

SCIENCE

NEW SERIES
VOL. 95, No. 2455

FRIDAY, JANUARY 16, 1942

SUBSCRIPTION, \$6.00
SINGLE COPIES, .15



$\frac{1}{5}$ th the Width of a Human Hair

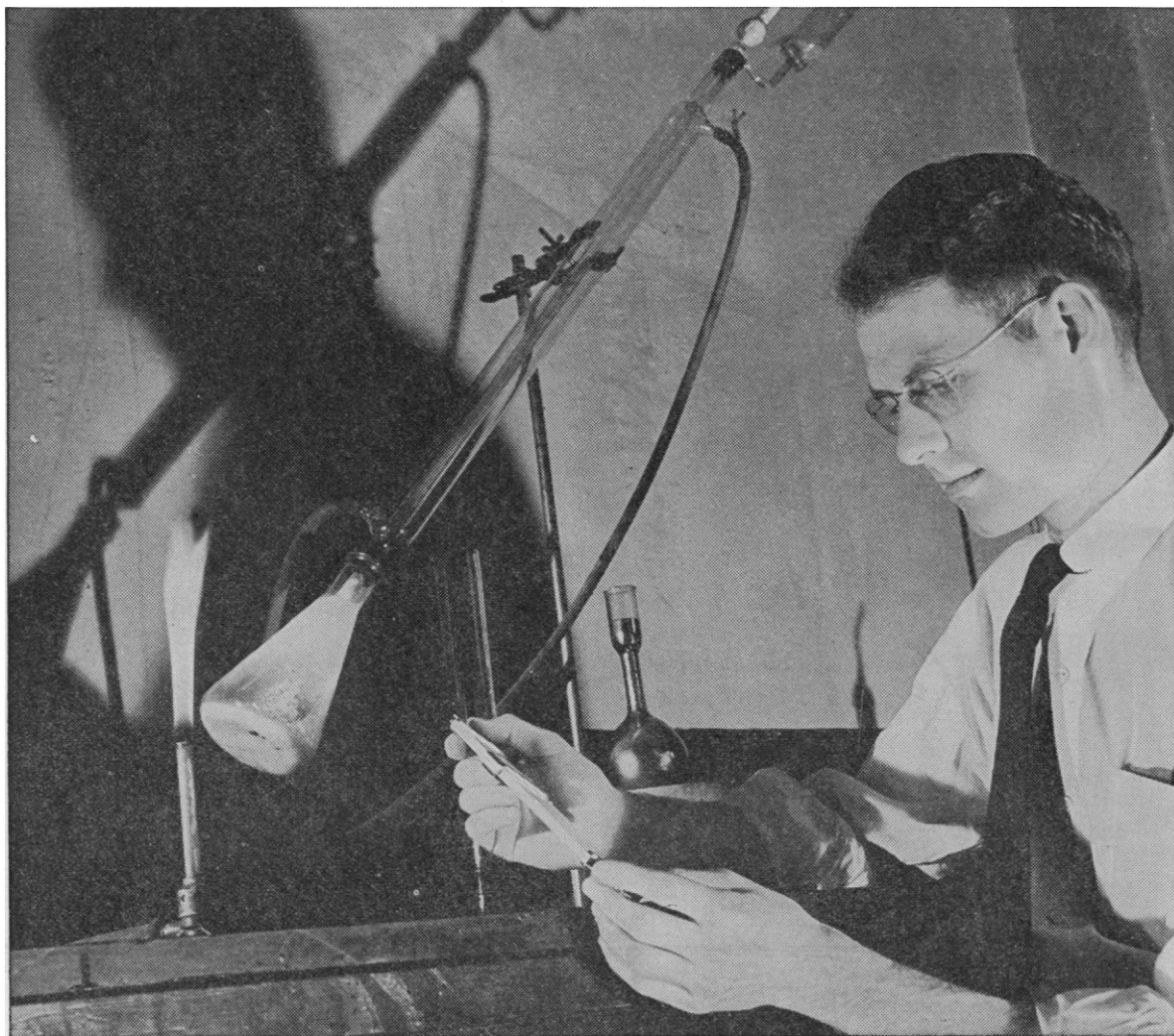
Instruments which play so important a part in national defense call for precision manufacturing methods which Bausch & Lomb have developed over years of producing fine optical instruments. Here, in air-conditioned rooms, deft operators accurately space and engrave lines only $\frac{1}{5}$ th as wide as a human hair on binocular "mil" scales.

