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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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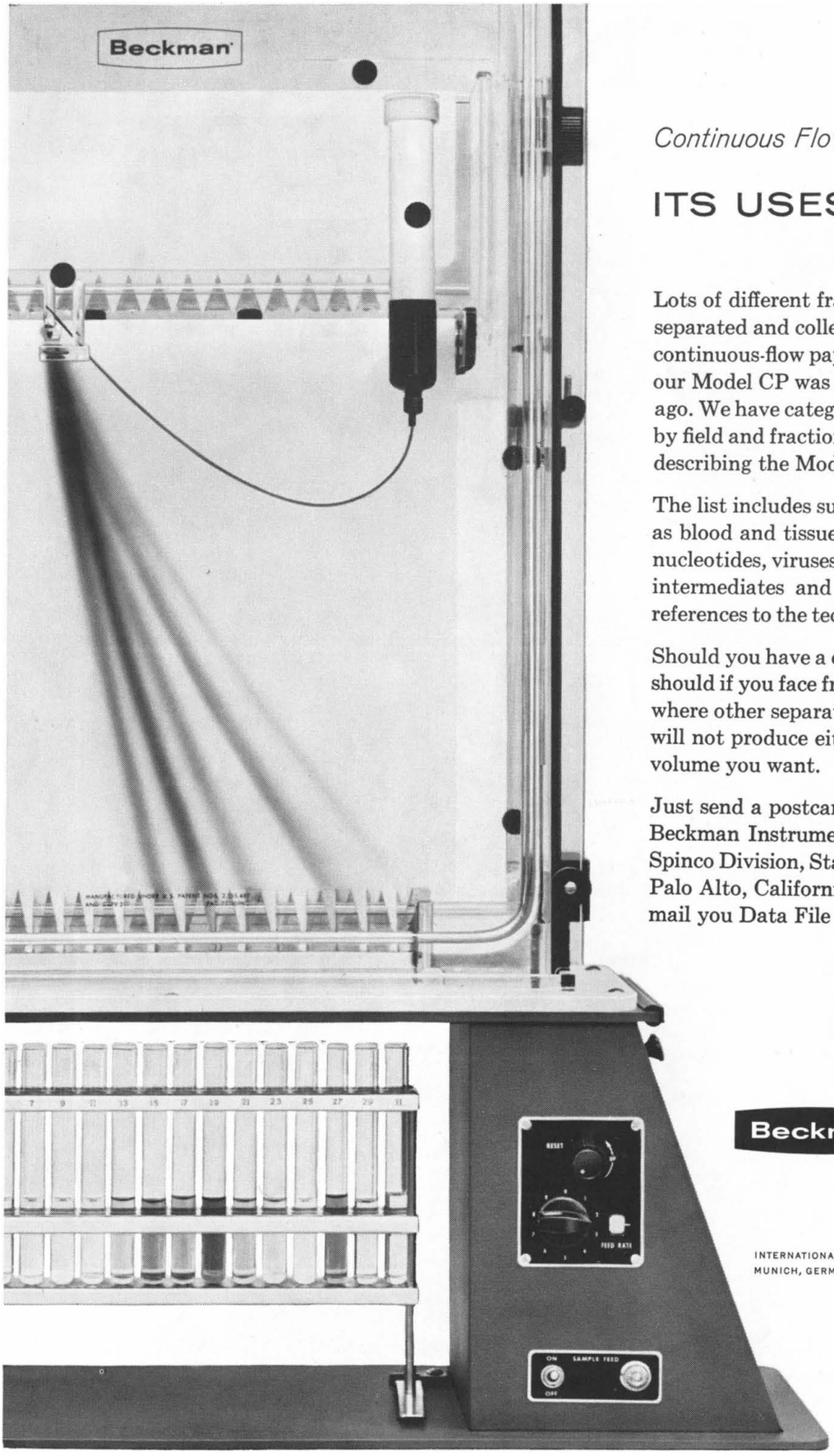

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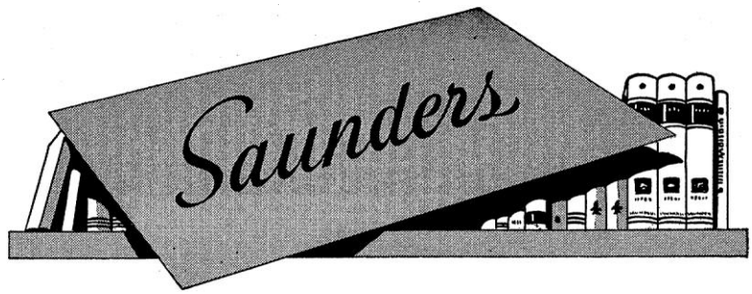

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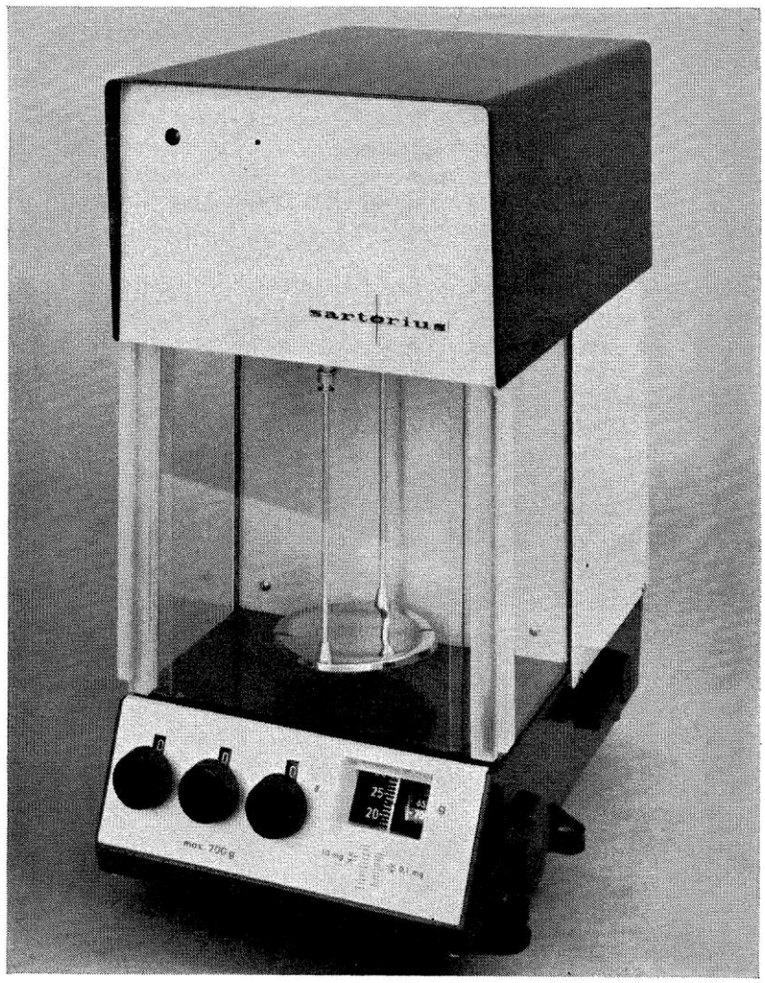

