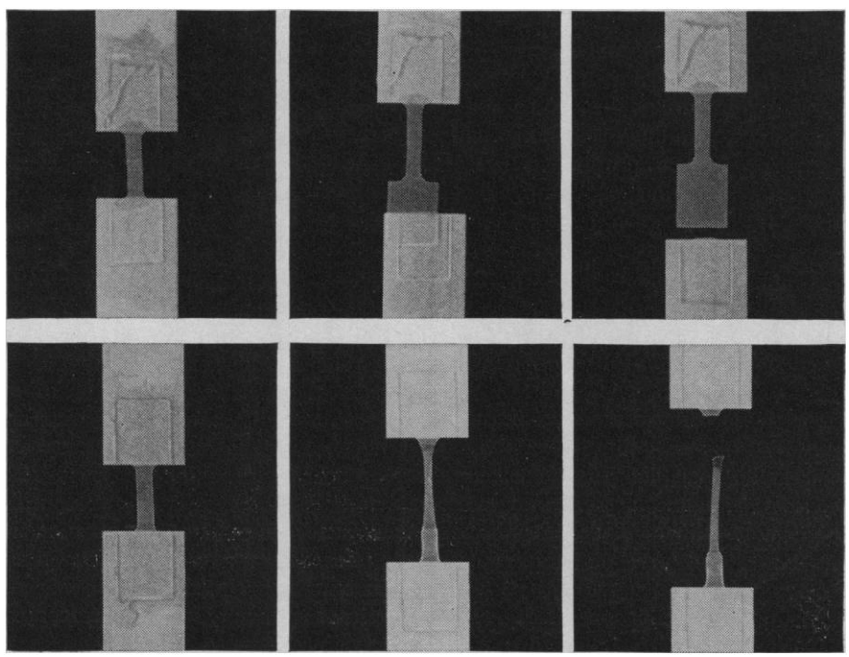
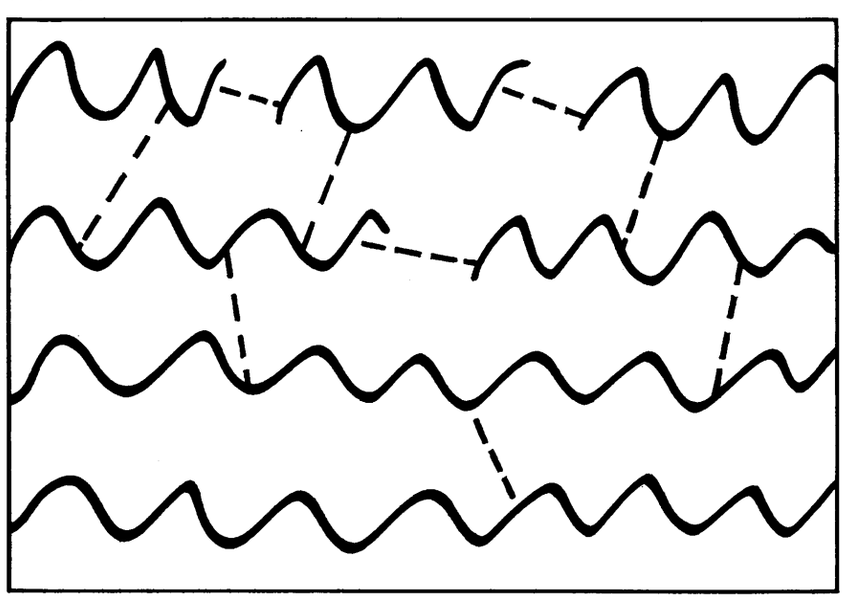
Report from

BELL LABORATORIES

On joining "non-stick" plastics



Untreated polyethylene sample (top three photos) and CASING-treated sample (bottom three photos) joined to metal plates. As tension is applied, left to right, untreated sample quickly pulls away from lower piece of metal. With treated sample, however, polyethylene-metal joints hold as plastic stretches and breaks.



Simplified cross-section shows relatively short molecules at surface of a plastic (wavy lines at top in drawing) and longer molecules underneath. CASING process strengthens surface layers by cross-linking (dashed lines), forming tough surface "skin."

