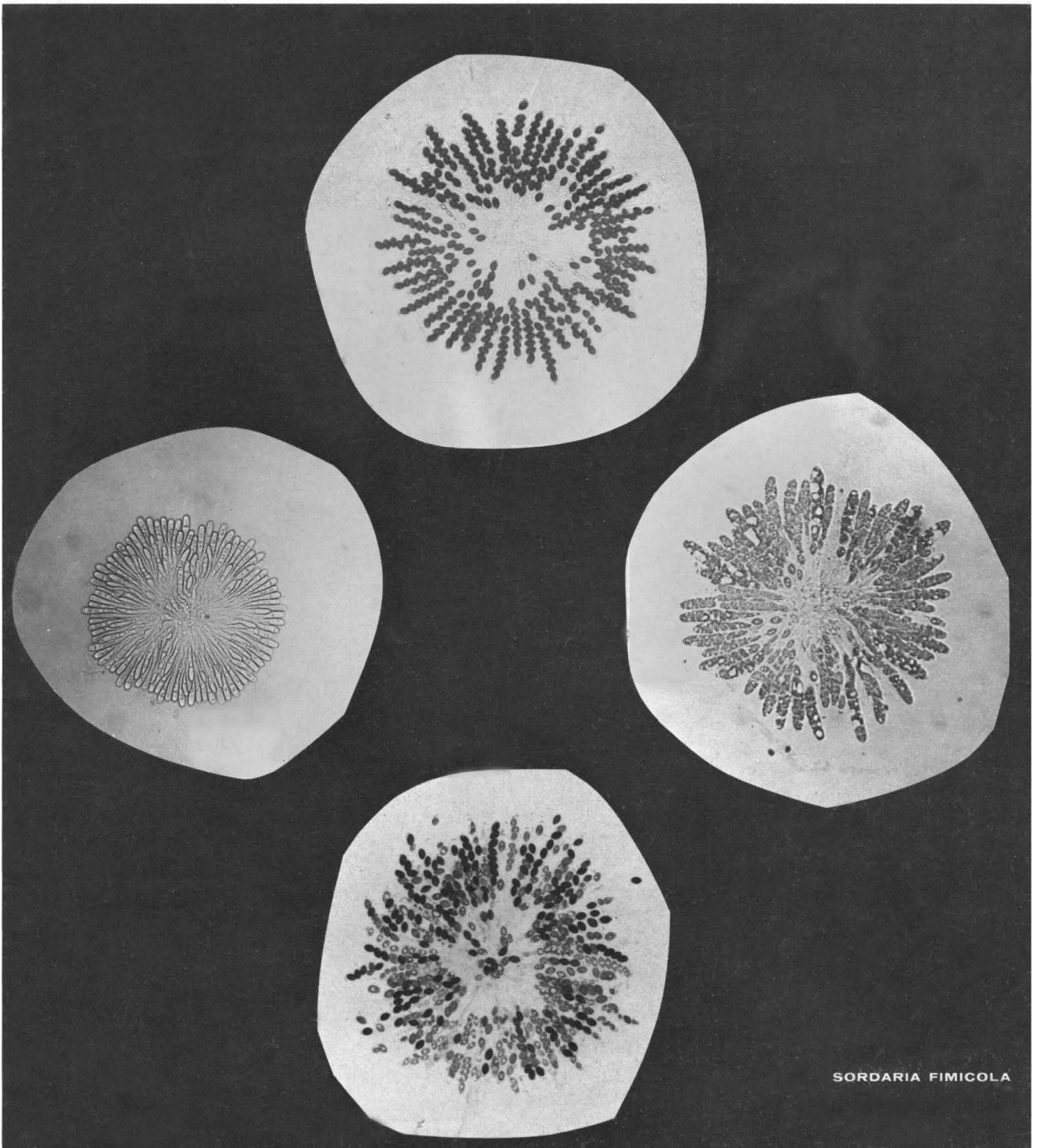


# SCIENCE

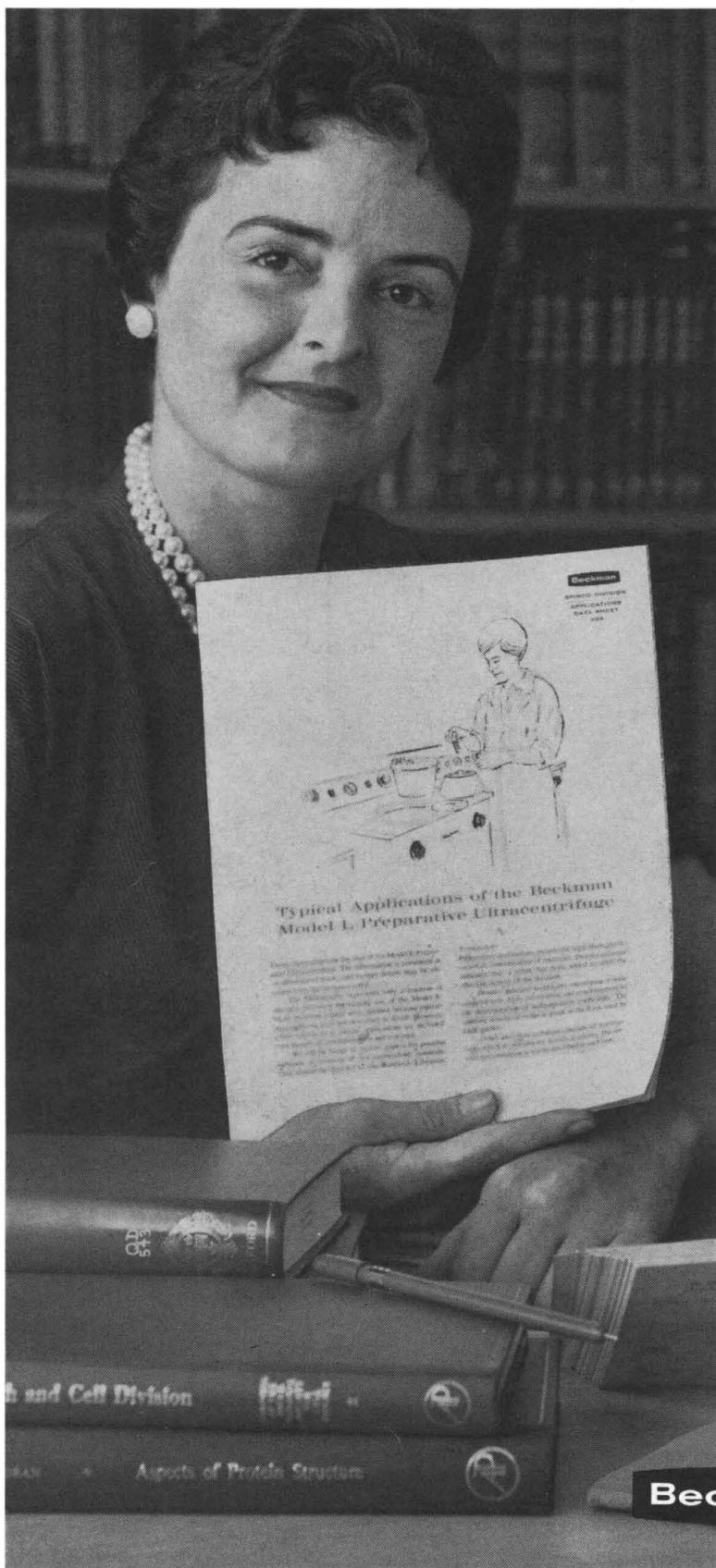
4 September 1964

Vol. 145, No. 3636

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



SORDARIA FIMICOLA



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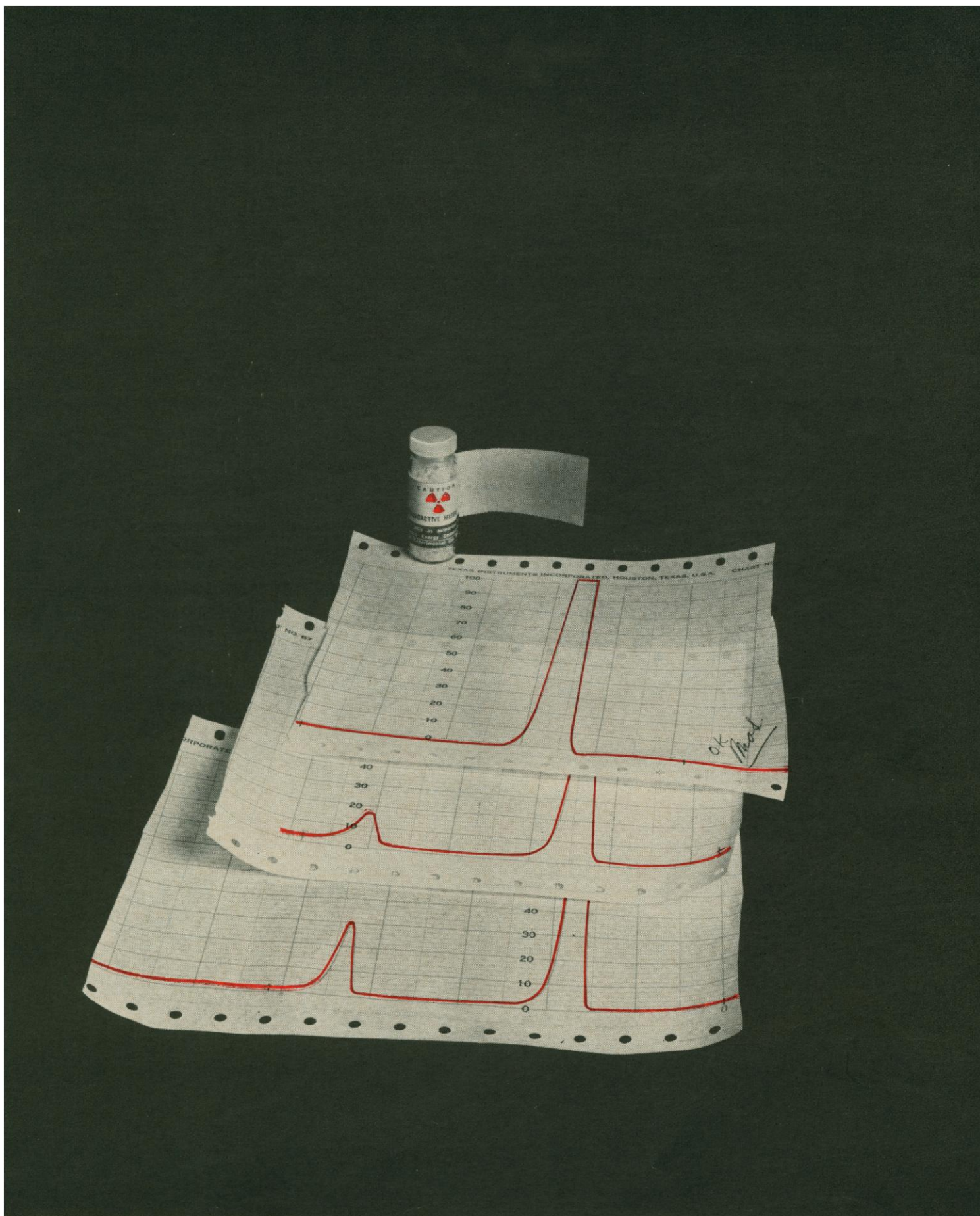
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## COVER

Asci of the wild type and of three auxotrophs of *Sordaria fimicola*. (Top) Asci of wild type which contain dark, mature ascospores. (Right) Asci of an arginine-requiring mutant which contain hyaline, nonviable ascospores. This auxotroph is a nonautonomous spore color mutant. (Bottom) Asci containing normal and nonviable ascospores of various colors of a lysine mutant. (Left) Abortive asci of a partially arginine-deficient mutant. See page 1067.

The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

## The Magnetic Personality of MHD Bearings

We've been analyzing it at the Research Laboratories.

Frankly, we don't know what the practical applications of our MHD analysis will be. Not yet, anyway.