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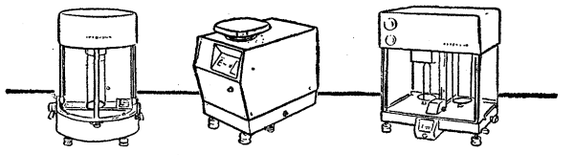

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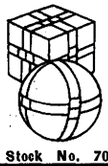

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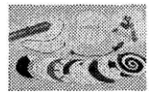

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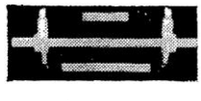

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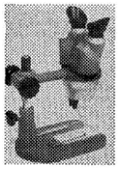

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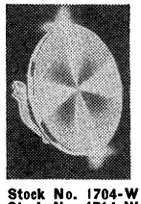

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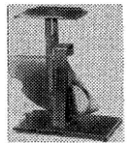

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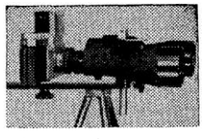

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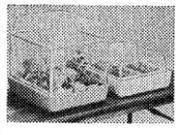

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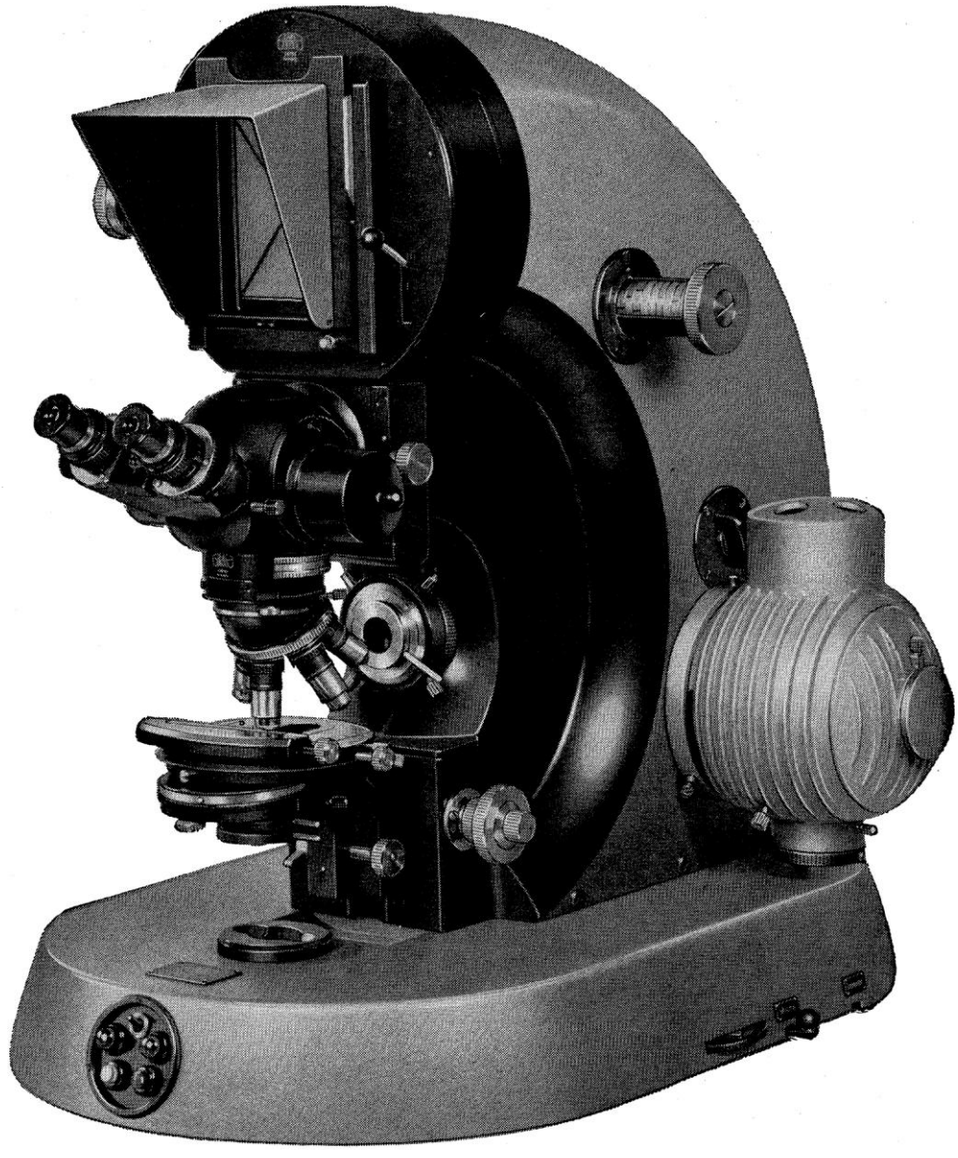

