SCIENCE 26 November 1965
Vol. 150, No. 3700
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

DIRECT LINEAR ABSORBANCE RECORDING

With The
Gilford 2000
Multiple Sample
Absorbance
Recording
Spectrophotometer

Versatile . . . Accurate . . . Productive

This integrated system adapts to a variety of research applications requiring high data productivity and accuracy. It is widely used for studies involving enzyme catalyzed reaction rates, liquid column chromatography, sucrose density gradients, DNA-RNA thermal denaturation profiles and other techniques. It can be used as a manual spectrophotometer to measure single samples or equally well as an automatic system for processing multiple samples.

Precise and reliable, this system takes full advantage of the unique Gilford photometer circuit and the low stray light characteristics of quality monochromators. It modernizes existing monochromators by retaining the optics but replacing the electronics and cell positioning mechanism, eliminating the shutter, dark current and sensitivity controls, dessicants and battery.

The basic system features include an automatic cuvette positioner, adaptable to laboratory quality monochromators such as the Beckman DU or the Zeiss MQ4III; a detector-indicator unit with direct digital absorbance readout; and a main console housing the lamp source stabilizer, photometer circuit, chart recorder and automation circuitry.

Absorbance Range	0.000 to 3.000 A.
Wavelength Range	200 — 700 mu
Background Neutralization	to 2.9 A.
Linearity	± 0.25% or within 0.005 A.
Stability	less than 0.01 A drift per hour
Maximum Noise	less than 0.003 A at 1.5 A.

gilford INSTRUMENT LABORATORIES INCORPORATED

INSTRUMENTATION FOR BIOLOGY AND MEDICINE

OBERLIN OHIO

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES THROUGHOUT THE U. S. A.

Does your lab pass the acid test?

Now . . . from NBCo . . . an opportunity to make your lab more complete, more functional in procedures utilizing amino acids. NBCo offers, at impressive savings, a complete stock of the 52 standardized amino acids (an assortment of one each of the smallest regular packages of the products listed below) for $89.50.

All products are laboratory tested by every available technique for rigid specification adherence to assure highest possible purity with criteria to meet the exacting requirements of Biochemical Research. Detailed analysis of al materials upon request.

Whether you order a single gram of one of our biochemicals . . . or stock your entire lab, NBCo handles your order carefully, efficiently and immediately. Phone collect, 216-662-0212 (U.S.A. only). NBCo guarantees shipment within 60 minutes of your call, one-day delivery anywhere in the continental U.S.A., 80 hours anywhere in the world.

Send for our free catalog containing more than 3000 items.

NUTRITIONAL BIOCHEMICALS CORPORATION

21010 Miles Ave. • Cleveland, Ohio 44128

DL Alpha Alanine
Beta Alanine (2 Amino Propionic Acid)
DL a-Amino-n-Butyric Acid
Aminoacetic Acid (Glycine)
L Arginine (Free Base)
L Arginine HCl
DL Asparagine Monohydrate
L Asparagine (Anhydrous)
DL Aspartic Acid
L Aspartic Acid
Betaine Hydrochloride
Betaine (Monohydrate)
Creatine C.P. (Monohydrate)
Creatinine
Creatinine, Zinc Chloride
L Cysteine (Free Base)
L Cysteine Hydrochloride H_2O
L Cystine

DL Tryptophane
L Tryptophane
DL Glutamic Acid (Monohydrate)
L Glutamic Acid HCl
L Glutamine (Reagent)
DL Histidine HCl (Monohydrate)
L Histidine (Free Base)
L Histidine HCl N.F. VIII (H_2O)
DL Homocystine
Hydroxy-L-Proline
DL Isoleucine (50% L Isoleucine)
DL Leucine
L Leucine (Methionine Free)
DL Lysine HCl
L Lysine Monohydrochloride
DL Methionine
L Methionine
L Monosodium Glutamate

DL Norleucine
DL Norvaline
DL Ornithine Monohydrochloride
DL Phenylalanine
L Phenylalanine
L Proline (Hydroxy-L-Proline Free)
Sarcosine Hydrochloride
DL Serine
Taurine
DL Threonine (Allo Free)
DL Tryptophane
L Tryptophane
3, 5 Diiodo-L-Tyrosine
DL Tyrosine
L Tyrosine
DL Valine

26 November 1965
Vol. 150, No. 3700

SCIENCE

SCIENCE is published weekly on Friday and on the fourth Tuesday in November by the American Association for the Advancement of Science, 1515 Massachusetts Ave Washington, D.C. 20005. Now combined with **The Scientific Monthly®**. Second-class postage paid at Washington, D.C. Advancement of Science. Annual subscriptions $8.50; foreign postage, $1.50; Canadian postage, 75¢; single copies, 35¢, except **Guide to Scientific Instruments**, which School year subscriptions: 9 months, $7, 10 months, $7.50. Provide 4 weeks' notice for change of address, giving new and old address and zip numbers. Send a address label. SCIENCE is indexed in the **Reader's Guide to Periodical Literature.**

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

The great horned owl (*Bubo virginianus*) is widely distributed throughout the timbered regions of North, Central, and South America, from the arctic regions to the Straits of Magellan. It is a ravenous feeder on a great variety of animal life, and a generous provider for its young. Almost any living creature that walks, crawls, flies, or swims, except the larger mammals, is its prey. See review of *Encyclopedia of the Life Sciences*, page 1151. [Ellen Kolansky, *Science*]

Service fast as lightning

No matter where you're located, you get lightning fast delivery of 'Baker Analyzed' Reagents. See the page opposite for the distributors in your area. You'll find none better!

You can now select from our complete line of almost 6,000 laboratory chemicals. Consolidate your purchases for added economy. Specify J. T. Baker and be sure of getting the finest laboratory chemicals available. Write for our new combined Laboratory Chemicals Catalog 660 listing the complete line of J. T. Baker inorganic and organic chemicals. Address: J. T. Baker Chemical Co., Phillipsburg, N. J.

J.T. Baker Chemical Co.

'BAKER ANALYZED' REAGENTS • LABORATORY ORGANICS • SPECIALTY GASES

ALABAMA
E. H. Sargent & Co.
Birmingham
251-5125

ARIZONA
Van Waters & Rogers, Inc.
Phoenix
ALpine 4-6111
Van Waters & Rogers, Inc.
Tucson
793-9371

CALIFORNIA
Van Waters & Rogers, Inc.
Los Angeles
269-9311
Van Waters & Rogers, Inc.
San Diego
262-0711
Van Waters & Rogers, Inc.
San Francisco
DElaware 4-2600
Van Waters & Rogers, Inc.
West Sacramento
FRontier 1-7600
E. H. Sargent & Co.
Anaheim
PRospect 2-3550

COLORADO
Van Waters & Rogers, Inc.
Denver
388-5651

CONNECTICUT
Brand-Nu Laboratories, Inc.
Meriden
BEverly 5-7989

DISTRICT OF COLUMBIA
J. T. Baker Chemical Co.
Muirkirk, Md.
776-7434

FLORIDA
W. H. Curtin & Co.
Jacksonville
ELgin 5-5426

GEORGIA
W. H. Curtin & Co.
Atlanta
351-3872
Will Scientific Inc. (Ga.)
Atlanta
874-3872
Estes Surgical Supply Co.
Atlanta
JA 1-1700