Production for Victory has unquestioned priority. While this may cause inconvenience, delay, and sacrifice in filling civilian orders we know it has the unqualified endorsement of everyone with whom America comes first.

BAUSCH & LOMB
OPTICAL CO. • ROCHESTER, NEW YORK
ESTABLISHED 1853

AN AMERICAN SCIENTIFIC INSTITUTION PRODUCING OPTICAL GLASS AND INSTRUMENTS
FOR NATIONAL DEFENSE, EDUCATION, RESEARCH, INDUSTRY AND EYESIGHT CORRECTION

*Science: published weekly by The Science Press, Lancaster, Pa.
Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.*



Science Shoulders Arms

What science in the past has done for peacetime America, needs no recounting.

But science today tackles a grimmer job. Research now must give America at war the fighting weapons she needs.

That's why Westinghouse Research Engineers—working in one of the world's leading laboratories—are devoting their full time to the nation's defense requirements. We wish we could tell you about some of the remarkable things they've done already.

We shall—later.

Westinghouse

WESTINGHOUSE ELECTRIC &
MANUFACTURING CO.

Pittsburgh, Pa.

CHOLINE CHLORIDE

SMACO

THE IMPORTANCE of choline in nutrition is now more widely recognized as a result of new investigations showing its relationship to liver cirrhosis¹ and renal damage.² Under specific dietary conditions a deficiency of choline results in fatty infiltration of the liver in rats³ and perosis in chicks.⁴ Choline is definitely involved in the metabolism of the sulphur containing amino acids.^{5, 6}

It has been suggested that choline is a factor in the B-complex⁷ and because of this there is increasing use of choline chloride as a routine supplement in nutritional research especially where highly purified diets are employed.

Choline Chloride synthesized in our laboratories, is available conveniently packaged for research purposes and in bulk quantities.



PRICES ON REQUEST

RESEARCH LABORATORIES
S. M. A. Corporation
CHAGRIN FALLS, OHIO

1. GYÖRGY, P., and GOLDBLATT, H.: *Proc. Soc. Exp. Biol. & Med.*, 46:492:1941.
2. GRIFFITH, W. H.: *J. Nutrition*, 21:291:1941.
3. BEST, C. H., and RIDOUT, J. H.: *Ann. Rev. Biochem.*, 8:349:1939.
4. HEGSTED, D. M., MILLS, R. C., ELVEHJEM, C. A., and HART, E. B.: *J. Biol. Chem.*, 138:459:1941.
5. DU VIGNEAUD, V., CHANDLER, J. P., MOYER, A. W., KEPPEL, D. M.: *J. Biol. Chem.*, 131:57:1939.
6. GRIFFITH, W. H., and WADE, N. J.: *J. Biol. Chem.*, 132:627:1940.
7. GYÖRGY, P., and GOLDBLATT, H.: *J. Exp. Med.*, 72:1:1940.



Interior Radiation Insures Even Chamber Tempera- ture for Better Incubation



THE Castle Precision Incubator No. 554, (as recommended for milk analysis by the agar plate method), features a temperature so uniform throughout that one thermometer is sufficient to secure accurate temperature measurements. This is due to the Castle method of heat transmission by *interior radiation* rather than by convection. It operates with a constancy of $\pm 1/5^\circ \text{C.}$ and a uniformity of $\pm 7/8^\circ \text{C.}$, under full load conditions.

22 gallons of warm water, accurately controlled, provide thousands of calories of reserve heat to compensate quickly for any heat loss.

Other models in varying capacities for various bacteriological applications are available.

Write—

WILMOT CASTLE COMPANY

1212 University Ave.,
Rochester, N. Y.

A POLAROID*

**All-Purpose Kit
\$9.75 COMPLETE**

This Polaroid Experimental Kit may be used by hand, on an optical bench, with a common horizontal projector or with a vertical projector. It includes accessories for all the basic demonstrations so important in acquainting students with the principles of the new applied science of polarized light.