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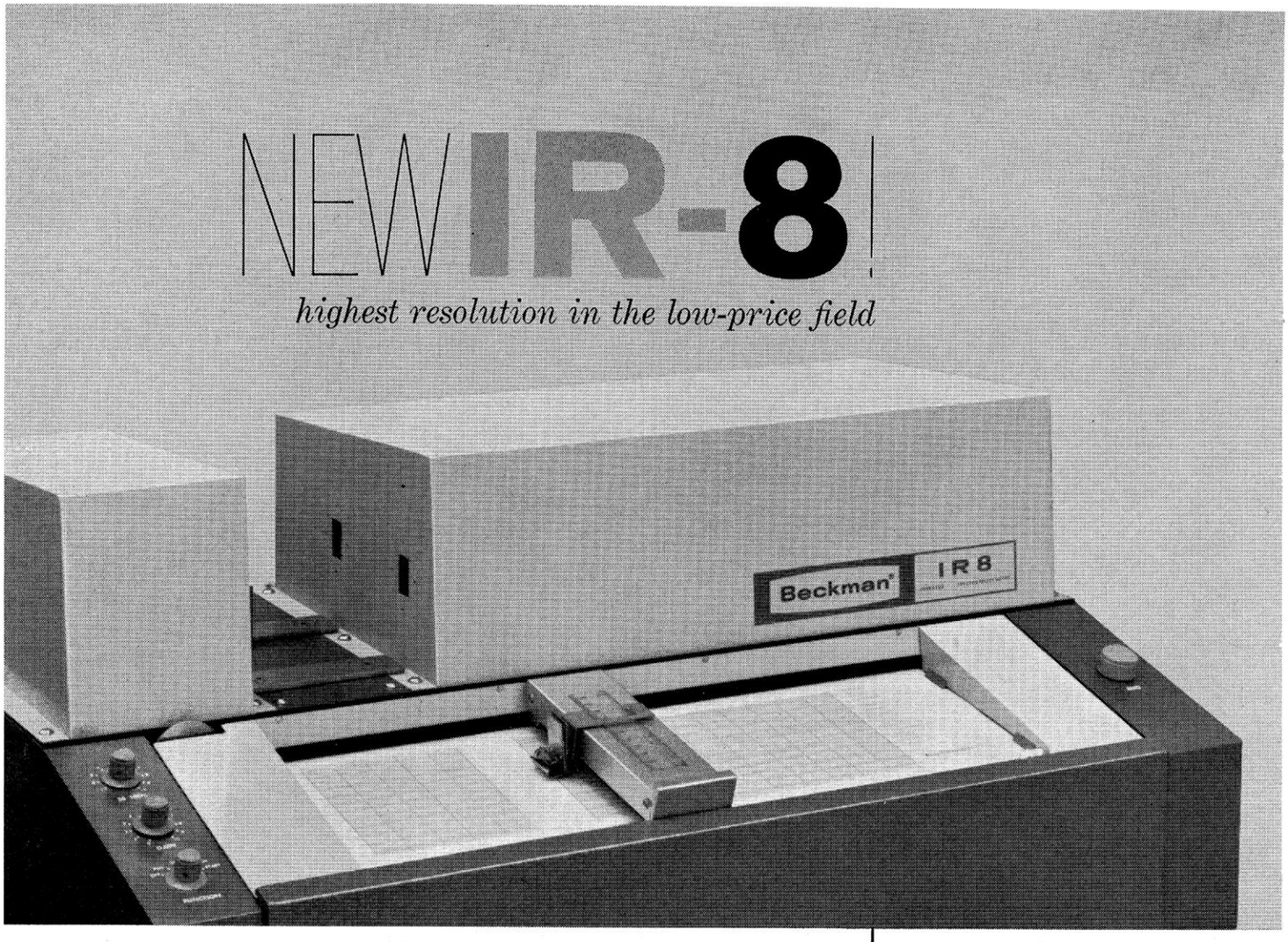
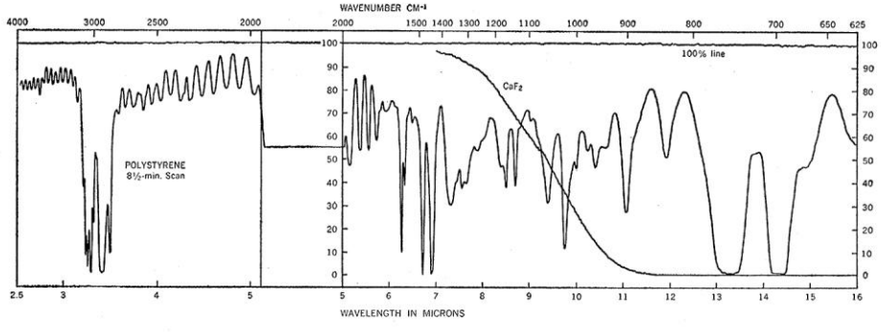
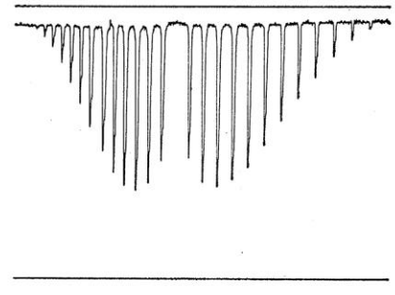




Polystyrene film. Note excellent resolution at fast scan, absence of stray light, 100% line stability, and absence of filter spikes.



HCl, 70-mm. pressure, 10-cm. path, 3.5 μ region, with Beckman Recorder.

WAVELENGTH RANGE:
2.5 to 16 μ

RESOLUTION:
25-minute scan: 3 cm^{-1} or better throughout entire range. Considerably better at slower scanning speeds with auxiliary recorder to expand wavelength.

WAVELENGTH ACCURACY:
0.008 μ from 2.5 to 5 μ;
0.015 μ from 5 to 16 μ

SCANNING SPEED:
8½ and 25 minutes, both for entire range.

Meet the Beckman IR-8 Infrared Spectrophotometer, a new instrument that's designed especially for routine work but which offers the high resolution that's missing–and often needed–in other low-cost infrared spectrophotometers. In addition to the highest resolution and fastest scanning in the low cost field, the IR-8 also offers these benefits: continuous scan on one sheet of paper (no re-setting), single- or double-beam operation, simultaneous auxiliary recording, and a complete line of accessories. The price? $6,300.

Get all the details from your nearest Beckman Sales Office or write direct for Data File LIR-38-162.