But we're nevertheless pleased that our engineers were the first to successfully demonstrate the much-investigated MHD bearing.

Recently, with the help of the University of Chicago's 32.5-inch cyclotron magnet, they proved experimentally a theory that has been described only by mathematical analysis; that is, when electrically conducting liquid metals are used as bearing lubricants, load carrying capacity can be dramatically increased by subjecting them to a magnetic field. The more powerful the magnetic field, the more viscous becomes the liquid-metal lubricant . . . and the greater the load the MHD bearing will support.

Even more important, our engineers found excellent agreement between their mathematical predictions and the measured performance of the experimental MHD bearing.

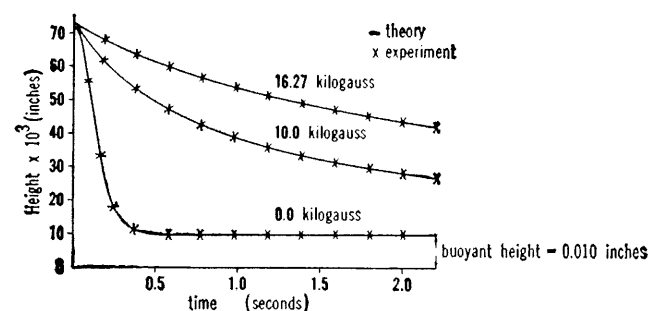
GM bearing designers are intrigued.

Consider the operating characteristics of the magnetohydrodynamic bearing: the possibility of zero frictional torque . . . high thermal conductivity . . . the ability to withstand high temperatures and nuclear radiations . . . and automatic electrical adjustment to compensate for transient loads.

From theoretical analysis through confirming experiment, the successful demonstration of the first experimental MHD bearing is typical of the full-circle research philosophy of General Motors.

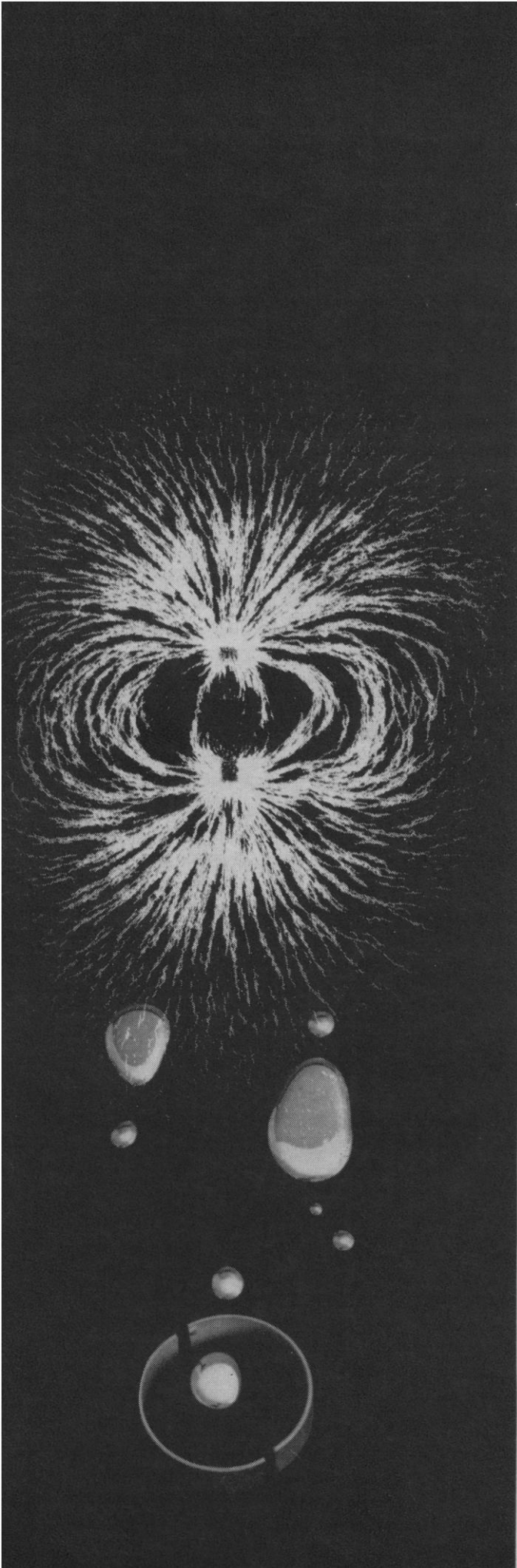
## General Motors Research Laboratories

Warren, Michigan



Predicted rate at which a film of mercury is squeezed from between two flat circular plates agrees closely with measured values.

Symbolized elements of MHD bearing.





## New purified animal diets... **Purina® PUR-PAK Chows**

This man is no astronaut. He's wearing a "space suit" to prevent contamination of the new purified diets, Purina Pur-Pak Lab Chow and Purina Pur-Pak Mouse Breeder Chow.

These Chows are formulated with very high vitamin levels, then pressure processed to eliminate potentially harmful microorganisms.

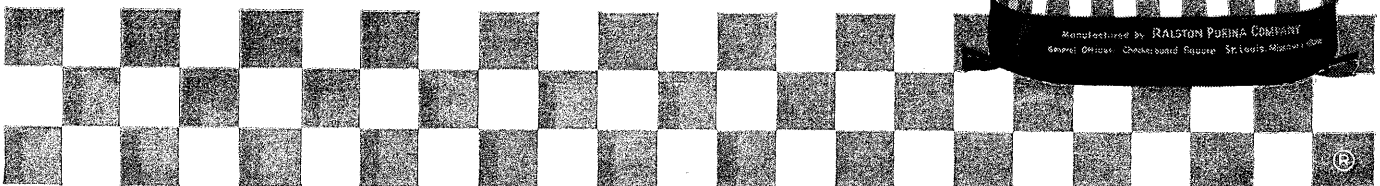
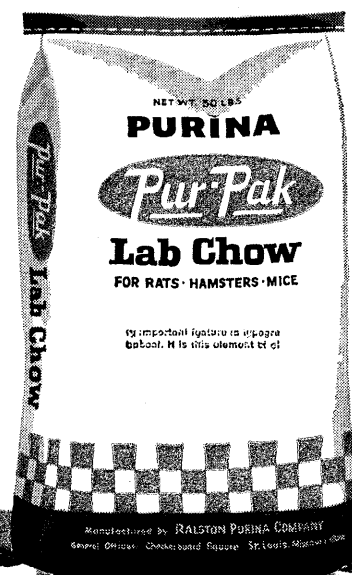
They are double heat sealed in plastic bags within a sanitary room, then pro-

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These diets provide you a new measure of nutritional and bacteriological control in critical laboratory animal experiments.