As a holder for the polarizing filters, the kit contains a slotted metal V-block screwed to a 10 mm support rod which may be held by hand, or in the carriages of optical benches, or mounted in a

projection lantern with laboratory clamps.

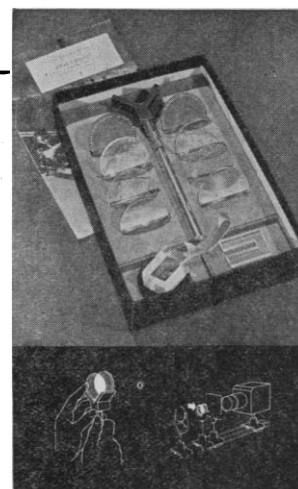
Price: Polaroid Experimental Kit, No. 420, with Laboratory J-Filters (set of 2), \$9.75. 48-page text and instruction manual included.

For complete catalog write your laboratory supply house or Division 11

POLAROID CORPORATION

730 Main Street, Cambridge, Mass.

* T. M. Reg. U. S. Pat. Off.



LaMotte Combination Soil Testing Outfit

One of the most popular outfits, contains tests for pH, potash, phosphorus, and nitrates, all assembled in one wooden carrying case with complete apparatus, reagents and instructions; price \$35.00 f.o.b. Baltimore, Md. Other combinations can be supplied varying from three tests up to eight. Prices on request.

LaMotte Chemical Products Co.

Dept. "H"

Towson, Baltimore, Md.

MATCHED TUBES

for

Colorimetric and Nephelometric Methods

We specialize in this field.

Write us regarding your requirements.

R. P. CARGILLE

118 Liberty St.

New York

PURE AMINO ACIDS

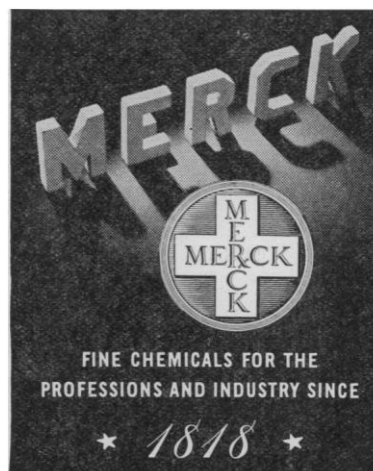
● In connection with the greatly increasing number of studies of nutritional problems, investigators have recognized the need for pure chemicals as the individual constituents of basic diets, to eliminate difficulties caused by the introduction of unknown factors. The rapid progress of recent years in the isolation, identification, and synthesis of the vitamins, especially those of the B complex, has fulfilled part of this need, but there remains the problem of the supply of pure amino acids in the required quantities.

The successful activities of Merck & Co. Inc. in furthering research and development of the vitamins, particularly those of the water-soluble group, have led the Company to engage in the commercial production of pure amino acids.

The following pure amino acids are now available at prices calculated to permit investigation of their nutritional significance:

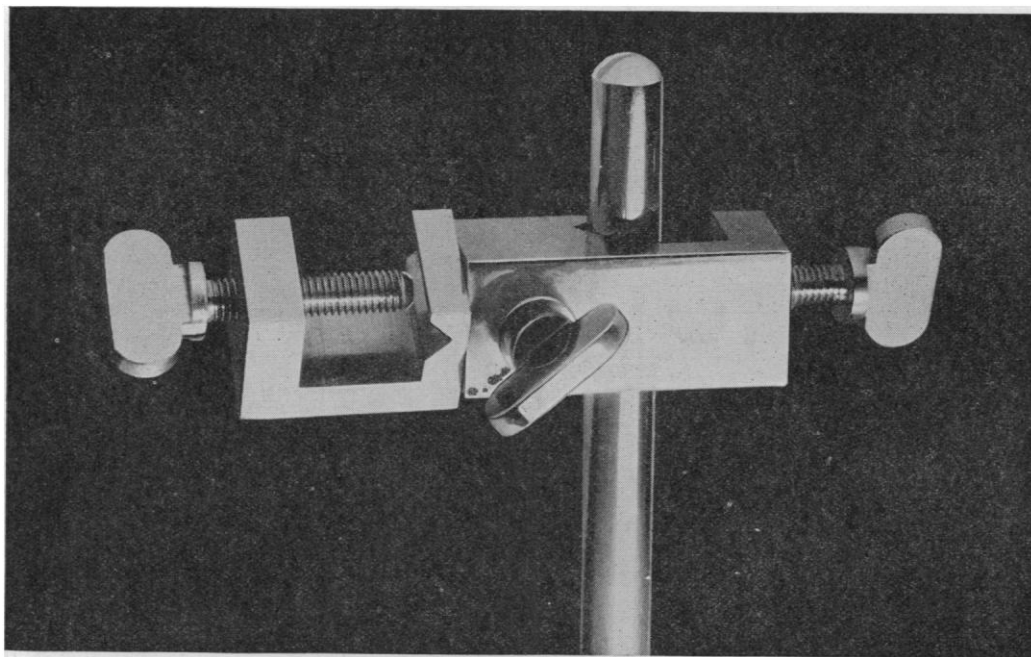
Aminoacetic Acid
(Glycocoll, Glycine)
**d*-Arginine Monohydrochloride
**dl*-Aspartic Acid
Beta-Alanine
dl-Alpha-Alanine
d-Cysteine Hydrochloride
L-Cystine
dl-Glutamic Acid Monohydrate
d-Histidine Monohydrochloride
**L*-Hydroxyproline
dl-Isoleucine
dl-Leucine
**d*-Lysine Monohydrochloride
dl-Lysine Monohydrochloride
**dl*-Methionine
dl-Norleucine
dl-Phenylalanine
**L*-Proline
dl-Serine
**dl*-Threonine
**L*-Tryptophane
dl-Valine

*Available in restricted quantities.



MERCK & CO. Inc. *Manufacturing Chemists* RAHWAY, N. J.

A SWIVEL THAT HOLDS



Swivel Clamp—Eleven-tenths Actual Size

ACCURATELY machined from brass and heavily nickered. The improved swivel joint is fixed by a special inner mechanism giving firm frictional holding power under moderate tension by the set-screw.

The HARVARD APPARATUS COMPANY, *Incorporated*

Dover, Massachusetts

SCIENCE

VOL. 95

FRIDAY, JANUARY 16, 1942

No. 2455

<i>The Golden Age of Botany</i> : DR. EDGAR N. TRANSEAU	53	<i>Special Articles</i> :	
<i>Evolution and Knowledge</i> : PROFESSOR WILLIAM E. RITTER	58	<i>The Endosperm as a Barrier to Interspecific Hybridization in Flowering Plants</i> : PROFESSOR D. C. COOPER and PROFESSOR R. A. BRINK. <i>On the Localization of Enzymes in Nerve Fibers</i> : DRS. D. NACHMANSOHN and H. B. STEINBACH	75
<i>Obituary</i> :		<i>Scientific Apparatus and Laboratory Methods</i> :	
<i>Alexander Lowy</i> : DR. ALEXANDER SILVERMAN.		<i>A Color Reaction for Dehydroascorbic Acid Useful in the Determination of Vitamin C</i> : PROFESSOR JOSEPH H. ROE and CARL A. KUETHER. <i>Binding of Sulfonamides by Plasma Proteins</i> : DR. BERNARD D. DAVIS	77
<i>Orin F. Stafford</i> : DR. F. L. SHINN. <i>Recent Deaths</i>	62	<i>Science News</i>	8
<i>Scientific Events</i> :			
<i>War Work of the Canadian Research Council; The Ella Sachs Plotz Foundation for the Advancement of Scientific Investigations; The Nutrition Foundation, Inc.; The National Foundation for Infantile Paralysis; Presentation to Wilfred Hudson Osgood; Award of the Davy Medal of the Royal Society to Dr. Dakin</i>	63		
<i>Scientific Notes and News</i>	66		
<i>Discussion</i> :			
<i>Continental Drift and Plant Distribution</i> : DR. DOUGLAS H. CAMPBELL. <i>Sclerotium Bataticola, A Cause of Damping-off in Seedling Conifers</i> : SPENCER H. DAVIS, JR. <i>Physics in Nazi Germany</i> : WM. MAYO VENABLE. <i>A Scientist at Peace and at War Four Hundred Years Ago</i> : PROFESSOR M. F. ASHLEY	69		
<i>Scientific Books</i> :			
<i>The Earth</i> : PROFESSOR KIRTLEY F. MATHER. <i>Banckes's Herbal</i> : DR. JOHN HENDLEY BARNHART	71		
<i>Reports</i> :			
<i>Scientific Work of the Carnegie Institution of Washington</i>	73		