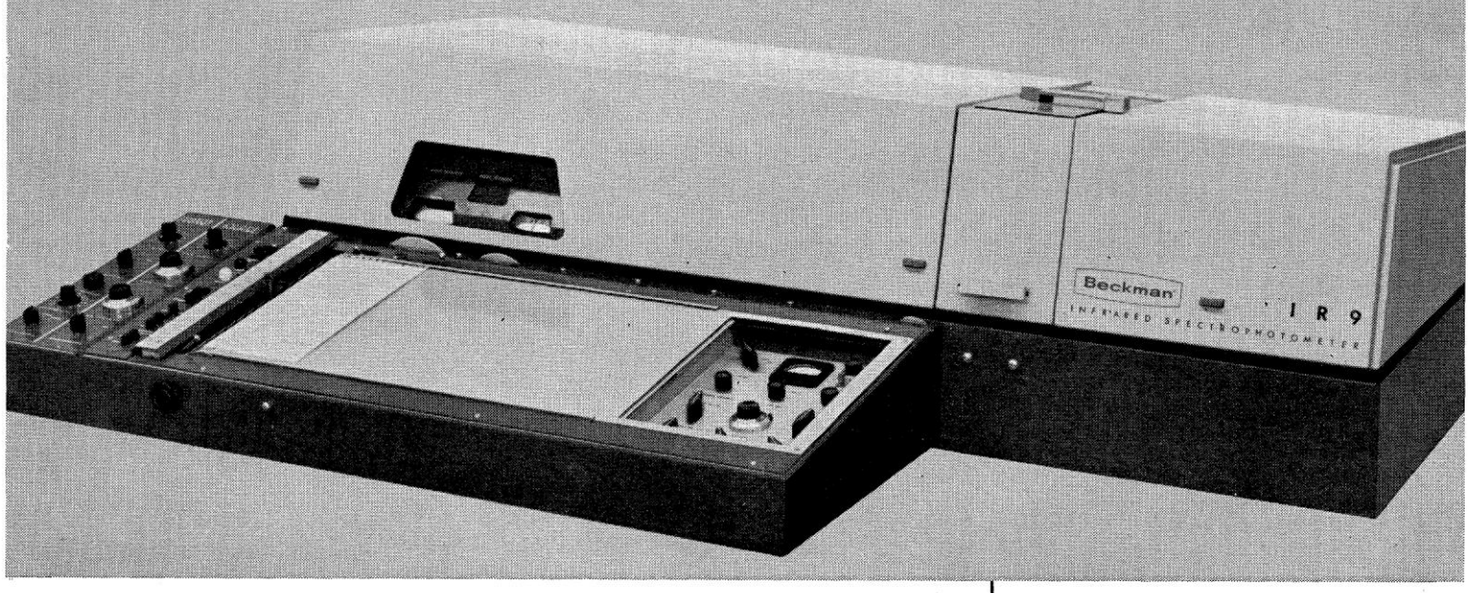
Beckman® INSTRUMENTS, INC.

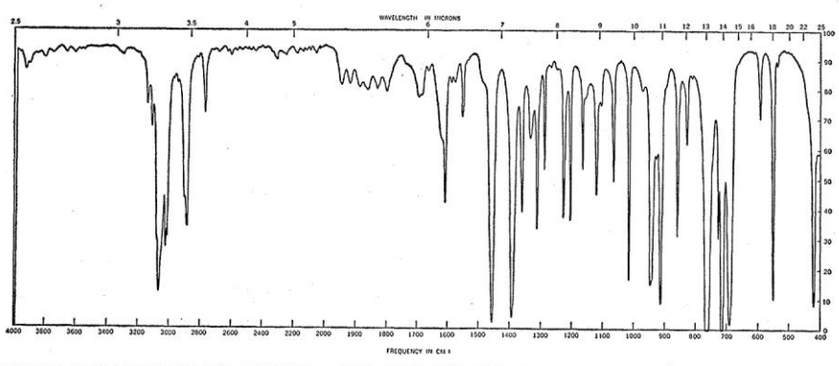
SCIENTIFIC AND PROCESS INSTRUMENTS DIVISION
Fullerton, California

NEW IR-9

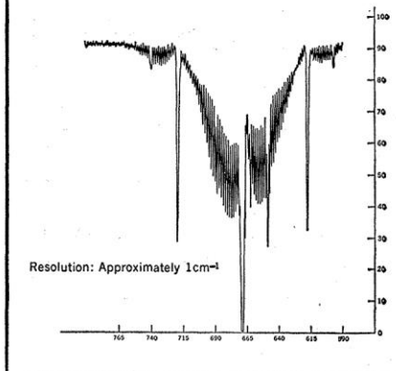
world's most advanced IR spectrophotometer

CONTINUOUS SPECTRA
WIDEST RANGE
UNEXCELLED RESOLUTION
HIGHEST ACCURACY





16-min. scan of indene at approximately 1.0 cm^{-1} resolution.



High resolution run of CO_2 showing excellent elimination of order break at 667 cm^{-1}.

FREQUENCY ACCURACY:
0.2 cm^{-1} at 400 cm^{-1}
0.3 cm^{-1} at 740 cm^{-1}
0.4 cm^{-1} at 1,330 cm^{-1}
0.5 cm^{-1} at 2,220 cm^{-1}
0.6 cm^{-1} at 4,000 cm^{-1}

RESOLUTION:
0.25 cm^{-1} at 923 cm^{-1}
Approximately 1.0 cm^{-1} resolution achieved in a typical 15-minute scan

FREQUENCY REPEATABILITY:
0.1 cm^{-1} throughout entire range, including grating changes

%T ACCURACY:
Single-Beam–0.2% any single reading
Double-Beam–1.0% absolute;
0.2% with calibration

With the prism-grating IR-9 Infrared Spectrophotometer, Beckman again establishes a new standard for fine infrared instrumentation. The IR-9 offers the ultimate available today in precision, range, and flexibility. Its features include continuous spectra with no order breaks or filter spikes, unexcelled resolution, a frequency range of 4000-400 cm^{-1} (which can be extended to 50 cm^{-1}), and the highest frequency accuracy available. No infrared problem performed is too complex for the IR-9; yet its simplicity of operation makes it ideal for routine analyses. In the IR-9, the analyst has at his fingertips the benefits of the most advanced engineering in the field of absorption spectroscopy. The price? $20,500.

For all the details, contact your nearest Beckman Sales Office or write direct for Data File LIR-38-262.