HAWAII
Van Waters & Rogers, Inc.
Honolulu
50-7431

ILLINOIS
A. Daigger & Co.
Chicago
644-9438
LaPine Scientific Co.
Chicago
735-4700
E. H. Sargent & Co.
Chicago
SPring 7-2700
Schaar Scientific Co.
Chicago
NAtional 5-7000
Scientific Glass App. Co., Inc.
Elk Grove Village
HEmpstead 9-2500
Stansi Scientific Co.
Chicago
276-8737
Wilkens-Anderson Co.
Chicago
EVerglade 4-4433

INDIANA
Curtis & French, Inc.
Indianapolis
WAlnut 6-5301

KENTUCKY
Preiser Scientific, Inc.
Louisville
636-3307
Steidle Chemical Co., Inc.
Louisville
583-3183

LOUISIANA
W. H. Curtin & Co.
New Orleans
524-0475

MARYLAND
Will Scientific Inc. (Md.)
Baltimore
Dickens 2-4850

MASSACHUSETTS
Doe & Ingalls, Inc.
Everett
387-4610
Hampden Color & Chem. Co.
Springfield
RE 2-2112
Howe & French, Inc.
Boston
426-5910
Macalaster-Bicknell Co., Inc.
Sub. of Will Scientific, Inc.
Cambridge
547-6933

MICHIGAN
Eberbach & Son Co.
Sub. of Will Scientific, Inc.
Ann Arbor
662-5634
Haviland Products Co.
Grand Rapids
EMpire 1-6691
E. H. Sargent & Co.
Detroit
WEbster 1-0337

MINNESOTA
Lerlab Supply Co.
Hibbing
AMherst 2-3456
Physicians & Hosp. Supply Co.
Scientific & Laboratory Div.
Minneapolis
333-5251
Geo. T. Walker & Co.
Minneapolis
333-3343

MISSOURI
Kansas City Lab. Supply Co.
Kansas City
JEfferson 1-7745

NEW JERSEY
J. & H. Berge, Inc.
S. Plainfield
757-8100
Macalaster Bicknell Co.
Milville
825-3222
Para Lab. Supply Co.
Trenton
TUxedo 2-4545
E. H. Sargent & Co.
Springfield
DRexel 6-7050
Scientific Glass App. Co., Inc.
Bloomfield
748-6600
Seidler Chem. & Supply Co.
Newark
MArket 2-4495

NEW MEXICO
Van Waters & Rogers, Inc.
Albuquerque
344-3407

NEW YORK
Albany Laboratories, Inc
Albany
434-1747
Amend Drug & Chem. Co., Inc.
New York
228-8920
Collier Chemicals, Inc.
Binghamton
723-5455
Greiner Scientific Corp.
New York
WOrth 6-4700
LaPine Scientific Co.
Irvington-on-Hudson
LYric 1-8900
New York Lab. Supply Co.
New York
CAnal 6-6504
Will Scientific of Buffalo, Inc.
Buffalo
885-6383
Will Scientific of N.Y.C., Inc.
New York
CYpress 4-3000
Will Scientific, Inc.
Rochester
BRowning 1-8200

NORTH CAROLINA
Carolina Biological Supply Co.
Burlington
584-8801

OHIO
Inland Chemical Corp.
Reagent & Scientific Div.
Toledo
243-5295
K & L Scientific Co.
Sub of Will Scientific, Inc.
Columbus
CApitol 8-5527

OKLAHOMA
W. H. Curtin & Co.
Tulsa
LUther 5-5757
Melton Company, Inc.
Labco Scientific Div.
Oklahoma City
CEntral 5-7481

OREGON
Scientific Supplies Co.
Div. of Van Waters
& Rogers, Inc.
Portland
CApital 2-1721

PENNSYLVANIA
Arthur H. Thomas Company
Philadelphia
MArket 7-5600
Bellevue Surgical Supply Co.
Reading
376-2991
Edward P. Dolbey & Co., Inc.
Philadelphia
EVergreen 2-6100
J. T. Baker Chemical Co
Pittsburgh—Penn Hills
371-5488
Scientific Supplies Co.
Philadelphia
BAring 2-5655

PUERTO RICO
H. V. Grosch Co.
San Juan

TENNESSEE
Fillauer Surgical Supplies, Inc.
Chattanooga
267-1161

TEXAS
Chem-Products
Austin
GReenwood 7-6813
W. H. Curtin & Co.
Dallas
RIverside 7-2503
W. H. Curtin & Co.
Houston
WAlnut 3-1661
E. H. Sargent & Co.
Dallas
FLeetwood 2-8411

UTAH
Van Waters & Rogers, Inc.
Salt Lake City
DAvis 8-1112

VIRGINIA
Phipps & Bird, Inc.
Richmond
MIlton 4-5401

WASHINGTON
Scientific Supplies Co.
Div. Van Waters & Rogers, Inc.
Seattle
MUtual 2-3460

WEST VIRGINIA
Preiser Scientific, Inc.
Charleston
343-5515
Will Scientific Inc. (W. Va.)
S. Charleston
POplar 8-1281

WISCONSIN
Roemer-Karrer, Inc.
Milwaukee
271-0468

CANADA

EDMONTON, ALBERTA
Canadian Lab. Supplies, Ltd.
454-6514

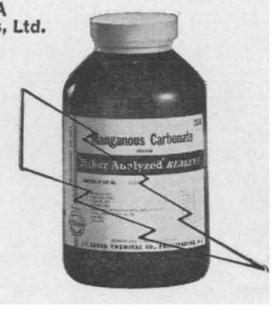
MONTREAL, QUEBEC
Canadian Lab. Supplies, Ltd.
748-8773

OTTAWA, ONTARIO
Canadian Lab. Supplies, Ltd.
729-5183

TORONTO, ONTARIO
Canadian Lab. Supplies, Ltd.
Toronto
255-5501

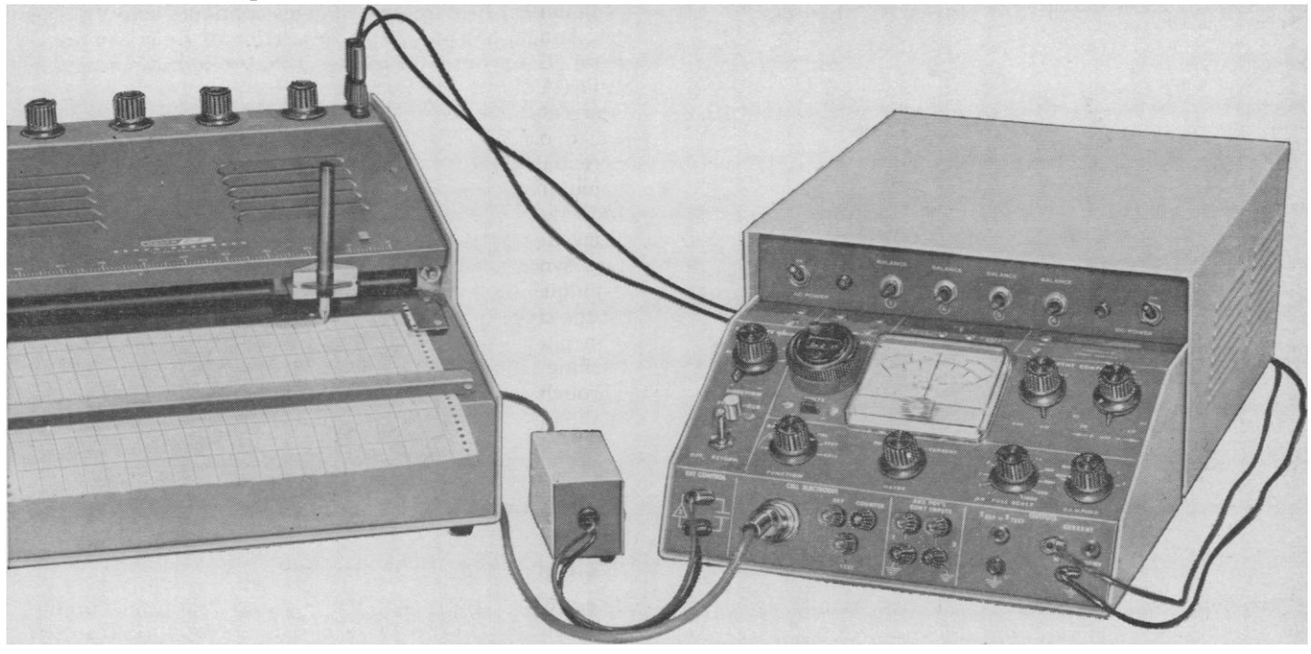
VANCOUVER, B. C.
Canadian Lab. Supplies, Ltd.
682-4291