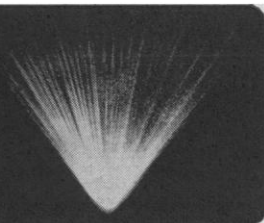
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**PURINA . . . world's leading manufacturer of laboratory animal diets**





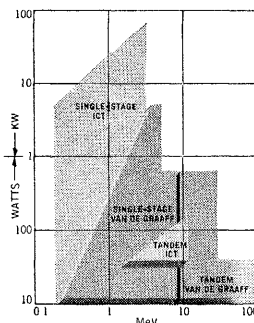
# CHARGED PARTICLES



## THE ICT CONCEPT: new high-current machines emerging from HVEC research

Development of higher energy Van de Graaff particle accelerators which retain high beam precision, stability, and homogeneity, remains a continuing contribution by HVEC to "energy-oriented" research.

To provide even greater freedom of experimentation, HVEC is also anticipating the need for the higher beam intensities required in power-oriented research projects. Invented by Dr. R. J. Van de Graaff, the new Insulating Core Transformer (ICT) accelerator now provides high beam currents with all the desirable beam char-



acteristics of Van de Graaff machines. As the graph shows, the high power levels available from the ICT accelerator now make possible a new realm of precision experimentation.

### The Insulating Core Transformer

The ICT is essentially a three-phase power transformer with multiple secondaries, each of which is insulated from the other. Rectified current from the secondaries is series-connected to achieve total voltage. In the ICT, electrostatic and electromagnetic fields exist in the same space, as contrasted to the conditions in a conventional transformer. The result is a highly efficient dc power source capable of stable operation at elevated potentials and power levels.

A number of ICT accelerators and power generation systems are now available.

### Single-Stage ICT Accelerators

Two types of single stage ICT accelerators have been developed for research use. The first incorporates an ICT power source coupled to the acceleration assembly through a coaxial cable.

	PROTON ENERGY (KeV)	CURRENT (MAX.) (Analyzed)	TANK HEIGHT Feet	TANK HEIGHT Meters	TANK DIAMETER Feet	TANK DIAMETER Meters
ICT 300	300	15 mA	4'4"	1.32	4	1.2
ICT 500	500	10 mA	5'3"	1.60	4	1.2

The second system utilizes a rigid transmission line to transmit electrical power to the accelerator terminal.

	ENERGY (MeV)	CURRENT	DIMENSIONS Length Feet	DIMENSIONS Length Meters
4 MeV ICT				
Positive Ions	1.5-4	3 mA	26'6"	8.08
Electron Conversion	1.5-3	10 mA	26'6"	8.08
3 MeV ICT				
Electrons	1.5-3	20 mA	29'	8.84

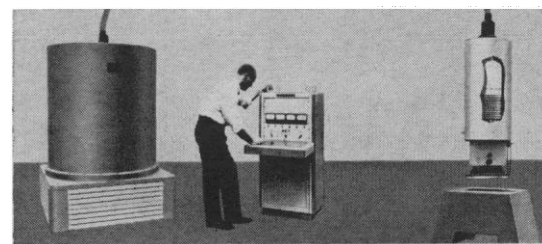
### 8 MeV ICT Tandem Accelerator

The 8 MeV ICT Tandem provides proton energies continuously variable from 3 to 8 MeV at a maximum guaranteed beam current of  $2\mu\text{A}$ . The ICT power source is capable of providing 12 mA at 4 mv which, in combination

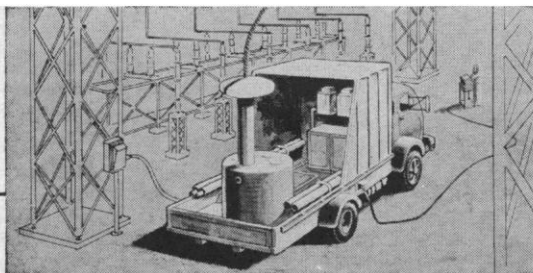
with newly developed components emerging from HVEC, will enable the accelerator to keep pace with future research requirements. The 8 MeV Tandem is convertible to single-stage ion or electron operation.

### ICT Electron Processing Systems

Developed primarily as high-current sources of electrons for industrial processing applications, these systems allow extreme flexibility of operation. Two models are available: 300 kv at 30 mA maximum beam current and 500 kv at 20 mA maximum beam current.



### Series 7 ICT Power Supplies



ICT equipment has crossed many barriers to dc operation at high particle energies and currents. There is no indication that a ceiling exists to further advances of similar importance.

Available with output ratings ranging from 240 kv at 80 mA to 600 kv at 20 mA, these highly stable power sources are suitable for use in high energy beam separator systems, r.f. transmission systems, plasma research and high voltage testing programs.

For detailed information, please write to Technical Sales, High Voltage Engineering Corporation, Burlington, Massachusetts.



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## Man in the Sea

Man is going to colonize the oceans, and it might just as well be our men. To compete successfully, we must be able to move faster in the sea, to go deeper, to stay down longer, than anyone else. We must understand more about the sea—its interfaces, its interactions with the atmosphere, its bottom and deep into its bottom, its shorelines, the motions within its bulk, everything it contains, the life and chemicals in it.

We are already beginning to occupy the sea. At a recent symposium on Buoys, the discussion was concerned with all kinds of platforms in the sea—manned or unmanned, surface or submerged—for observation or for actual exploitation of sea resources. Ships and buoys and then much more sophisticated complexes of platforms will form future oceanic cities and lead to the occupation of the surface of the sea.