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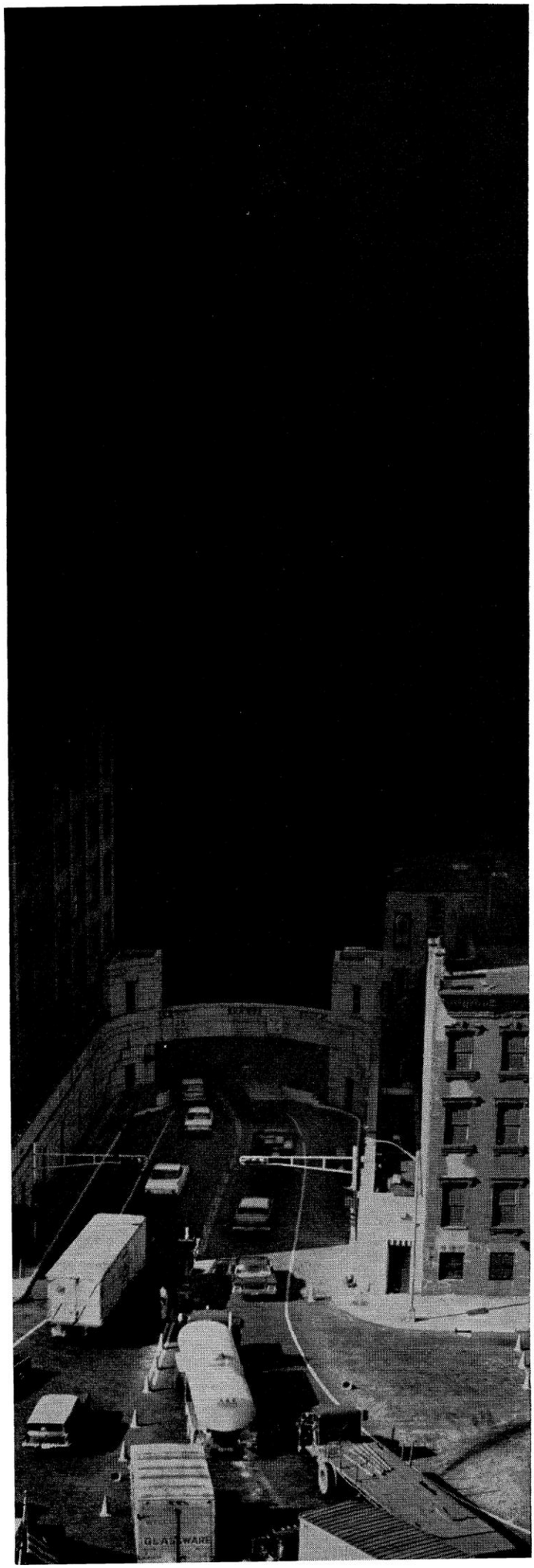
Fullerton, California



One of a series briefly describing GM's research in depth

At the Holland Tunnel, traffic is stopped to make it go: Why?

In their theoretical studies of traffic flow, scientists at the GM Research Laboratories have been developing mathematical models to describe how one car follows another. To check the validity of these models, mass flow experiments were conducted in the Holland Tunnel in close collaboration with The Port of New York Authority which is trying to relieve congestion at this vital traffic artery.

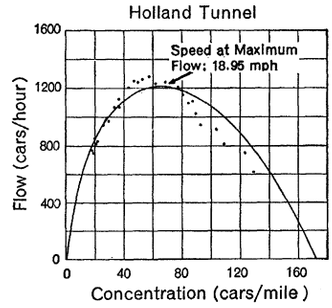
Observations indicated that the car-following models do give a highly consistent description of the steady-state stream of traffic. One interesting point: Both car-following theory and analysis of mass flow data showed that the optimum speed for maximum traffic flow in the tunnel is a surprisingly low 19 mph.

These cooperative studies are contributing significantly to the evolution of unique traffic control systems by the Port Authority for the Holland and Lincoln Tunnels. With the control system now being developed, the number of vehicles allowed to enter per minute is automatically adjusted as the speed and density of traffic in the tunnel changes. Test results to date show a significant reduction in congestion and increase in traffic volume during rush hours.

At General Motors, we believe information from such fundamental traffic studies may well have wide applications . . . for the cars, drivers, and perhaps, automatic highways of the future.

General Motors Research Laboratories

Warren, Michigan



Curve is a "least squares" fit of theoretical car-following model to mass flow data.

16 November 1962, Volume 138, Number 3542

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Who Teaches Science?

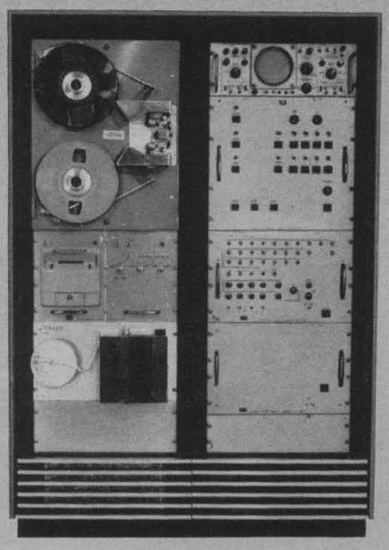
The AAAS Cooperative Committee on the Teaching of Science and Mathematics—a committee consisting of representatives of scientific societies and societies interested in the teaching of science and mathematics—in 1960 published its recommendations for the preparation of high school science and mathematics teachers [*Science* **131**, 1024 (1960)]. The timing was excellent, for the recommendations served as a basic document at several subsequent conferences on the education of teachers and laid much of the groundwork for a study carried out by the National Association of State Directors of Teacher Education and Certification. The association with the long name—NASDTEC for short—consists of the persons, usually one per state, responsible for certifying public school teachers in their states. Their report follows that of the Cooperative Committee in placing much emphasis upon better education in the disciplines to be taught. The full impact of this recent report is yet to come, but already its recommendations for the education of teachers have been adopted by 110 colleges and universities and by four states. Adoption in others is expected, for the report has been formally endorsed by appropriate educational groups or agencies in 15 of the 50 states.