WINNIPEG, MANITOBA
Canadian Lab. Supplies, Ltd.
SPruce 4-1945



NEW! from HEATH

a Complete Controlled Potential Polarography System For Less Than $500



...The Heath Malmstadt-Enke EUW-401

Featuring An Electronically Produced Controlled Potential ... The Heath Malmstadt-Enke Polarography System produces a precision controlled electronic sweep potential through the combined functions of the EUW-19A Operational Amplifier, and the direct plug-in EUA-19-2 Polarography Module. The sweep potential is adjustable to 6 calibrated rates accurate to ± 1%. In addition, the Polarography System provides for the measurement of electrode currents from 0.5 to 1000 microamperes full scale, 5 degrees of damping for recording d.m.e. currents, continuously variable initial potential, adjustable electrode current suppression, and adjustable charging current suppression. The circuit includes a very high input impedance follower amplifier to enable use with any reference electrode, and low impedance outputs for recording both current and voltage readout. A panel meter shows electrode current or voltage for manual polarography and amperometric titrations. With appropriate function generators and readout devices supplied by the customer, the Heath Polarography System is adaptable to many additional highly sophisticated polarographic techniques. It features a fast-response potential control section with external control inputs for use with AC, oscillographic, harmonic, phase, and other specialized techniques of polarography. The System is completed by the Heath Malmstadt-Enke EUW-20A Servo Chart Recorder, providing readout for conventional 2-electrode, and 3-electrode polarography.

EUA-19-2 Polarography Module (factory assembled & tested).....**$185.00**
EUW-19A Operational Amplifier (factory assembled & tested).....**$135.00**
EUW-20A Chart Recorder (factory assembled & tested).....**$199.00**
EUW-401, Complete Polarography System (consists of EUA-19-2, EUW-19A, EUW-20A) **$499.00**
Further educational discounts available.

With suitable electrodes, burettes, etc., the Heath Malmstadt-Enke Polarography System (EUA-19-2 & EUW-19A combination with direct reading or EUW-20A Servo Chart Recorder readout) enables these modes of operation:

- **2-electrode (conventional) Polarography**
- **3-electrode (non-aqueous or high-resistance) Polarography**
- **Manual Polarography**
- **Amperometric Titrations**

With suitable electrodes, burettes, etc., and specialized function generators & readout devices supplied by the customer, the Heath Malmstadt-Enke Polarography System can be used for these and many more modes of Polarography:

- **Coulometry**
- **Cyclic Polarography**
- **Harmonic & Phase Polarography**
- **AC Polarography**
- **Oscillographic Polarography**

See the Heath Malmstadt-Enke Polarography System in operation at the American Chemical Society Show, Atlantic City, N. J. Sept. 14, 15, 16, Booths 505 & 507.

HEATH Built

FREE 1966 CATALOG!

See the wide array of Heathkit electronic equipment for the laboratory, classroom, and the hobbyist. Many instruments in both kit and assembled form ... save up to 50%. Send for your Free Copy Today!

Heath Company, Dept. 37-11, Benton Harbor, Michigan 49023
In Canada: Daystrom, Ltd., Cooksville, Ontario

☐ Please send FREE 1966 Heathkit Catalog and place me on your permanent educational mailing list.

Name_____

Address_____

City_____ State_____ Zip_____

Prices & Specifications subject to change without notice. EK-184

. . . . Secret things are revealed only to initiates. It is forbidden to reveal them to profane persons before they are initiated into the mysteries of knowledge. . . .

In commenting on this passage, the classical scholar Werner Wilhelm Jaeger goes on to observe:

Here we have mankind divided, as if by a religious rite, into two classes, one of which is severely debarred from an arcane knowledge . . . [*Paidea*, (Oxford Univ. Press, New York, 1944), vol. 3, p. 10].

No modern scientist consciously withholds knowledge as suggested in the passages quoted, yet we are all impelled, in one way or another, to retain the seventh veil around those matters that are closest to our professional lives.

I am far from proposing this as the root cause of scientists' notorious failure to communicate to a lay public. I only suggest that the reasons for this failure may lie deeper than mere indifference, a technical vocabulary, or lack of dramatic flair.

J. S. ROBOTTOM
Graduate Research Center for the Southwest, Dallas, Texas 75230

Education and Support of Scientists

An article by Adolf Butenandt, president of the Max-Planck-Gesellschaft, in *Bulletin No. 111 of the West German Press and Information Office* (Bonn, 1965), deals with the sponsoring of research in the Federal Republic, but many points made in it are universally applicable and should be of interest to American scientists. Following are a few translated excerpts:

The building of immense institutes whose dimensions reach beyond the available intellectual capacity may quite conceivably be the reverse of meaningful research support. . . .

Investment in research is economically as sound as any other logical investment. The meaning of research here is rather broad and without a borderline between basic and applied, for "research is a unit." . . .

Basic research should and must be supported without planned partiality and to an extent determined by the number of available productive minds and facilities. . . .

Careful evaluation of the literature gives the impression that publication of industrial research findings is much more restrained in Germany than in the United States or Switzerland. . . .

I would like to comment as follows on the natural sciences, especially the field of chemistry: I am definitely convinced through my experiences that a young scientist will reap the most profit in his later professional career if the fundamentals of his initial training are widely extended and if all early specialization is avoided. Of course, a dissertation will always be specific, but the nature of this detailed topic is of no importance at all. Its major purpose must be to supply the aspiring researcher with an opportunity for observation, critical thought, orderly experimentation, and an understanding of casual reasoning. These processes can be learned on any chemical problem and can be effectively applied in the solving of any problematical situation. . . .

With regard to training and course work for our students, I consider as best promoting our research effort that education which is general in scope and which does not aim at a future professional specialty. . . .

A professional education which is formally ended when the student is 30 years of age cannot be any good; it should be reduced by at least three or four years. . . .

The 1963 Student Guide of the Technische Universität Berlin contains the following words of Professor Kniehahn: "A preferably brief university education is not to fill a vessel, but to kindle a fire. The world should not be supplied with supersaturated or conceited intellectuals, but with unfinished, yet hopeful, human beings still capable of generating enthusiasm." . . .