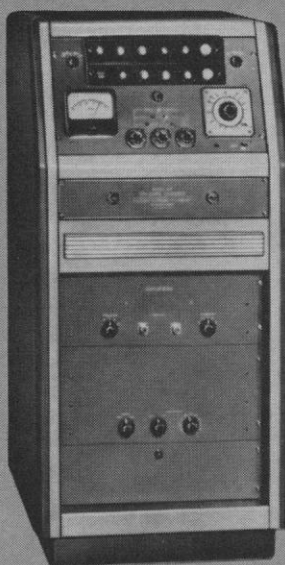
At the same time, we are beginning to go down. New experimental submarines are being built. Experiments such as those sponsored by the Navy to stay for long periods 60 meters down are a next step toward occupying the ocean depths. Magnificent work has been done in the exploration of the deep-sea sediments and the earth's crust below the sea by ingenious, remote seismic methods, by the coring and drilling of the ocean bottom. Already phosphorites and diamonds are being taken commercially from the shelves in the sea, and nodules may be an inexhaustible source of other minerals in the future. The deep-diving vessels will provide the first prospecting with a man-on-the-spot on the bottom of the ocean. The little deep-diving submarines will be the burros of the ocean prospector.

In colonizing and exploiting the sea we will have formidable competition. Already the Russians, employing hundreds of vessels, fish on our doorstep with modern, efficient factory ships. The Japanese outfish us too, not only on our doorstep but also on the high seas.

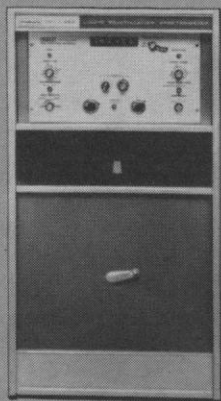
If we are to meet competition successfully we must organize our efforts better. We must find a way of avoiding the great waste entailed in building a national program by the addition of thousands of little individual projects. Rather, we should employ a scheme of supporting, in larger chunks, institutions, laboratories, and industries that have good people. Then we should allow their initiative to make the program. We must find ways of instrumenting large sections of the oceans for experimental purposes, and we must make these areas available to private institutions and industries as well as to the Navy. This would encourage scientists to undertake the large-scale kind of engineering experimentation that is necessary for the occupation of the sea.

To achieve these objectives I have suggested the establishment of "sea-grant colleges" in existing universities that wish to develop oceanic work. The sea-grant college would focus attention on marine science, and it would develop strengths in the applications of marine science in colleges of aquaculture and oceanic engineering. These would be modernized parallels of the great developments in agriculture and the mechanic arts which were occasioned by the Land Grant Act of about a hundred years ago. Basic funds, undesignated except that they be used by sea-grant colleges, could be obtained in much the way that agricultural support has been obtained in the past. Establishment of the land-grant colleges was one of the best investments this nation ever made. The same kind of imagination and foresight should be applied to exploitation of the sea.—ATHELSTAN F. SPILHAUS, Dean of the Institute of Technology, University of Minnesota, and member of the Board of Directors of AAAS

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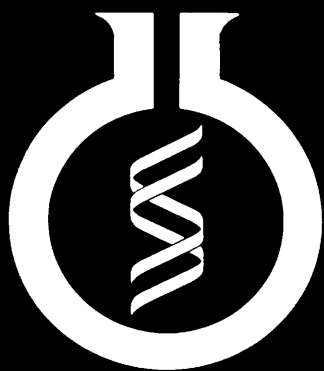
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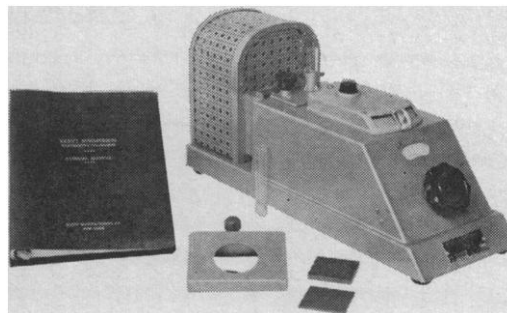
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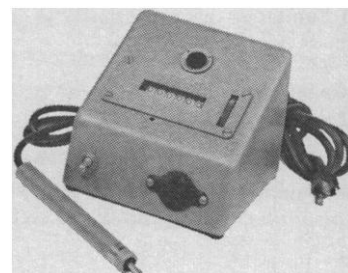


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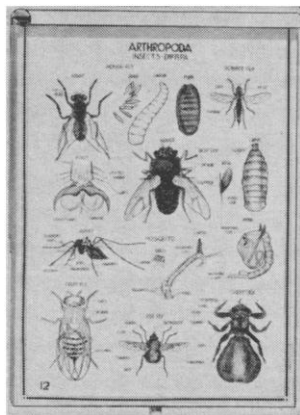
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Robert L. Bowman (R.L.B.), with the assistance of Denis J. Prager (D.J.P.), Laboratory of Technical Development, National Heart Institute, Bethesda 14, Md. (medical electronics and biomedical laboratory equipment).

Joshua Stern (J.S.), Basic Instrumentation Section, National Bureau of Standards, Washington 25, D.C. (physics, computing, electronics, and nuclear equipment).