But there is a substantial gap between what is desirable and what is. NASDTEC, again in cooperation with the AAAS, has made clear the size of this gap through a second study which analyzes the education of a statistically good sample of all teachers of science and mathematics in the public and private high schools of the nation. (The full report will be published by the National Science Foundation.) The most striking finding is the contrast between the general educational level of these teachers and their education in the specific fields taught. Essentially all have bachelor's degrees, and 39 percent have master's degrees. But the amount of work in the subjects taught is disproportionately small. The data are best expressed in terms of classes rather than teachers, for some teachers (often those with least preparation) have only one or two classes, while others have five or six. Here are the findings:

	Percentage of classes taught by teachers whose total hours of college credit in the subject taught is—			
Classes	*Fewer than 9*	*9–17*	*18–29*	*30 or more*
Biology	8	13	22	57
Chemistry	14	20	32	34
Physics	23	43	20	14
Mathematics (grades 9–12)	11	12	32	45
Mathematics (grades 7–8)	34	19	26	21

An individual teacher with 30 hours in his field is not necessarily better than another individual with only 10. But, in general, 30 hours is surely better preparation than 10. Yet only in biology does a student have better than a 50–50 chance of being taught by a teacher who has had 30 hours of college work in the science being taught.

This latter study provides the most detailed information yet available on the subject-matter preparation of America's high school science and mathematics teachers. The earlier study means that many scientists and the responsible educational authorities have agreed upon desirable amounts of subject-matter education for future teachers. Together, the studies provide the basis for action, action that has already started in some states. We salute NASDTEC for wanting to carry out these studies. We are glad that AAAS was able to help—D.W.



New approaches to problems in technical measurement

Nuclear structure studies can now be made in greater detail than ever, by physicists using the TMC 4096-channel time-of-flight analyzer. As the target material is bombarded by neutrons, nuclear particles may be displaced and scattered hither and yon. The time-of-flight analyzer detects these particles, measures their flight time from target to detector and stores the information in an appropriate channel of the unit's computer memory. With a capacity of 4096 channels* each storing 10^5 "bits" of data and ability to record flight times in the nanosecond range, this new analyzer provides resolution that permits more critical research analyses than ever before. In addition, the instrument can be set up to make pulse height analyses of gamma radiation simultaneously with time-of-flight studies.

This is one of many TMC innovations in nuclear physics research instrumentation. And TMC subsidiaries are equally important in their fields . . . Mnemotron Corporation in medical and industrial research; Telemetrics, Inc. in advanced ground station telemetry. For details on TMC capabilities in solving your technical measurement problems, write Technical Measurement Corp., 441 Washington Avenue, North Haven, Connecticut.

*also available with 16384 channel capacity.

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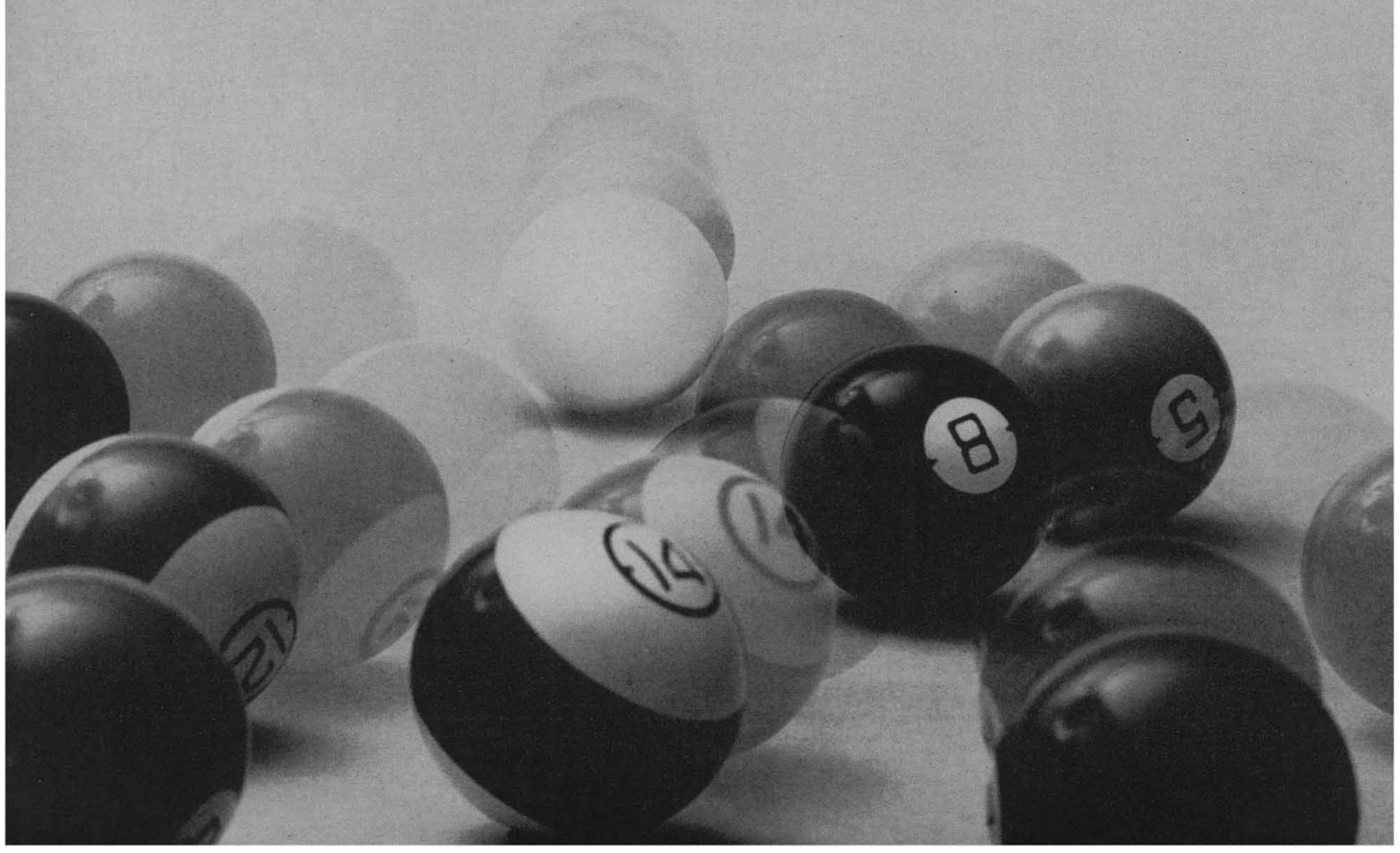
Managing displaced nuclear particles



perivascular collagen fibers. Zucker, referring to the studies of Hugues, reported that when purified collagen fibers were added to citrated platelet-rich plasma, platelet aggregates rapidly appeared along the surfaces of the fibers. In this case platelet serotonin and factor 3 were not released, but "fusion" of the platelet aggregates occurred. Collagen fibers induce only weak agglutination of washed platelets. It is not known whether a cation is necessary for these reactions. Polybrene, a synthetic polysaccharide macromolecule, closely resembles collagen fibers in its action on platelets.