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.
New York City: Grand Central Terminal
Annual Subscription, \$6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE GOLDEN AGE OF BOTANY¹

By Dr. EDGAR N. TRANSEAU

THE OHIO STATE UNIVERSITY

THOSE of us who were so fortunate as to enter the field of botany about the beginning of the century have witnessed the period of its greatest growth and differentiation. In no other country and at no other time have there been so many undergraduate students of botany, so many graduate students and so many botanists employed in educational and research institutions. We vividly recall that this 40-year period began just after the Spanish-American war when America took over the Philippine Islands. We have likewise had a part in all the educational phe-

¹ Address of the retiring president of the Botanical Society of America, delivered at Dallas, Texas, on December 29, 1941.

nomena before, during and after the first World War. The period closes as World War II is thrust upon us.

This time the war is not "to make the world safe for democracy," but to keep democracy from being crushed against the wall at its back. After the first world war came the collapse of European credits and subsequently a variety of social revolutions that have ended in ruthless dictatorships. The state-supported Continental universities were first impoverished, then regulated and finally regimented or liquidated. Because of declining financial aid, teaching and research in botany have been possible only to men of independent means, and in many of the Continental

BINDING OF SULFONAMIDES BY PLASMA PROTEINS

CEREBROSPINAL fluid concentrations of sulfathiazole which occur during treatment of meningitis do not generally exceed 25 per cent. of the plasma concentrations; values for sulfanilamide in the cerebrospinal fluid may reach 100 per cent. of the plasma concentrations, whereas the values for sulfapyridine and sulfadiazine are intermediate. These differences in concentration have been ascribed to differences in the diffusibility of the drugs into the spinal fluid. An alternative explanation would be the existence of part of the drug in combination with plasma protein. Schonholzer¹ has demonstrated binding of the azo-dye of sulfanilamide, Prontosil, to serum albumin in electrophoresis experiments, but this technique does not furnish quantitative data for partial binding. The experiments reported in the present paper support the view that the sulfonamide drugs are bound to plasma proteins in varying proportions, the relative concentration of drug attained in the spinal fluid depending upon the extent to which the drug is bound in the blood.

Normal human plasma was dialyzed in Cellophane bags against 0.15 N. NaCl, buffered at pH 7.4 by the addition of 0.01 M. phosphate, with varying additions of a sulfonamide. At equilibrium the drug concentration was found to be higher in the plasma than in the buffer. While this distribution coefficient is not direct evidence of binding to protein, the data fit the Freundlich adsorption isotherm, as is the case with phenol red,² for which direct evidence of chemical binding has been furnished by absorption spectrophotometry.³ Whether the phenomenon be due to adsorption, coordination, or simply depression of the activity coefficient by the protein is of less biological than chemical interest, for in any case, it is the value of the distribution coefficient which determines the distribution in the body. The binding (using the term in a very general sense) is due to albumin but not to globulin; lipid-free plasma behaves similarly. In normal plasma containing 7 per cent. protein, with drug concentrations of 10 mg per cent., the proportion of "free" (unacetylated) drug which is bound to protein is as follows:

Sulfanilamide	20 per cent.
Sulfapyridine	40 per cent.
Sulfadiazine	55 per cent.
Sulfathiazole	75 per cent.

These data can explain the observed distribution in body fluids and the greater solubility in plasma than in saline.

¹ G. Schonholzer, *Klin. Wchnschr.*, 19: 790, 1940.

² A. Grollman, *Jour. Biol. Chem.*, 64: 141, 1925.

³ H. W. Robinson and C. G. Hogden, *Jour. Biol. Chem.*, 137: 239, 1941.