Two Bell Telephone Laboratories scientists have found a way to greatly improve the joint strength between ordinary adhesives or printing inks and PTFE (polytetrafluoroethylene), polyethylene, and certain other plastics. The process is a safe, fast, and inexpensive surface treatment for these plastics . . . one which does not affect the tendency for them to be wet by liquids, and which permits the formation of strong joints without melting the plastics. Also, it does not change their unique bulk chemical, physical, or electrical properties.

The difficulty with such plastics has been the tendency of relatively short polymer molecules to collect near the surface. This results in a weak layer that cannot produce a strong joint. The answer is to strengthen this region. In the new process, this is done by exposing the plastics to a flow of electrically excited inert gases. The gases remove some hydrogen or fluorine atoms from molecules near the surface, which thus become polymer radicals. The chemically reactive sites in these radicals combine, by cross-linking, to form a strong surface layer.

With this new method, conventional epoxies will adhere to such surfaces on PTFE with up to 1500 psi tensile shear strength; for polyethylene the figure is 3500 psi. These strengths are about ten times those of untreated plastics.

The inventors, R. H. Hansen and H. Schonhorn, call this process CASING (cross-linking by activated species of inert gases).

Bell Telephone Laboratories
Research and Development Unit of the Bell System

of potential areas where the heated thermocouple may be used.

The two classical views of the control of the salivary circulation are that of Claude Bernard, Bayliss, and Dale, on the one hand, who believed in parasympathetic vasodilator nerves; and of Barcroft, who contended that metabolic intermediaries were responsible for a functional hyperemia. Two contemporary antagonists who presented opposing views in paired essays were Melville Schachter (University of Alberta) and Graham Lewis (Ciba Laboratories, England). Schachter gave his evidence for a cholinergic mediation of vasodilation in the salivary glands, and the results of his recent work which raised serious question about the existence of a functioning dilator mechanism involving the kallikrein-bradykinin mechanism. In the companion essay by Lewis, the evidence was put forth to support the metabolic dilator hypothesis in the salivary glands involving the plasma kinins.

A preparation for measuring blood flow to the stomach in the conscious animal with simultaneous determination of gastric secretory activity was described by Jacobson, Swan, and Grossman. The results of their studies indicated a complex relationship between secretion and blood flow in the stomach. Eugene Grim suggested some of the methodological limitations inherent in the study.

Björn Folkow (Göteborg, Sweden) presented some of the recent work from his laboratory and several novel concepts relating to the circulation of the gut which his group has developed, including autoregulatory escape, the physiological redistribution of blood flow within the wall of the intestine, and the countercurrent exchange mechanism in the gut. Benjamin Zweifach raised questions about the countercurrent hypothesis based upon structural considerations of the microcirculation.

The concept that variations in arteriolar dimensions depend upon changes in blood flow, whereas precapillary sphincters appear to be influenced by intravascular pressure changes was presented by Paul Johnson (Indiana University). This view appeared to be a compromise between the so-called metabolic and myogenic explanations of autoregulation. The discussant, Lerner Hinshaw, in discussing this new view, objected to Johnson's critical experiment, namely, the

elevation of venous outflow resistance in order to vary intravascular pressure and blood flow in opposite directions.

Francis Haddy and his colleagues (Michigan State University) considered the role played by visceral smooth muscle in the intestinal vascular responses to a variety of naturally-occurring vasoactive agents. This muscle factor in the wall can be used to explain otherwise puzzling findings in the intestinal circulation. Harold Green expanded the consideration of hemodynamic responses to the naturally-occurring agents.

Jacob Fine (Harvard) set forth his concept of the pathogenesis of irreversible shock: the stress of shock prompts sympathetic nervous hyperactivity which results in splanchnic ischemia; prolongation of this inadequate perfusion of the gut and abdominal reticulo-endothelial system permits a state of endotoxemia. This combination of factors pushes the shocked animal into irreversibility. Hiroshi Kuida criticized certain aspects of this hypothesis in the discussion paper.