Endotoxins. McKay and Des Prez each described the platelet agglutinating activity of bacterial endotoxin. These two investigators used different endotoxin preparations. The induction of platelet agglutination by endotoxins is well illustrated by the generalized Shwartzman reaction, in which the intravenous injection of endotoxin into a previously sensitized recipient produces white thrombi primarily in the lungs, liver, and spleen but not in the kidney. If a second injection of endotoxin is given, thrombi are then formed in the kidney. McKay reported that injection of endotoxin was followed by a fall in platelet, leukocyte, and fibrinogen levels and a decrease in whole-blood clotting time. Apparently endotoxin in some way initiates in vivo thrombin production, with subsequent agglutination of platelets and thrombus formation. Special comment was made concerning the work of Lee and others, who have shown that if the sensitized recipient's reticuloendothelial system is first blocked by injection of denatured albumin, Thorotrast, or cortisone, the first injection of endotoxin produces thrombi in the kidney as well as in the lung, liver, and spleen. This was interpreted by various participants at the conference to mean that the reticuloendothelial system may play an important role in the prevention of intravascular thrombosis.

How does endotoxin initiate thrombus formation? There was no agreement on this question, but the possibility that the induction of platelet agglutination by endotoxin is mediated through thrombin formation was discussed. Des Prez showed that the addition of endotoxin alone to platelet-rich plasma produces platelet agglutination with subsequent "fusion," and release of platelet serotonin and factor 3. The same changes in platelet-rich plasma can be initiated by the ad-

dition of endotoxin-antibody complexes. A better understanding of the mechanism of action of endotoxin may be attained through future tests with plasmas deficient in antibodies to endotoxin. It appears that platelets, or some other source of thromboplastin, are necessary for the coagulant action of endotoxin. However, a direct action of endotoxin on platelets was not demonstrated. The importance of understanding these problems is apparent, since syndromes similar to the generalized Shwartzman reaction can be induced by vitamin E deficiency in pregnancy, by certain diets, or by injection of such diverse agents as tissue thromboplastin, placenta, trypsin, some snake venoms, and various types of organic and inorganic particulate matter.

Prevention of Thrombosis

The prevention of thrombosis has long been the dream of clinician and research worker alike. There is ample proof that coumarin derivatives lower the plasma levels of prothrombin and certain other procoagulants. Heparin not only inhibits the generation of thrombin but blocks the action of thrombin on fibrinogen. Recently, numerous questions concerning the efficacy of coumarin and heparin therapy in the prevention of thrombosis have prompted investigators to study the effects of these agents on platelet agglutination. Both Berman and Borchgrevink reported that neither coumarin agents nor heparin, in the usual therapeutic dose, prevent the formation of hemostatic thrombi. On the other hand, Mustard reported that heparin, but not coumarin derivatives, prevents the formation of thrombi in extracorporeal shunts.

Mason and Brinkhous reported that coumarin derivatives, when given in doses within the usual clinical dose range, do not abolish the in vitro generation of platelet agglutinating activity of plasma. Such hypoprothrombinemic plasma can still generate sufficient thrombin to induce rapid platelet agglutination. On the other hand, heparin over a wide range of concentrations not only inhibited the generation of thrombin in plasma but also blocked the agglutination of platelets by preformed thrombin. Zucker reported that heparin has little effect on the agglutination of platelets induced by collagen fibers. Perhaps a more thorough understanding of the sequence of reactions

leading to platelet agglutination and thrombus formation will permit the development of new anticoagulants. It was suggested that anticoagulants might be found with sufficient specificity of action to inhibit pathologic platelet agglutination but leave physiologic agglutination mechanisms intact.

There was one final subject of discussion: What causes platelets to adhere to one another when agglutination occurs? There are indications that several of the agents known to induce platelet agglutination may mediate their action through thrombin. The action of other agents, such as ADP, thrombocyte agglutinating factor, and collagen fibers, cannot at present be explained in this manner. Indeed, it has been suggested that thrombin merely causes the release of ADP from platelets and that only then does platelet agglutination occur. Waugh proposed several possible mechanisms or models for platelet agglutination. In one model a platelet agglutinating agent such as thrombin would act to produce hiatuses in the platelet membrane by removing a single molecular species. This would render the membrane unstable, and molecules from the interior of the platelet would be attracted to these hiatuses. These molecules, since they differ from the molecular species originally present, would be unable to stabilize the membrane and would simply continue to congregate at the membrane surface. Eventually this process would lead to the formation of pseudopods, one of the earliest morphologic changes observed in the agglutination process. In another model a platelet agglutinating agent would act upon the platelet membrane either to remove or to rearrange structurally certain molecules. In this manner new electrical charges would be uncovered which could participate in binding platelets together. It is conceivable that these two processes operate simultaneously. Other molecules, released perhaps from the interior of the platelet, along with cations from the plasma, could form the bridges which would link adjacent membranes together. At present all of this is only educated speculation, but herein lies the challenge.

Note

1. Special presentations at the conference were made by H. J. Berman, C. F. Borchgrevink, K. M. Brinkhous, R. K. Cannan, A. B. Chandler, H. Cottier, R. M. Des Prez, R. L. Henry, D. P. Jackson, R. G. Mason, Jr., D. G. McKay, J. F. Mustard, N. F. Rodman, Jr., and M. B. Zucker.