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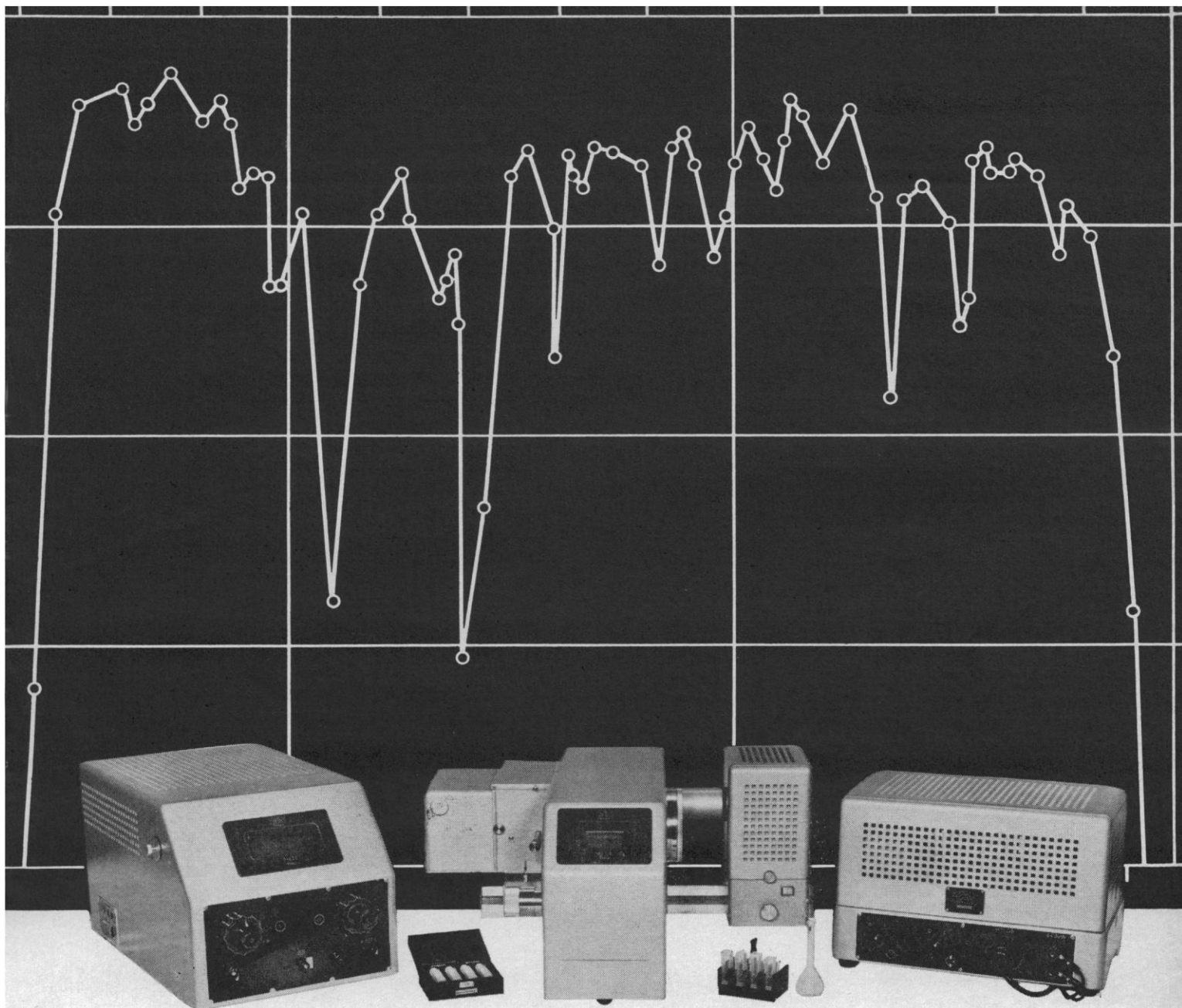
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## NEWS AND COMMENT

(Continued from page 1025)

of the nature and consequences of what is proposed. Assumed consent or consent obtained by undue influence is valueless and, in this latter respect, particular care is necessary when the volunteer stands in special relationship to the investigator as in the case of a patient to his doctor, or a student to his teacher.

The need for obtaining evidence of consent in this type of investigation has been generally recognized, but there are some misunderstandings as to what constitutes such evidence. In general, the investigator should obtain the consent himself in the presence of another person. Written consent unaccompanied by other evidence that an explanation has been given, understood and accepted is of little value.

The situation in respect of minors and mentally subnormal or mentally disordered persons is of particular difficulty. . . .

Investigations that are of no direct benefit to the individual require, therefore, that his true consent to them shall be explicitly obtained. After adequate explanation, the consent of an adult of sound mind and understanding can be relied upon to be true consent. In the case of children and young persons the question whether purported consent was true consent would in each case depend upon facts such as the age, intelligence, situation and character of the subject and the nature of the investigation. When the subject is below the age of 12 years, information requiring the performance of any procedure involving his body would need to be obtained incidentally to and without altering the nature of a procedure intended for his individual benefit.

**Professional discipline.** All who have been concerned with medical research are aware of the impossibility of formulating any detailed code of rules which will ensure that irreproachability of practice which alone will suffice where investigations on human beings are concerned. The law lays down a minimum code in matters of professional negligence and the doctrine of assault. But this is not enough. Owing to the special relationship of trust that exists between a patient and his doctor, most patients will consent to any proposal that is made. Further, the considerations involved in a novel procedure are nearly always so technical as to prevent their being adequately understood

by one who is not himself an expert. It must, therefore, be frankly recognized that, for practical purposes, an inescapable moral responsibility rests with the doctor concerned for determining what investigations are, or are not, proposed to a particular patient or volunteer. Nevertheless, moral codes are formulated by man and if, in the ever-changing circumstances of medical advance, their relevance is to be maintained, it is to the profession itself that we must look, and in particular to the heads of departments, the specialized Societies and the editors of medical and scientific journals.

In the opinion of the Council, the head of a department where investigations on human subjects take place has an inescapable responsibility for ensuring that practice by those under his direction is irreproachable.

In the same way the Council feel that, as a matter of policy, bodies like themselves that support medical research should do everything in their power to ensure that the practice of all workers whom they support shall be unexceptionable and known to be so.

So specialized has medical knowledge now become that the profession in general can rarely deal adequately with individual problems. In regard to any particular type of investigation, only a small group of experienced men who have specialized in this branch of knowledge are likely to be competent to pass an opinion on the justification for undertaking any particular procedure. But in every branch of medicine specialized scientific societies exist. It is upon these that the profession in general must mainly rely for the creation and maintenance of that body of precedents which shall guide individual investigators in case of doubt, and for the critical discussion of the communications presented to them on which the formation of the necessary climate of opinion depends.