Preliminary bacteriostatic experiments were carried out with *B. coli* in a synthetic medium, with and without added albumin.⁴ The results suggest that the concentration of unbound drug determines the level of bacteriostatic activity, the bound drug being apparently inactive. It was also noted that the order of increasing tendency to be bound to plasma albumin was identical with the order of increasing bacteriostatic effectiveness for the four sulfonamides studied.⁵ This latter relationship may be of theoretical significance and is being studied further.

It has been demonstrated that the sulfonamide drugs behave as though bound in varying degree to plasma albumin or some fraction thereof, and it appears that the bound drug is not bacteriostatically effective. The effective level of the sulfonamides in the cerebrospinal fluid may therefore be as great as that in the blood stream, and the apparent level compared with the blood should not be used as a guide to the choice of a drug. Inasmuch as excellent therapeutic results have been reported with the use of sulfathiazole in meningococcal meningitis⁶ it may be preferable to the more toxic sulfanilamide and sulfapyridine, which have often been favored because of the higher concentrations attained in the cerebrospinal fluid.

BERNARD D. DAVIS

CHEMICAL DIVISION, DEPARTMENT OF
MEDICINE,
THE JOHNS HOPKINS HOSPITAL

⁴ We are indebted to Dr. W. Barry Wood for assistance in the bacteriological work.

⁵ (a) W. B. Wood, personal communication. (b) H. J. White, T. T. Litchfield, Jr., and E. K. Marshall, Jr., *Jour. Pharm. and Exp. Therap.*, 73: 104, 1941.

⁶ (a) M. Finland and J. H. Dingle, *New Eng. Jour. Med.*, 225: 825, 1941. (b) H. S. Banks, *Lancet*, 1: 104, 1941.

BOOKS RECEIVED

Carnegie Institution of Washington. *Embryology of the Rhesus Monkey (Macaca Mulatta)*. Publication 538, Contributions to Embryology. Illustrated. Carnegie Institution of Washington.

DUNNING, J. R. and H. C. PAXTON. *Matter Energy and Radiation*. Volume 1 in Columbia College Natural Science Series. Illustrated. Pp. xvi + 668. McGraw-Hill. \$3.50.

HUREWICZ, WITOLD and HENRY WALLMAN. *Dimension Theory*. Volume 7 in Princeton Mathematical Series, MARSTON MORSE, H. P. ROBERTSON and A. W. TUCKER, editors. Pp. 165. Princeton University Press. \$3.00.

JOHNSTONE, RUTHERFORD T. *Occupational Diseases*. Illustrated. Pp. x + 558. Saunders.

KNIGHT, HARRY H. *The Plant Bugs, or Miridae, of Illinois*. Bulletin of the Illinois Natural History Survey, Volume 22, Article 1. Illustrated. Pp. 234. State of Illinois.

STEGGERDA, MORRIS. *Maya Indians of Yucatan*. Illustrated. Pp. xx + 280. Publication 531. Carnegie Institution of Washington. \$1.50.

Stratigraphic Type Oil Fields. A Symposium, A. I. LEVORSEN, editor. Illustrated. Pp. xii + 902. American Association of Petroleum Geologists. \$5.50 (\$4.50, members).

For Semester Courses

Musical Acoustics

By C. A. Culver, Ph.D.
Carleton College
128 Illus. 194 Pages \$2.50

Intended for a one semester college course for students interested in the physical basis of music, this new text presents a unified account of recent research and development work having a bearing on the production and transmission of musical sounds. The first part presents the elementary principles of musical acoustics; the latter part deals with sound production by the voice and by various musical instruments.

Survey of Physical Science for College Students

By P. C. McCorkle, Ph.D.
State Teachers College, Pa.
273 Illus. 471 Pages \$2.75

This text presents material for a vigorous, well balanced survey course for college freshmen. Some features of special interest are: star maps; discussion of radioactivity; polaroid; television; lightning; synthetic chemistry; and acoustics of halls. Laboratory exercises suitable for individual work or for classroom demonstrations are provided at the end of each chapter.

Temperature Measurement and Control

By R. L. Weber, Ph.D.
Penna. State College
183 Illus. 430 Pages \$4.00

Written for college students and especially for those preparing for industrial positions, this new text presents the basic principles necessary for the appreciation, intelligent use and extension of the methods of temperature measurement and control. The experiments have been developed and tested by actual laboratory use over a period of years.