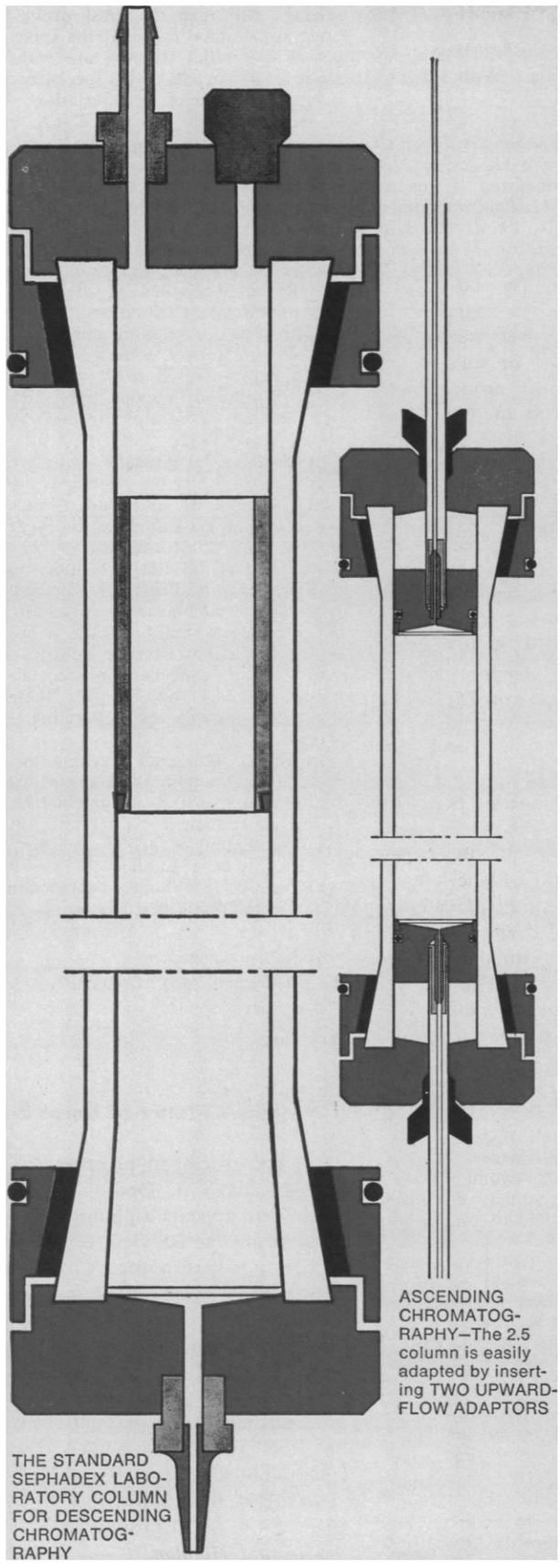
A future researcher learning the basic facts of his discipline should not disregard this statement of the late psychiatrist Ernst Kretschmer; "Science is a matter of character, a matter of denial and firm compliance, it is a matter of integrity, of steadfastness, of honest conviction and of an infinite will to achieve."

MANFRED KROGER
College of Agriculture, Pennsylvania State University, University Park

Erratum: A Matter of Local Pride

In the article on plankton by J. L. Brooks and S. I. Dodson (1 Oct., p. 28), there appears a photograph identified as an "aerial view of Cedar and Linsley ponds (Branford, Connecticut)." These ponds are located in the Town of North Branford, not Branford, North Branford having been legally set apart from Branford in 1831. As a lifelong resident of North Branford, I know that the residents take particular pride in the fact that these bodies of water, commonly known as Twin Lakes, are situated in their town.

ELLSWORTH B. FOOTE
Foote and Hannan, 265 Church Street, New Haven, Connecticut 06501



ASCENDING CHROMATOGRAPHY—The 2.5 column is easily adapted by inserting TWO UPWARD-FLOW ADAPTORS

THE STANDARD SEPHADEX LABORATORY COLUMN FOR DESCENDING CHROMATOGRAPHY

Especially designed for Gel Filtration Chromatography Ion Exchange Chromatography

Sephadex®

Laboratory Columns

A product of over six years' research know-how brings you these "exclusive" column features:

1 SPECIAL DESIGN BED SUPPORT—eliminates troublesome sintered glass disc

2 MIXING CHAMBER—of less than 1/10% of bed volume minimizes sample dilution to insure optimal zone sharpness for critical separations

3 INERT NYLON NETTING—on both the sample applicator and bottom endpiece eliminates adsorption of biologic material

4 DESCENDING TO ASCENDING SYSTEM—easily converted by replacing both endpieces with upward-flow adaptors

5 SAMPLE APPLICATOR—distributes the sample evenly over the bed surface to insure sharp zones for critical separations as well as to protect and stabilize the bed

6 STRAIGHT COLUMN DESIGN—eliminates zone interaction by insuring horizontal flow

7 UNIQUE COLUMN DESIGN—allows for interchanging of parts, replacement of broken parts, and it can easily be assembled or disassembled for cleaning and storage

8 SELECTED CONSTRUCTION MATERIAL—to avoid destruction of sensitive biologic materials

Available Sephadex Columns and Accessories

Type	LABORATORY COLUMNS	Size
Sephadex Column		1.5 cm x 30 cm
Sephadex Column		1.5 cm x 90 cm
Sephadex Column		2.5 cm x 45 cm
Sephadex Column		2.5 cm x 100 cm
Type	**COOLING JACKETS**	**Size**
Sephadex Cooling Jacket		To fit 2.5 cm x 45 cm column
Sephadex Cooling Jacket		To fit 2.5 cm x 100 cm column
Type	**UPWARD-FLOW ADAPTORS**	**Size**
Upward-Flow Adaptor		To fit the 2.5 cm Sephadex Column

Information Service A comprehensive reference list, abstract cards, and other information on Sephadex columns and products are available. Direct inquiries on your letterhead to the local Pharmacia representative or to:

PHARMACIA FINE CHEMICALS INC.
800 Centennial Avenue, Piscataway, N. J. 08854

(Inquiries outside North America should be directed to PHARMACIA FINE CHEMICALS, Uppsala, Sweden.)

CHARGED PARTICLES

Extending the capabilities of research equipment

Results from Tandem Research Program

The Tandem Research Group has made notable progress in the past year. Significant experimental results from the program are:

1. 250 mA high-brightness positive ion beam from an expanded-plasma source operating at 38 kv.

2. 270 μA analyzed beam of H_1^+ ions out of the Research Tandem with 320 μA H^- injection and water-vapor stripping.

3. 2.0 μA analyzed dc beam of He^- ions. The previous maximum current routinely available has been 0.1 μA with the EN source.

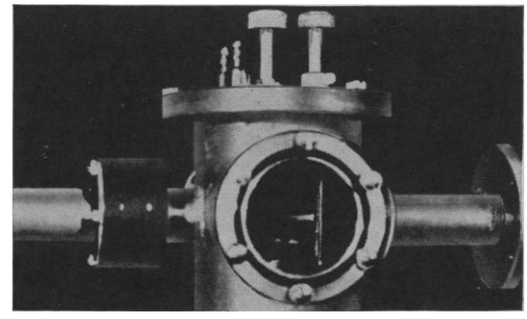
Doubly Charged Helium Ions

Components are now available for converting 3, 4 and 5 MeV machines to produce He^{++} ions at higher energies. Specifications: 30 μA at 5.0 MeV; 10 μA at 7.0 MeV; 5 μA at 10.3 MeV. More than double this current performance has been demonstrated but with some loss in stability and reliability. Multiple-charge states (2, 3 and 4) of neon, oxygen and nitrogen have also been produced with the new kit installed in a 3 MeV Van de Graaff. Beam energies from 5.04 MeV to 9.8 MeV and beam currents from 0.1 to 10 μA were observed. For details on the new HE^{++} kit and experimental results, write for Technical Note #13.