Finally, it is the Council's opinion that any account of investigations on human subjects should make clear that the appropriate requirements have been fulfilled and, further, that no paper should be accepted for publication if there are any doubts that such is the case.

The progress of medical knowledge has depended, and will continue to depend, in no small measure upon the confidence which the public has in those who carry out investigations on human subjects, be these healthy or sick. Only in so far as it is known that



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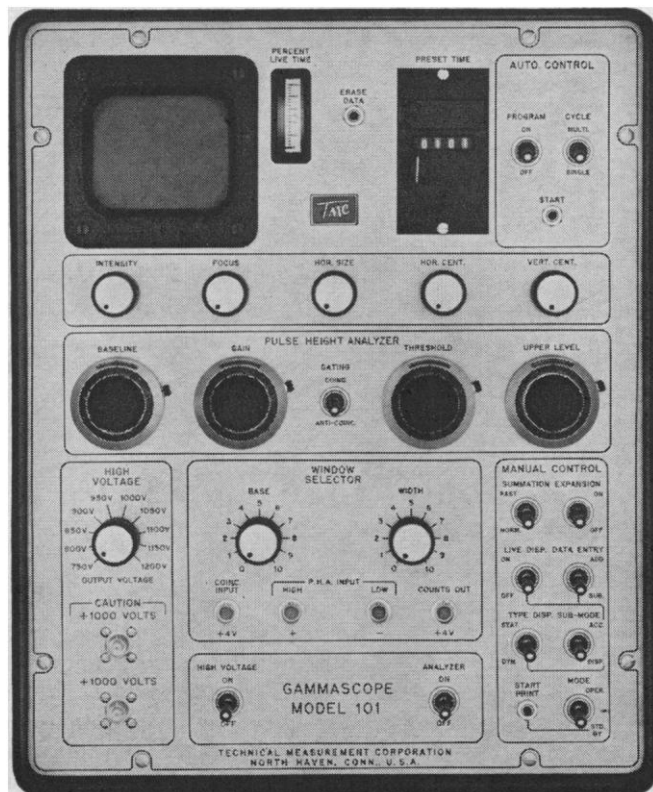
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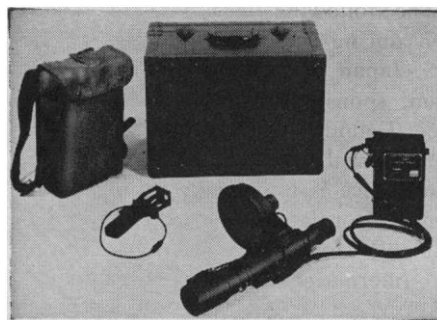
### Announcements

A graduate program leading to the master's and doctor's degrees in **materials science** has been established at the University of Virginia. The curriculum, open to persons holding a bachelor's degree in engineering or science, will center on the quantum mechanics of solids, crystal structure of materials, and the theory of lattice defects. Experimental research will concentrate on work with electron microscopes, x-ray diffractometers, and high and low energy electron diffraction apparatus. A training and research program in medical and dental materials is also being established, supported by an NIH grant. Information on the new programs is available from H. G. F. Wilsdorf, Department of Materials Science, University of Virginia, Charlottesville.

The National Bureau of Standards' Institute for Basic Standards is starting a four-phase program to establish **standards for radar equipment**. The work is being done at the Boulder, Colorado, laboratories, for the Defense Department's Advanced Research Projects Agency. The program will concentrate on exploratory research and on technical requirements in measurements of radar power, noise, and antenna patterns. Additional information is available from J. M. Richardson, chief of the Radio Standards Laboratory, NBS, Boulder.

### Meeting Notes

Papers on **theoretical and experimental physics** are invited for presentation at the American Physical Society meeting 21-23 December in Berkeley, California. Persons giving papers may be members of the society or non-members whose papers are sponsored by members. Deadline for receipt of abstracts: **16 October**. (W. Whaling, California Institute of Technology, 1201 E. California St., Pasadena)



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Editor: Stephen Rothman 1959

AAAS Symposium Volume No. 54

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The following meetings are scheduled during November as part of the **U.S.-Japan cooperative science program**, sponsored by the National Science Foundation and the Japan Society for the Promotion of Science. Attendance is by invitation only; additional information on the program is available from N. P. Neureiter, Office of International Science Activities, NSF, Washington 25.

4-7. Seminar on *bioclimatology*; Sapporo, Japan.

4-7. Seminar on *mechanisms of the dose rate effect at the genetic and cellular level*; Oiso, Japan.

6-7. Conference on *group structure and social interactions of primates*; Covington, Louisiana.

16-20. Conference on *chemistry education*, Hakone, Japan.

16-27. Conference on *narcotics and drug abuse*; Tokyo and other cities.

The call for papers has been issued for the 1965 international convention of the Institute of **Electrical and Electronics Engineers**. The meeting will take place in New York 22-26 March. The divisions of science and electronics, and of industry and applications are planning sessions, along with the various technical groups. Abstracts should be 50 to 100 words. Deadline: *16 October*. (E. L. Harder, IEEE, Box A. Lenox Hill Station; New York 10021)

The Human Factors Society will hold its annual meeting 19-21 October in Washington. The meeting will stress the applications of **human factors technology** in such areas as architectural design, industrial application, personnel subsystems, and the space program. (R. B. Sleight, Applied Psychology Corporation, 4113 Lee Highway, Arlington 7, Va.)