THE BLAKISTON COMPANY
PHILADELPHIA

SPRAGUE - DAWLEY, INC.

Pioneers in development of the standard laboratory rat

Madison, Wisconsin

BIODYNAMICA MONOGRAPHS ON GENERAL PHYSIOLOGY

1. "Life and Death at Low Temperatures" by B. J. Luyet and P. M. Gehlen. 341 pages. Net \$4.50
2. "Optical Activity and Living Matter" by G. F. Gause. 162 pages. Net \$2.75

Order from

BIODYNAMICA, NORMANDY, MISSOURI

THE SCIENCE PRESS PRINTING CO.

PRINTERS OF
SCIENTIFIC AND EDUCATIONAL JOURNALS,
MONOGRAPHS AND BOOKS

Correspondence Invited
LANCASTER, PENNSYLVANIA

A Short

HISTORY OF THE PLANT SCIENCES

by Howard S. Reed, Prof. of Plant Physiology, Univ. of California:—The first history of botany written by an American and published in America. The discovery and domestication of plants in ancient times as well as the development of the plant sciences in selected fields, since the opening of the 20th century, receive particular attention.—"A New Series of Plant Science Books", edited by F. Verdoorn, Vol. 7, 323 pages, 37 ill., buckram. \$5.00

Chronica Botanica Co., Waltham, Mass.

New York
G. E. Stechert

Toronto
Wm. Dawson

Rio de Janeiro
Livr. Kosmos



PULFRICH PHOTOMETER

(Arranged as Colorimeter)

This instrument is designed for colorimetry without comparison solution. It measures the absorption occurring in different wave-length regions with a degree of precision formerly obtainable only with a spectro-photometer. The results are rapidly determined by one measurement without variation of the depth of liquid.

Additional accessories equip this instrument as a Nephelometer, and Glossimeter. Literature will be gladly sent on request.

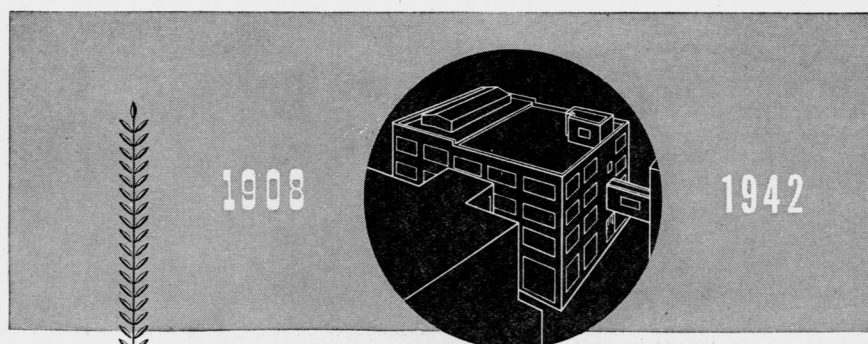
(Prompt delivery from stock)

CARL ZEISS, INC.

485 Fifth Avenue
NEW YORK

728 So Hill Street
LOS ANGELES





GROWTH THROUGH ACHIEVEMENT

FROM a modest one room laboratory in 1908 to the present four story Research Laboratory Building—from a personnel of 4 to a staff of 190...Such has been the growth of Corning Research in Glass over the past three decades.

Many have been the achievements of these scientists during these 34 years. Of the 25,000 or more different glass formulas developed by them, two are of outstanding importance to the school laboratory.

Pyrex brand Chemical Glass No. 774—the *Balanced Glass* used in Pyrex brand Laboratory Ware—helped make our country independent of European sources in World War I. Corning's new 96% Silica Glass No. 790—announced in 1939—used in Vycor brand Ware, strengthens that independence. These two glasses answer virtually every laboratory need.

Whatever your laboratory requirement, call your regular supply dealer. He brings to you speedily and economically the results of "Corning Research in Glass."

PYREX BRAND
LABORATORY WARE



CORNING
means
Research in Glass



"PYREX" and "VYCOR" are registered
trade-marks and indicate manufacture by
CORNING GLASS WORKS
CORNING, N. Y.