Optical Spectroscopy of Excited Atomic States

When an energetic beam of ions is passed through a thin foil, the charge state of the ion may change, either up or down. The emitted particles may be left in states of electronic excitation from which visible light is subsequently emitted during de-excitation. The emitted light spectrum is characteristic of the excited ion. When particle beams of approximately 0.4 μA or more are used, the light is sufficiently intense for spectroscopic analysis.

The refinement and application of this technique promises to be of major importance in the theory of atomic structure, in measuring hot plasma temperatures, and in acting for the means of energy loss in fast fission fragments in an absorber. Perhaps most importantly, it will help determine the relative abundance of the elements in the sun and other stars, which is the basis for theory of stellar evolution, the origin of the chemical elements, the age of astronomical objects and the nature of the stellar energy. For further details, ask for Technical Note #10.

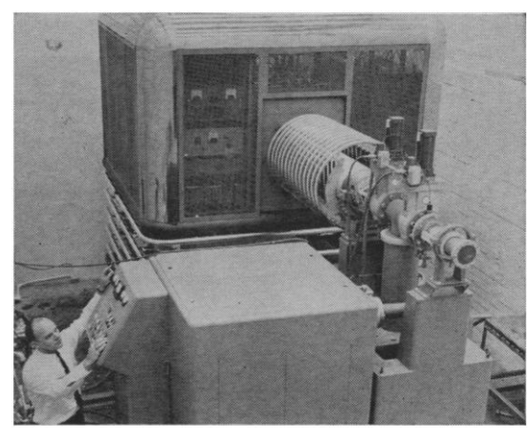


A nitrogen beam, 0.8 μA at 2 MeV, passes from right to left through a carbon foil approximately 9 $\mu g/cm^2$ thick.

Intense Ion Beams at 500 kv

The ICT-500 keV positive ion accelerator now being built by High Voltage Engineering operates at energies from 100 to 500 keV dc and pulsed. In performance tests, the machine has produced analyzed ion beam currents from 4 mA at 100 keV to 10 mA from 300 to 500 keV. 10 mA dc positive ion beam currents of H^1, H^2, and D^1 have been produced at a target located 6 feet from the end of the acceleration tube. Beam diameter is 15 millimeters maximum for all particles over the entire energy range. Previous experience with a similar machine of 300 keV maximum energy showed 15 mA of d_2^+ and a 3 centimeter beam diameter. The ICT-500 positive ion accelerator is designed for dc and pulsed operation in the nanosecond and microsecond range with a minimum pulse length of 2 nsec. at a repetition rate of 2.5 Mc/s. Pulse content is 1 mA protons and 0.7 mA deutrons.

The particle source utilized with the ICT-500 positive ion accelerator is an expanded plasma type which has produced 70 mA total beam at 500 kv.



The high-brightness, intense ion beam produced by the ICT-500 accelerator is eminently suited for laboratory production of 14 MeV neutrons for cross-section measurements, dosimetry studies, weapons-effect simulation and special low-density target experiments.

For detailed information, write to Technical Sales, High Voltage Engineering Corp., Burlington, Mass. or HVE (Europa) N. V. Amersfoort, The Netherlands. Subsidiaries: Electronized Chemicals Corporation, Ion Physics Corporation. ARCO Division, Walnut Creek, California.

HIGH VOLTAGE ENGINEERING

26 November 1965, Volume 150, Number 3700

SCIENCE

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Phone: 202-387-7171. Cable: Advancesci, Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. ADVERTISING CORRESPONDENCE: Rm. 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE 6-1858.

Japan Points a Way

In many sciences, as in biology today, the conceptual fabric has changed fundamentally in the past 15 years. Together with the important task of resynthesizing our knowledge, new and old, we face the imperative task of retraining teachers at all levels, but especially in the lower schools. It is no longer endurable to permit teachers to continue using a stock in trade acquired 30, or even 15, years ago. Summer institutes are only a partial answer. In 12 years they have involved only about one-third of all our secondary-school science teachers, and those, because of qualifications for admission, the better ones. Moreover, the courses provided in summer science institutes often do not present material prepared to bring teachers up to the level of modern thinking across the advancing front in biology, chemistry, physics, or earth sciences.

In the United States the principal effort toward reform has been the curriculum studies, which are producing a revolution in American high school teaching and will shortly pose serious problems for college teachers, presenting them with an influx of better prepared and better motivated students than they are accustomed to expect. In Japan another approach has been developed, one of tremendous promise. Through local pressure from teachers and schools, some of the prefectures began to establish "science education centers" about five years ago. The first ones proved so successful that the movement rapidly spread, until today nearly every prefecture in Japan has such an institution.

Each center has a laboratory for physics, for chemistry, for biology, and for earth sciences. There is a permanent staff, usually of 8 to 12 persons, two or three for each science. A Ph.D. working with two experienced former secondary school science teachers is the usual unit. Groups of 25 to 30 teachers are enrolled in short, specially planned refresher courses and courses dealing with modern teaching methods. Other groups of teachers, on leave from their schools, may spend half a year in residence. Inasmuch as teachers in Japan are regularly employed on a 12-month basis, they can be required to participate in courses given during the school's vacation time; but they are so eager to do so that little suasion is needed. Some centers provide dormitories for the teachers in residence; others depend on local lodgings. Many teachers commute from their homes.

I was privileged to visit six of these institutions, while courses were in progress. The instructors were well acquainted with the new science curricula developed in the United States and were using them as a basis of much of their training programs. Not uncritically, however! Constructive criticism and improvement of the American materials was going on, as well as adaptation for Japanese conditions. One demonstration class of high school students taught by a teacher enrolled in the course was the finest science teaching I have ever seen. The students were led to develop their own experimental investigations of an enzyme in the true spirit of scientific inquiry. Although the Japanese Science Education Centers are insufficient in size to permit rotation of all teachers in any prefecture through them in a period of 5 or even 10 years, their permanent status as elements of a successful local school system is assured. So evident is their success that they are now being expanded to include retraining courses for teachers in *all* subjects.

—BENTLEY GLASS, *State University of New York, Stony Brook*

BERKELEY • 132nd AAAS MEETING • 26-31 DECEMBER

Order Your General Program

It provides complete, detailed information about all the sessions and symposia scheduled, the Annual Exposition of Science and Industry, and the Science Theatre.

Program Highlights

Moving Frontiers of Science: F. Clark Howell on Significant Advances in Human Evolutionary Studies; Norman F. Ness on A New Look at the Earth's Magnetic Field; Jerome Y. Lettvin on Physiological Basis of Mental Activity; and William M. Fairbank on Some Aspects of Low Temperature Physics.

AAAS Distinguished Lecture: Genetics and Cultural Change by George W. Beadle, president, University of Chicago.

Interdisciplinary Symposia: Ground-level Climatology; Proteins and Nucleic Acids; Materials Science in Medicine, Dentistry, and Pharmacy; Behavior, Brain, and Biochemistry; Mathematical Bases in Economic Planning.

Special Sessions: AAAS Presidential Address on Antarctica: Continent of International Science by Laurence M. Gould; the Joint Address of Sigma Xi and Phi Beta Kappa by J. Bronowski; the George Sarton Memorial Lecture by Stillman Drake on "The Accademia dei Lincei"; and the National Geographic Society Illustrated Lecture.