The Institute of Electrical and Electronics Engineers and the University of Pennsylvania will sponsor the 1965 international **solid-state circuits** conference, 17-19 February in Philadelphia. Papers are invited for the meeting. A 35-word abstract and a 300- to 500-word summary are required; major illustrations may be included. Deadline: *26 October*. (B. J. Lechner, RCA Laboratories, Princeton, N.J. 08540)

A symposium on "personnel dosimetry for accidental high-level **exposure to external and internal radiation**"

is scheduled 8-12 March in Vienna. The sponsors are the World Health Organization and the International Atomic Energy Agency. Papers are invited for presentation regarding measurement techniques, assessment of dose from the results of measurements, current practices and experience gained from previous accidents. Abstracts of 250 to 350 words are required. Deadline: *15 October*. (J. H. Kane, International Conferences Branch, Division of Special Projects, U.S. Atomic Energy Commission, Washington, D.C. 20545)

### Courses

A course entitled "an engineering approach to the **control of contamination**" will be offered 19-25 October in Rochester, New York. The course will deal with problems encountered by administrative and supervisory personnel, and by technically oriented persons. The sponsors are Rochester Institute of Technology and the American Association for Contamination Control. Tuition is \$250. (H. M. Kentner, Rochester Institute of Technology, 65 Plymouth Avenue South, Rochester 14608)

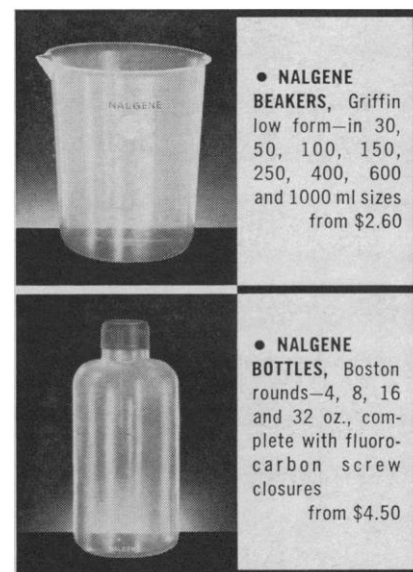
Georgia Institute of Technology plans a course on **automation, computers, and instrumentation**, 2-6 November. It is designed for senior technical personnel in manufacturing, commercial, and government organizations. The course fee is \$150, which will cover tuition, supplies, and textbooks. Deadline for receipt of applications: *21 October*. (Director, Department of Continuing Education, Georgia Institute of Technology, Atlanta, 30332)

### Scientists in the News

**Hugh L. Dryden**, NASA deputy administrator, has received the 1964 Louis W. Hill award from the American Institute of Aeronautics and Astronautics. He was cited for his contributions in fluid mechanics research, in advancing civilian space activities, and in the X-15 research airplane program. The award carries a \$5000 honorarium.

**Howard J. Teas**, program director for metabolic biology at the National Science Foundation, has become chairman of the division of biological sciences at the University of Georgia, Athens.

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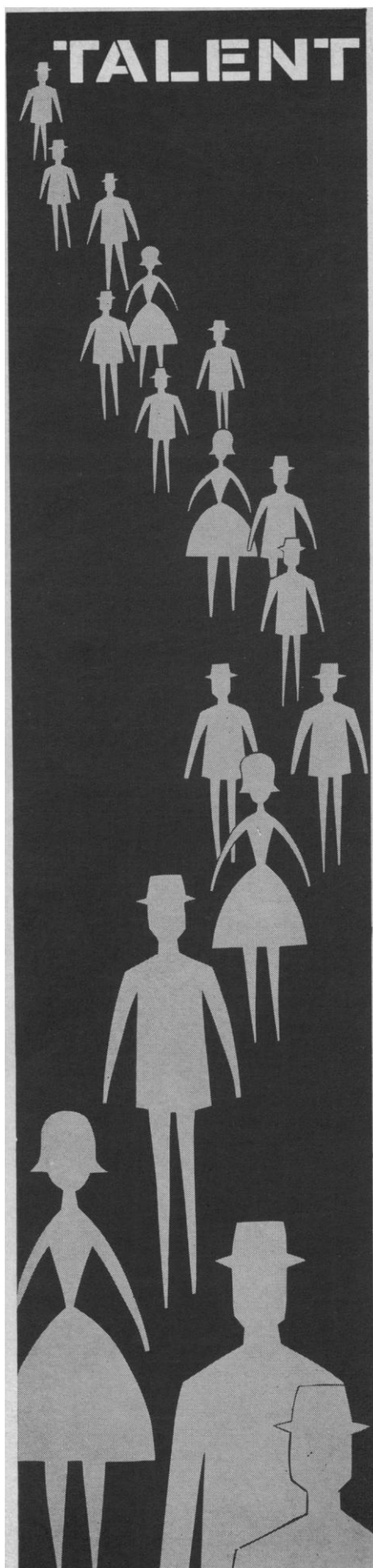
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### U.S. NAVAL LABORATORIES IN CALIFORNIA

The University of North Carolina has named **Isaac M. Taylor** dean of the medical school. He is a professor of medicine at the school.

**Hugo Dahlke**, formerly with North American Aviation, in Columbus, Ohio, has joined the Ling-Temco-Vought research center in Anaheim, California, in charge of the acoustic instrumentation research program.

**Franz Reichsman**, formerly associate professor of medicine and assistant professor of psychiatry at the University of Rochester's medical school, has become professor of psychiatry at the State University of New York Downstate Medical Center, in Brooklyn.

**William C. Leslie**, assistant director of the E. C. Bain Laboratory for Fundamental Research, U.S. Steel Corporation, has been named Battelle visiting professor of metallurgy at Ohio State University for the coming academic year.

**Cyril Hazard**, formerly lecturer in astronomy at the school of physics, University of Sydney, Australia, has joined Cornell University's Center for Radiophysics and Space Research as senior research associate.

The University of Wisconsin has appointed **Gerald Nadler** to establish a graduate program in industrial engineering. He had been on leave as professor of industrial engineering and chairman of the human and organization factors area at the Washington University school of engineering.

#### Recent Deaths

**Harold F. Balmer**, 65; astrophysicist with the Air Force's Strategic Air Command; 25 July.

**George S. Bryan**, retired chief hydrographer for the Navy; 12 July.

**Ernest Martin Hopkins**, 86; retired president of Dartmouth College; 13 August.

**Robert W. Gelinis**, 41; research physicist at the Rand Corporation, Santa Monica, Calif.; 25 July.

**Mitchell Gray**, 46; visiting professor at the University of Illinois college of veterinary medicine; 27 July.

**Louis R. Kaufman**, 83; former director of surgery at New York Medical College; 19 August.