Detailed studies of the circulatory events in canine endotoxic shock in which events in various segments of the splanchnic circulation lead to characteristic systemic circulatory effects were described by Fuad Bashour. A companion paper by Richard Lillehei covered added conceptual material and stressed a unitary view of the hemodynamics of many shock states.

Proceedings of this conference will be published as a special supplement in the journal *Gastroenterology*. The symposium was sponsored by the department of physiology of the UCLA School of Medicine and was supported by a grant awarded by the National Heart Institute (HE 10561-01).

EUGENE D. JACOBSON
Department of Physiology, University of Oklahoma Medical Center, Oklahoma City 73104

Forthcoming Events

January

2–6. **Endocrinology**, 3rd Asia and Oceania congr., Manila, Philippines. (L. S. Villadolid, Dept. of Medicine, College of Medicine, Univ. of the Philippines, Herran, Manila)

3–7. **Chemistry**, 4th Caribbean symp., Univ. of the West Indies, Mona, Kingston, Jamaica. (W. R. Chan, Chemistry

Dept., Univ. of the West Indies, Mona, Kingston 7)

4–5. Society for **General Microbiology**, 48th general mtg., London, England. (The Society, c/o Soc. for Visiting Scientists, 19 Albermarle St., London W.1)

4–7. National Soc. of Professional **Engineers**, winter mtg., San Juan, P.R. (The Society, 2029 K St., NW, Washington, D.C. 20006)

4–7. **Solid State Physics**, conf., Manchester, England. (Inst. of Physics and the Physical Soc., 47 Belgrave Sq., London S.W.1)

5–6. **Rheology and Texture of Foodstuffs**, symp., London, England. (P. Sherman, Unilever Research Laboratory, Welwyn, Herts., England)

9–10. **Industrial Research**, 2nd natl. conf., Purdue Univ., West Lafayette, Ind. (W. E. Spaulding, Krannert Graduate School of Industrial Administration, Purdue Univ., West Lafayette)

9–11. Electrical and Electronic **Measurement and Test Instruments**, conf., Ottawa, Ontario, Canada. ("EEMTIC '67," Box 6015, Postal Station J, Ottawa 13)

9–14. American **Library** Assoc., mtg., New Orleans, La. (D. H. Clift, The Association, 50 E. Huron St., Chicago, Ill. 66011)

9–18. **Spectroscopy**, intern. conf., Bombay, India. (Organizing Committee, Spectroscopy Div., Atomic Energy Establishment, 414 A Cadell Rd., Bombay 28)

10–12. **Reliability**, annual symp., Inst. of Electrical and Electronics Engineers, Washington, D.C. (IEEE, 345 E. 47 St., New York 10017)

10–13. Physics of **Quiescent Plasmas**, conf., Rome, Italy. (Quiescent Plasmas, Laboratorio Gas Ionizzati, EURATOM-C.N.E.N., C. P. 65, Frascati, Rome, Italy)

11–13. **Surface Chemistry**, 3rd Scandinavian symp., Fredensborg, Denmark. (Nordforsk, Ørnevej 30, Copenhagen NV)

12–14. Evaluation of Agents Used in Prevention of **Oral Diseases**, conf., New York Acad. of Sciences, New York. (J. Hein, Forsythe Dental Center, 140 Fenway, Boston, Mass. 02215)

13–14. **Orthopaedic Research** Soc., mtg., San Francisco, Calif. (R. A. Calandruccio, 869 Madison Ave., Memphis, Tenn.)

13–14. American Soc. for **Surgery of the Hand**, San Francisco, Calif. (R. M. Curtis, 2947 St. Paul St., Baltimore, Md. 21218)

14–19. American Acad. of **Orthopedic Surgeons**, San Francisco, Calif. (J. K. Hart, 29 E. Madison St., Chicago, Ill.)