AAAS Committees: Special Program of the AAAS Committee on Council Affairs on Civil Defense: Speakers: Eugene Wigner, Wolfgang Panofsky, Owen Chamberlin, Fred Payne, Barry Commoner, Bentley Glass, and Anatol Rapoport, moderator, and Henry Eyring, chairman; Committee on Desert and Arid Zones Research.

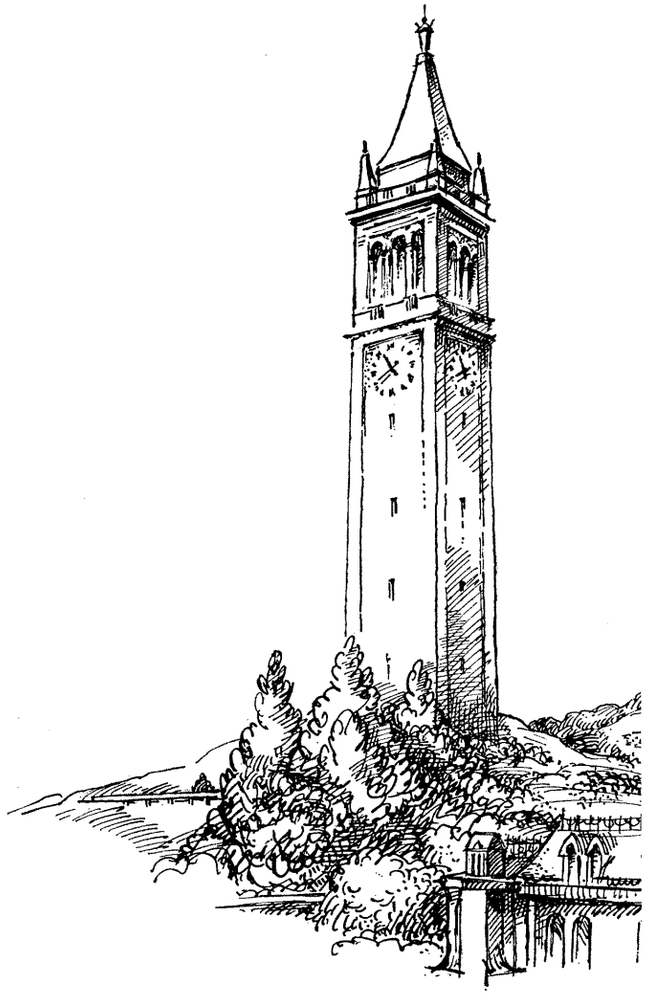
Lawrence Hall of Science: Director Harvey E. White will lecture twice on this splendid Center of Science Education, 27 and 29 December.

Sections and Societies: The 20 AAAS Sections and some 92 participating societies are scheduling specialized symposia and papers.

AAAS Science Theatre: The latest foreign and domestic films.

Exhibits: The Annual Exposition of Science and Industry is on the lower level of the ASUC Student Center, AAAS Headquarters.

Advance Registration: By registering in advance, you avoid delay at the Registration Center on arrival; you receive the **General Program** in time to plan your days at the meeting; and your name is posted in the Visible Directory when the meeting opens. Use the coupon below.



AAAS
1515 Massachusetts Ave., NW
Washington, D.C. 20005

(Check 1a or 1b) 1a. ☐—Enclosed is $5.00 Advance Registration Fee. This brings me the **General Program** and a **Convention Badge.**

1b. ☐—Enclosed is $3.00 for the **General Program.** (If I attend the meeting, the Badge, which I need to obtain the privileges of the meeting, will cost me $2.00 more.)

2. FULL NAME (Dr., Miss, etc.) .....
(Please print or typewrite) (Last) (First) (Initial)

3. OFFICE ☐ OR HOME ☐ ADDRESS .....
(For receipt of General Program)

CITY ..... STATE ..... ZIP CODE .....

4. ACADEMIC, PROFESSIONAL, OR BUSINESS CONNECTION .....

5. FIELD OF INTEREST .....

6. CONVENTION ADDRESS .....
(May be added later, after arrival)

Please mail this coupon and your check or money order for the total amount to the AAAS in Washington, D.C. (address as shown)

a

BERKELEY • 132nd AAAS MEETING • 26-31 DECEMBER

Make Your Reservations

Make sure you have the sleeping accommodations you prefer. Since this is a campus meeting—and the ASUC Student Center is AAAS headquarters—society headquarters will be mainly in university buildings.

Hotel and Motel Information. A deposit of $5 is required by all hotels and motels. Deposits are credited toward the final bill, and are refunded if cancellation is received not later than 10 days before the date of your reservation. Make checks payable to the AAAS Housing Bureau.

Residence Hall Information. Accommodations are available for one or two persons per room, for couples, and for children 14 years or older. Hours for room registration at the Hall are 8:00 a.m.–10:30 p.m. daily. The full amount for room, with or without meals, is collected in advance. There is a special charge for overnight 30 December (no meals December 31): $6.00 single occupancy, $5.00 per person double. Parking is 50¢ per 24-hour day. The general deadline for residence hall reservations is 10 December.

For more details on all of the above facilities and services, see the 23 July issue of Science, page 454.

The hotel, motel, and residence hall sleeping accommodations are for your convenience in making your room reservation in Berkeley. **Please use the coupon below and send it and any necessary deposit directly to the AAAS Housing Bureau in Berkeley**. Give a definite date and estimated hour of arrival, and also your probable date of departure. The Housing Bureau will make the assignment and promptly send you a confirmation.

AAAS Housing Bureau
P.O. Box 210
Berkeley, California 94701

Date of Application ..... Deposit of $..... enclosed

Please reserve the following accommodations for the 132nd Meeting of the AAAS in Berkeley, 26-31 December 1965

First Choice of Hotel, Motel, or Residence Hall .....**Second Choice** .....

Type of room: Single ☐ Double bed ☐ Double, twin beds ☐ Suite ☐ Rate: Desired ..... Maximum rate.....

Number in party ..... Sharing this room will be: .....
(List name and address of each person, including yourself. Attach list if space is insufficient.)

.....

DATES: ARRIVAL ..... A.M. .....P.M. ..... DEPARTURE .....
(These must be indicated—add approximate hour, A.M. or P.M.)

NAME .....
(Individual requesting reservation) (Please print or type)

ADDRESS .....
(Street) (City) (State) (ZIP Code)

Mail this coupon now to the AAAS Housing Bureau. Enclose hotel or motel room deposit if needed. Make checks payable to AAAS Housing Bureau. All rooms will be assigned and confirmed in order of receipt of reservation.

Rates per Day

HOTELS	Single	Double	Twin	Suite	Parking
Claremont (300)	$11.00	$15.00	$15.00		Free
Durant (200)	8.50*		12.00*	$18.00-22.00	50¢, $1.00
Shattuck (250)	8.50	11.00	14.00	25.00-35.00	Public
* A few single rooms at $5.50, twins at $7.50.					
MOTELS					
Berkeley House (112)	9.50	13.50	13.50	25.00-28.00	
Berkeley Plaza (52)	7.00	8.50	9.50	15.00	
Berkeley Travelodge (46)	8.00	10.00	11.00		
California Motel (42)	6.50	7.00	8.00		
Golden Bear (44) (and others)	7.00-8.00	8.00-10.00	10.00-12.00	18.00	

RESIDENCE HALLS

Single occupancy—$7.50 without meals; $8.50 with breakfast and lunch
Two in a room—$6.50 each without meals; $7.50 each with breakfast and lunch

A Special Invitation to Graduate Students in the Sciences

from the Board of Directors of the American Association for the Advancement of Science

To encourage membership at the start of a scientific career, AAAS membership is now open to you at a reduced student rate.