Forthcoming Events

December

11–14. American **Documentation** Inst., Hollywood-by-the-Sea, Fla. (J. B. Kaiser, 1718 N St., NW, Washington 6)

12–14. American Soc. of **Agricultural Engineers**, Chicago, Ill. (J. L. Butt, P.O. Box 229, St. Joseph, Mich.)

17–20. International **Arms Control**, symp., Ann Arbor, Mich. (IACS, P.O. Box 1106, Ann Arbor)

17–21. University **Physics Teaching** Curricula, Laboratory Experiments, and Equipment in UNESCO member states, comparative survey, Paris, France. (UNESCO, Place de Fontenoy, Paris 7°)

26–31. American Assoc. for the **Advancement of Science**, annual, Philadelphia, Pa. (R. L. Taylor, AAAS, 1515 Massachusetts Ave., NW, Washington 5)

The following 40 organizations will meet in conjunction with the AAAS annual meeting in Philadelphia:

Academy of **Psychoanalysis**. (A. H. Rifkin, 125 E. 65 St., New York 21)

American Assoc. of **Clinical Chemists**. (P. Paubionsky, Abington Memorial Hospital, Abington, Pa.)

American **Astronautical** Soc. (J. G. Stephenson, Airborne Instruments Laboratory, Walt Whitman Rd., Melville, L.I., N.Y.)

American **Economic** Assoc. (H. F. Williamson, AEA, Northwestern Univ., Evanston, Ill.)

American **Geophysical** Union. (W. E. Smith, AGU, 1515 Massachusetts Ave., NW, Washington 5)

American **Meteorological** Soc. (F. Sergent, II, Dept. of Physiology, Univ. of Illinois, Urbana)

American **Nature Study** Soc. (J. A. Gustafson, Route #1, Homer, N.Y.)

American **Physiological** Soc. (R. E. Smith, School of Medicine, Univ. of California, Los Angeles)

American **Political Science** Assoc. (E. M. Kirkpatrick, APSA, 1726 Massachusetts Ave., NW, Washington, D.C.)

American **Psychiatric** Assoc. (M. Greenblatt, Massachusetts Mental Health Center, Boston)

American **Rocket** Soc. (B. Chifos, ARS, 500 Fifth Ave., New York 36)

American Soc. of **Criminology**. (J. Chwast, New York Inst. of Criminology, 115–117 W. 42 St., New York 36)

American Soc. of **Naturalists**. (W. K. Baker, Dept. of Zoology, Univ. of Chicago, Chicago 37, Ill.)

American Soc. of **Zoologists**. (R. L. Watterson, Dept. of Zoology, Univ. of Illinois, Urbana)

American **Sociological** Assoc. (B. Clark, Center for the Study of Higher Education, 2747 Bancroft Way, Berkeley 4, Calif.)

Association of American **Geographers**. (B. Burton, 213-1500 Arlington Blvd., Arlington, Va.)

Association for **Computing** Machinery. (B. Gilchrist, IBM Research Laboratory, Post Office Box 218, Yorktown Heights, N.Y.)

Biomedical **Information-Processing** Organization. (R. S. Ledley, Natl. Biomedical Research Foundation, Silver Spring, Md.)

Biometric Soc., ENAR. (T. A. Bancroft, Iowa State Univ., Ames)

Ecological Soc. of America. (R. B. Platt, Dept. of Biology, Emory Univ., Atlanta 22, Ga.)

Herpetologists' League. (W. Fox, School of Medicine, Louisiana State Univ., 1542 Tulane Ave., New Orleans 12)

Institute of **Management Sciences**. (B. V. Dean, Dept. of Management, Case Inst. of Technology, Cleveland, Ohio)

Metric Assoc. (R. P. Fischelis, 1426 G St., NW, Washington, D.C.)

Mountain Lake **Biological** Station. (J. L. Riopel, Univ. of Virginia, Charlottesville)

National Assoc. of **Biology Teachers**. (P. R. Fordyce, Oak Park–River Forest High School, Oak Park, Ill.)

National Assoc. of **Science Writers**. (N. Haseltine, *Washington Post,* Washington, D.C.)

National **Geographic** Soc. (W. R. Gray, NGS, 16th and M Sts., Washington 6)

National **Science Teachers** Assoc. (R. H. Carleton, NSTA, 1201 16th St., NW, Washington 6)

National **Speleological** Soc. (J. V. Thrailkill, Dept. of Geology, Princeton Univ., Princeton, N.J.)

Philadelphia **Botanical** Club. (W. M. Benner, Acad. of Natural Sciences of Philadelphia, Philadelphia 3)

Scientific **Research** Soc. of America. (D. B. Prentice, RESA, 51 Prospect St., New Haven, Conn.)

Sigma Delta Epsilon. (D. Quiggle, 133 Chemical Engineering Bldg., Pennsylvania State Univ., University Park)

Society for General **Systems Research**. (R. L. Meier, Mental Health Research Inst., Ann Arbor, Mich.)

Society for the **History of Technology**. (T. P. Hughes, Dept. of History, Washington and Lee Univ., Lexington, Va.)

Society for Industrial and Applied **Mathematics**. (G. Kaskey, Remington Rand Univac, 1900 W. Allegheny Ave., Philadelphia)

Society for Industrial **Microbiology**. (T. C. Cordon, Agricultural Research Service, 600 E. Mermaid Lane, Philadelphia 18)

Society of the **Sigma Xi**. (T. T. Holme, 51 Prospect St., New Haven, Conn.)

Society of Systematic **Zoology**. (C. F. Lytle, 801 Ware St., SW, Vienna, Va.)

Tau Beta Pi Assoc. (R. H. Nagel, Tau Beta Pi Assoc., Univ. of Tennessee, Knoxville)

United Chapters of **Phi Beta Kappa**. (C. Billman, 1811 Q St., NW, Washington 9)

Special conferences to be held during the meeting include:

Academy Conference, natl. meeting of 47 state academies. (R. C. Miller, California Acad. of Sciences, San Francisco)

Conference on **Science Manuscripts**. (N. Reingold, Science and Technology Div., Library of Congress, Washington 25)

Conference on **Scientific Manpower**. (T. J. Mills, National Science Foundation, Washington 25)

27–29. American **Geophysical** Union, western natl. meeting, Stanford, Calif. (W. W. Kellogg, Rand Corp., 1700 Main St., Santa Monica, Calif.)