16–18. **Compressed Gas** Assoc., annual mtg., New York, N.Y. (The Association, 500 Fifth Ave., New York 10036)

16–20. **Australian and New Zealand** Assoc. for the Advancement of Science, 39th congr., Melbourne, Australia. (W. W. Fee, The Association, Dept. of Chemistry, Univ. of Melbourne, Parkville, N.2, Australia)

16–20. **Highway Research** Board, NAS–NRC, 46th annual mtg., Washington, D.C. (E. W. Harris, 2101 Constitution Ave., NW, Washington, D.C. 20418)

16–21. Atomic, Molecular, and Solid State **Physics**, symp., Gainesville, Fla. (P.-O. Löwdin, Quantum Theory Project, Nuclear Sciences Bldg., Univ. of Florida, Gainesville 32601)

16–21. Recent Advances in **Tropical Ecology**, symp., Varanasi, India. (R. Misra, Intern. Soc. for Tropical Ecology, Dept. of Botany, Banaras Hindu Univ., Varanasi 5)

16–27. Low Energy **Nuclear Physics**, intern. seminar, Dacca, Pakistan. (A. M. Harunar Rashid, Atomic Energy Center, P.O.B. 164 RAMNA, Dacca)

16–31. **Ocean Science**, 5th Pan Indian congr., Bangkok, Thailand. (P. Cheosakul, Natl. Research Council, Bangkhen, Bangkok)

17–18. **Engineering** Socs. and Their **Literature Programs**, symp., Engineers Joint Council, New York. (EJC, 345 E. 47 St., New York 10017)

17–18. **Simulation** in Medicine and Biology, symp., Central and Midwestern States Simulation Council, Mayo Clinic, Rochester, Minn. (J. B. Bassingthwaighte, Dept. of Physiology, Mayo Clinic, Rochester 55902)

18–20. **Oil and Water**, symp., Brighton, England. (Inst. of Petroleum, 61 New Cavendish St., London W.1)

18–21. **Conformation of Biopolymers**, intern. symp., Madras, India. (C. Ramakrishnan, Centre of Advanced Study in Biophysics, Univ. of Madras, A.C. College Bldgs., Madras 25)

18–22. **Parasitology**, 1st Latin American congr., Santiago, Chile. (R. Donckaster, Dept. of Parasitology, Univ. of Chile, Santiago)

20–21. **Blood**, 15th symp., Wayne State Univ., Detroit, Mich. (W. H. Seegers, Dept. of Physiology, Wayne State Univ. School of Medicine, Detroit 48207)

20–2. International College of **Surgeons**, 3rd Caribbean surgical congr. and cruise. (S. E. Henwood, 1516 Lake Shore Dr., Chicago, Ill. 60610)

22–3. **Electron Microscopy**, workshop, Northeastern Univ., Boston, Mass. (M. D. Maser, Millard Fillmore Hospital, 3 Gates Circle, Buffalo, N.Y. 14209)

23–24. **Avionics**, symp., Montreal, Canada. (Secretary, Canadian Aeronautics and Space Inst., 77 Metcalfe St., Ottawa, Ont.)

23–24. **Coupled Reactor Kinetics**, natl. mtg., Texas A&M Univ., College Station. (C. G. Chezem, Dept. of Nuclear Engineering, Texas A&M Univ., College Station 77843)

23–25. **Aerospace Science**, 5th mtg., American Inst. of Aeronautics and Astronautics, New York, N.Y. (Manager of Public Information, AIAA, 1290 Sixth Ave., New York 10019)

23–25. Society of **Thoracic Surgeons**, mtg., Kansas City, Mo. (F. X. Byron, The Society, City of Hope Medical Center, 1500 E. Duarte Rd., Duarte, Calif. 91010)

23–27. **Relativistic Astrophysics**, symp., New York, N.Y. (A. G. W. Cameron, Belfer Graduate School of Science, Yeshiva Univ., New York 10033)

24–27. **Comparative Pharmacology**, intern. symp., Natl. Inst. of Health, Bethesda, Md. (G. J. Cosmides, Room 5B29, Bldg. 31, NIH, Bethesda 20014)

25–27. American **Crystallographic** Assoc., mtg., Georgia Inst. of Technology, Atlanta. (W. L. Kehl, Gulf Research and Development Co., P.O. Drawer 2038, Pittsburgh, Pa. 15230)