The new student rate offers a 2-year membership, including a 2-year subscription to SCIENCE, for $9.00. Regular membership is $8.50 for one year. The many benefits of membership are described on the other side of this page.

Accelerated editorial handling now assures prompt publication of reports. Thus SCIENCE is now receiving an increasing share of the important work in all fields. This suggests that it will be well worth your while to secure your own copy of SCIENCE each week.

An Invitation to AAAS Members

You are cordially invited to make use of the student membership card on this page in entering gift subscriptions for graduate students in science and for those undergraduates who expect to make science their career.

SCIENCE also makes an ideal holiday gift for your professional colleagues. In making up your gift list, consider especially colleagues in other countries. To strengthen international ties in science, AAAS membership is now being opened to scientists in other countries at the same annual dues ($8.50) as that paid by scientists in the U. S. Use the card at the lower right to enter a gift subscription at the regular membership rate, which we will announce by sending a gift card.

AAAS Membership Includes These Benefits:

1. Annual dues of $8.50 include a subscription to SCIENCE, the only U.S. weekly journal of research. Scientists in all fields rely on SCIENCE for news of the significant advances in research. Written and edited by scientists, SCIENCE exploits the speed made possible by modern printing technology for rapid publication of research reports without loss of the reviewing procedures essential for admission of new work to the scientific record. Published by the American Association for the Advancement of Science, SCIENCE is one of the most frequently cited journals in the world's scientific literature.

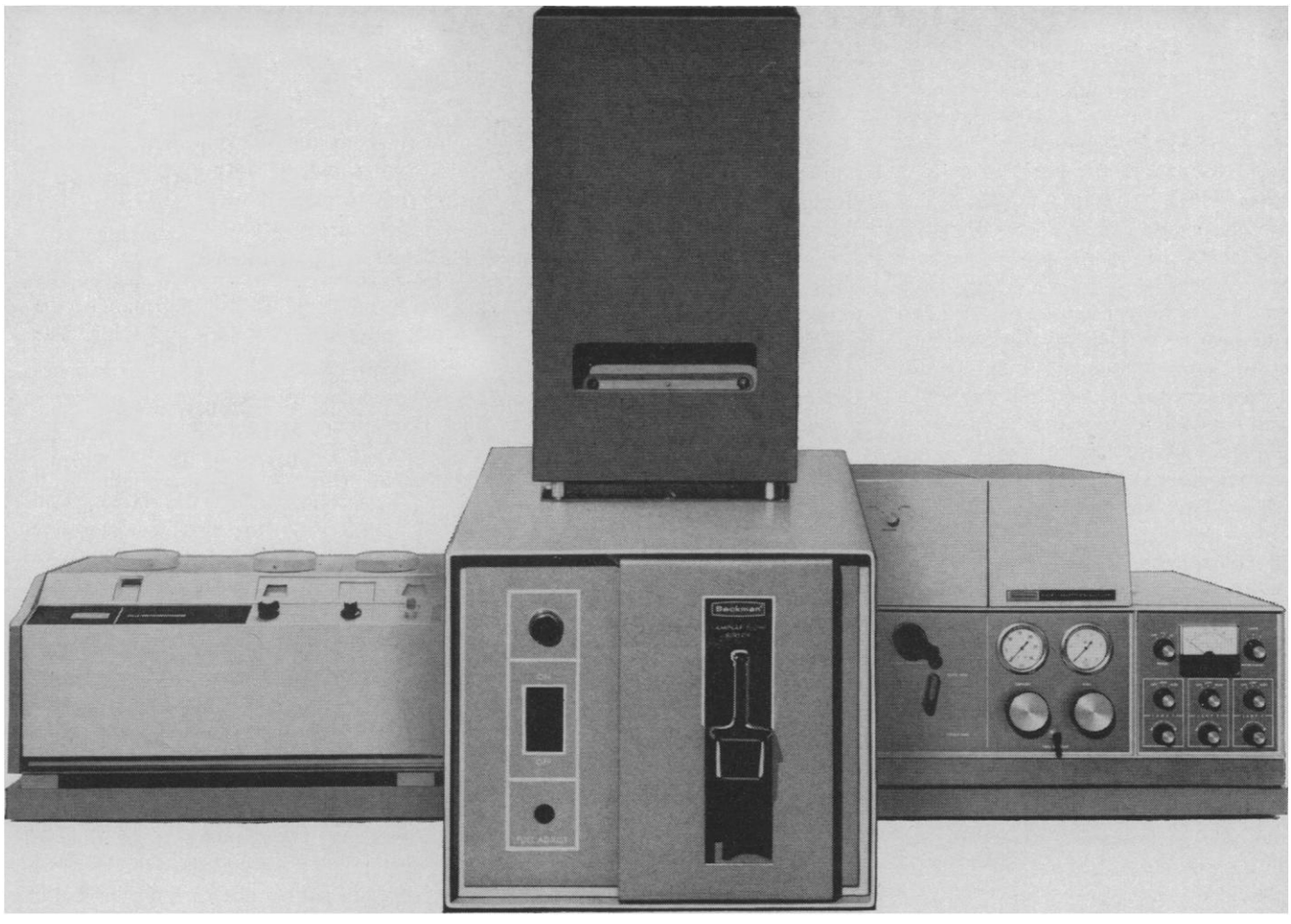
2. Fellowship in AAAS honors meritorious contributions to science and makes members eligible to serve on the AAAS Council, the Association's governing body, or to be elected as officers or directors. Fellows are nominated from among the membership by section secretaries and by other Fellows.

3. All members receive the quarterly newsletter of Association affairs, the *AAAS Bulletin* and may order SYMPOSIUM volumes, reporting advanced work in selected fields of science, at a reduced price for direct, prepaid orders.

4. Members may subscribe at reduced rates to the magazines, DAEDALUS, THE ADVANCEMENT OF SCIENCE, and PERSPECTIVES IN BIOLOGY AND MEDICINE.

5. Members share the satisfaction of supporting AAAS work to

- Improve the effectiveness of science in the promotion of human welfare.
- Increase public understanding of science.
- Improve science education at all levels.



Extend sensitivity six-fold with the most advanced burner in atomic absorption.

It's the new Laminar Flow Burner* on the Beckman Atomic Absorption Accessory. A marked advance in burner design, it increases sensitivity of most analyses six-, ten-, fifteen-fold or more by eliminating the solvent and concentrating the sample before it reaches the flame. Thus, only solid sample is burned... no solvent dilutes it... no solvent cools the flame. With the Beckman Atomic Absorption Accessory, analysis is simple, specific, and highly sensitive... permitting analysis of trace quantities of a great many metals in the parts per billion range... in a variety of applications.

The Atomic Absorption Accessory is designed for use with the Beckman DU®, DU-2, DB®, or DB-G Ultraviolet Spectrophotometer. Add the accessory to the spectrophotometer you already have, and get atomic absorption capability for one-half the cost of most single-purpose atomic absorption instruments. Or buy a new spectrophotometer and accessory for the same cost as most single-purpose instruments. The Beckman system allows you to perform atomic absorption analyses, emission flame photometry, *and* ultraviolet spectrophotometry. Change-over from one type of analysis to another is rapid and easy.

For more information on the Atomic Absorption Accessory, contact your local Beckman Sales Engineer or write for Data File LUV-266.

*PATENT PENDING

Beckman® INSTRUMENTS, INC.
SCIENTIFIC AND PROCESS INSTRUMENTS DIVISION
FULLERTON, CALIFORNIA • 92634

INTERNATIONAL SUBSIDIARIES:
GENEVA; MUNICH; GLENROTHES, SCOTLAND;
TOKYO; PARIS; CAPETOWN; LONDON

be administered orally. This vaccine is especially useful for mass programs designed to eliminate the disease, and—because of its rapid effect—it is also useful in quickly controlling the epidemics.

More than 350,000,000 people all over the world, including more than 100,000,000 in the United States, have now received this oral poliovirus vaccine. Wherever it has been used extensively, both for initial mass vaccination and for subsequent immunization of new generations of children, poliomyelitis has been either completely eliminated or reduced to only a few sporadic cases.

Many have worked towards this objective, and to them we pay high tribute, but Albert Sabin, convinced that poliomyelitis is primarily an infection of the alimentary tract, committed himself to a long, painstaking and difficult search for attenuated strains of the virus that could multiply in the alimentary tract, but not in the central nervous system. After more than two decades of work, he succeeded in isolating clones of poliomyelitis that possessed these properties. He then persistently proceeded to the preparation, testing and proof of the efficacy and safety of the live oral polio vaccine which is now in use throughout the world.

For this work which has dramatized and demonstrated the role that vaccination can play in the control and the elimination of death and crippling disability from the dread disease of polio;

For his numerous contributions in other important areas of virology, bacteriology and protozoology, and

For his scientific integrity and courageous persistence, this 1965 Albert Lasker Clinical Research Award is given.

Meeting Notes

The Association for Computing Machinery will sponsor a symposium on **symbolic and algebraic manipulation** 29–31 March in Washington. Papers are solicited on the implementation of programming systems which manipulate symbolic or algebraic data, and on the applications of such systems. Deadline for receipt of papers: *14 January*. (J. E. Sammet, IBM Corporation, 545 Technology Square, Cambridge, Massachusetts 02139)

The Institute of Electrical and Electronics Engineers group on **microwave theory and technique** will present a symposium in Palo Alto, California, 16–18 May. Papers are requested on all aspects of the field. Summaries: 500 to 1000 words in quadruplicate, abstracts: 200 words, deadline: *3 January*. (L. Young, Stanford Research Institute, Menlo Park, California 94025)

The American University in Cairo, Egypt, is organizing an international conference on **solid state science**, 3–7 September. The topic of the meeting will be "interaction of radiation with solids," including both crystalline and noncrystalline solids. In addition to invited papers, 36 contributed papers will be accepted. Deadline for receipt of titles and abstracts: *15 January*. Accepted papers must be submitted by 1 June. (A. Bishay, Department of Physical Sciences, American University in Cairo, 113, Kasr El Aini Street, Cairo, United Arab Republic)

An international symposium on the **life sciences** will be held at M.I.T. 2–3 December. The topics to be discussed will include molecular structure and the functional organization of cellular constituents; adaptation and functional coordination; and the "future of man and the life sciences." The meeting is part of the celebration to dedicate the new Whitaker building for the M.I.T. Center for Life Sciences. The $5.8 million building provides expanded classrooms, laboratories, and office space for faculty, students, and staff. (J. B. Wiesner, School of Science, M.I.T., Cambridge, Mass.)

Papers are invited for presentation during an international symposium on **gas chromatography** and associated techniques, 20–23 September, in Rome. Areas to be covered include methods, uses, and comparisons with other forms of chromatography. Abstracts: approximately 500; deadline, *1 January*. (A. B. Littlewood, School of Chemistry, The University, Newcastle upon Tyne 1, England)

A national congress of **applied mechanics** will be held 14–17 June at the University of Minnesota, sponsored by the university, the American Institute of Chemical Engineers, and the American Institute of Mechanical Engineers. Papers are invited on experimental and theoretical applied mechanics, including mechanics of rigid bodies, de-

NEW ZEALAND ELECTRON MICROSCOPIST

APPLICATIONS are invited for an **ELECTRON MICROSCOPIST** to join a Research Group in the Meat Industry Research Institute of New Zealand (Inc.), working in the fields of muscle metabolism and structure.

The Institute is the central research organization for the New Zealand Meat Industry, and undertakes both applied and basic investigations. The Electron Microscopist will be encouraged to initiate and conduct original investigations within an active academic and strong research environment. He will also be expected to give advice and help to the adjoining Ruakura Agricultural Research Centre (animal and soil research) of the Department of Agriculture

The Institute's laboratories are spacious, well-equipped, and with excellent library facilities. The electron microscope (Philips E. M. 200) is housed in a newly designed suite.

Applicants are required to have an Honours Degree or equivalent qualification, with experience in the use of the electron microscope, preferably in biological research.

A Superannuation scheme operates, and professional officers are given the opportunity at intervals for overseas study leave.

Passage: Fares for the appointee (and his wife and family, if married) will be paid.

Incidental Expenses: Up to £35 for a single man, and £100 for a married man, can be claimed to cover the cost of taking personal effects to New Zealand.

Salary Range: £1,800 to £2,500 according to qualifications and experience. Prospects of advancement are excellent and will be based on scientific merit.

Further particulars may be obtained from either—The Director, Meat Industry Research Institute of New Zealand (Inc.), P. O. Box 617, Hamilton, New Zealand, or—The Senior Scientific Liaison Officer, New Zealand Scientific Office, Africa House, B.C.S.O., Kingsway, London, England.

Applications, with names of two referees, to be sent (airmail) to either—**The Director, Meat Industry Research Institute of New Zealand (Inc.), P. O. Box 617, Hamilton, New Zealand, or—The Senior Scientific Liaison Officer, New Zealand Scientific Office, Africa House, B.C.S.O., Kingsway, London, England.**

APPLICATIONS will CLOSE on the 31st day of January 1966

formable solids, fluids, and gases, and thermodynamics and heat transfer. Abstracts: 200 words; deadline *15 January*. (R. Plunkett, 107 Aero Building, University of Minnesota, Minneapolis 55455)

Courses

Applications are being accepted for 1966 for a PHS-supported training program in **obstetrics and gynecology** at U.C.L.A. Research training will be provided in cardiovascular, renal, endocrine, placental, and uterine physiology and biochemistry; biomathematical models; and computer simulation. Emphasis will be on application to reproduction in general, including fetal and neonatal states. The training varies from 1 to 2 years. (N. S. Assali, Department of Obstetrics and Gynecology, School of Medicine, U.C.L.A., Los Angeles 90024)

Scientists in the News

Sigmund L. Friedman, staff consultant to the Hospital Review and Planning Council of Southern New York, has been appointed director of the recently established graduate school of medical administration at the New York Medical College.

The American Psychological Association has presented its 1965 gold medal award to **Heinrich Kluver**, of the University of Chicago, for his contributions in psychology, neurophysiology, neurohistology, and psychochemistry.

Ray Pepinsky, formerly chairman of physics and professor of chemistry and physics at Florida Atlantic University, has become a research professor of chemistry and physics at Nova University, Fort Lauderdale, Florida.

Laurence E. Strong, professor of chemistry at Earlham College, has taken a year's leave of absence to co-direct a UNESCO-sponsored project for the teaching of chemistry in Southeast Asia. He will remain in Bangkok, Thailand, until next July.

Thomas L. McMeekin has become a research professor in biology at the University of South Carolina; he retired recently as a research scientist in the Agriculture Department's Eastern