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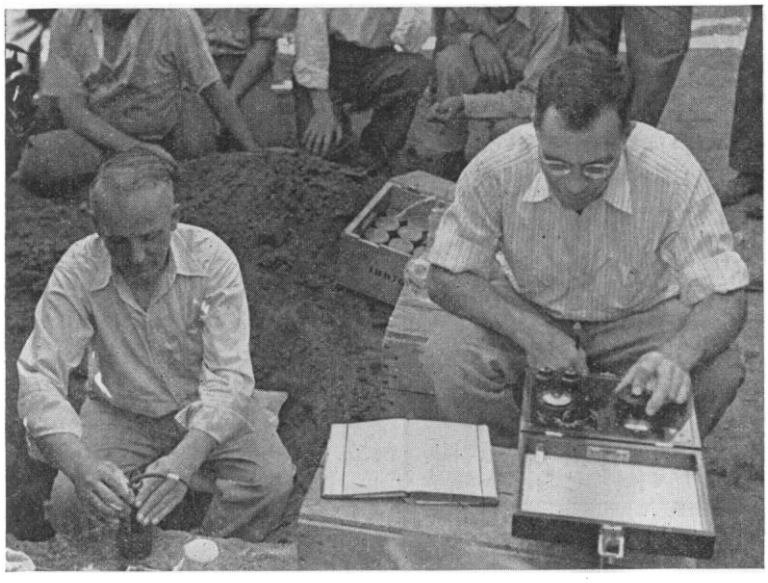
BECKMAN pH NEWS

FROM THE WORLD'S LARGEST MANUFACTURER OF GLASS ELECTRODE pH EQUIPMENT



Dr. Haas, left, and Mr. Compton, right, checking soil pH with Beckman Meter

BECKMAN LABORATORY METER AIDS IMPORTANT CITRUS STUDY

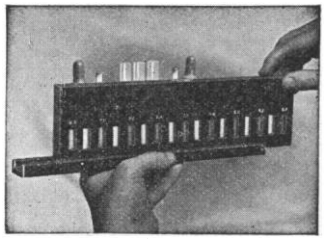
Permits Direct pH Measurement of Soil

RIVERSIDE, CALIFORNIA.—The College of Agriculture, University of California, is conducting an important study to determine the effect of pH on the growth of fruit trees—particularly citrus, avocado, and walnut trees. Under the direction of Dr. A. R. C. Haas, who has been working on this problem for a number of years, extensive soil pH determinations made both in the laboratory and field indicate that acid soil conditions give best growth for the trees mentioned, although they will tolerate wide variations.

A Beckman Laboratory pH Meter with a temperature-correction adjustor to within 1° C, was used in this work, and it was found that measurements made by the usual 1–5 soil-water ratio on oven or air dried samples generally showed higher pH values than those made under actual field-moisture conditions. Inasmuch as Beckman Glass Electrodes can be pushed directly into the soil at the roots of growing plants and trees, their use permits measurements to be made under substantially the exact conditions with which the trees must contend for their nutrition.

Further information on the above application will gladly be supplied by National Technical Laboratories, 820 Mission St., S. Pasadena, Calif.

TAYLOR Swimming Pool Sets



The ideal outfits for complete control (pH and chlorine) of swimming pool water.

Standards enclosed in plastic slide—no separate standards to handle.

All standards carry an unlimited guarantee.

Determinations made by matching sample with standards and reading value directly from slide.

Taylor Swimming Pool Set $17.50

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W. A. Taylor & Co., Inc.
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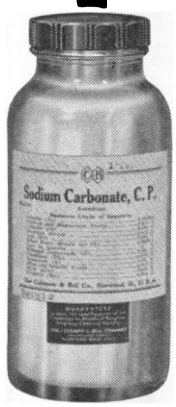

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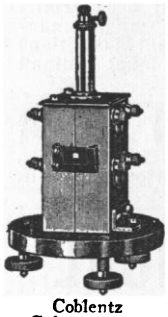
Astronomers Study Planet's Radiation

Measure Minute Voltages At Lowell Observatory

Radiation, atmospheric transmission, and atmospheric water vapor content are being measured at the Lowell Observatory, Flagstaff, Ariz.

Radiation is measured with a small thermocouple at the focus of a telescope, connected to a galvanometer. With the big 42-inch telescope, a Coblentz-type of moving magnet galvanometer is used.



Coblentz Galvanometer

Dr. C. O. Lampland, at the observatory, writes, "The moving magnet galvanometer (Coblentz) . . . has very high sensitivity and much flexibility in that one may readily change the sensitivity and period to suit the requirements . . . the seemingly contradictory characteristics of a short period and high sensitivity too, are highly desirable for astronomical measurements. Sometimes a shorter period will permit making use of momentary intervals of good seeing."

Leeds & Northrup Type HS moving coil galvanometers are used for measurements with the spectro-radiometer. This narrow coil instrument has a remarkably short period and high sensitivity compared to other moving coil galvanometers.

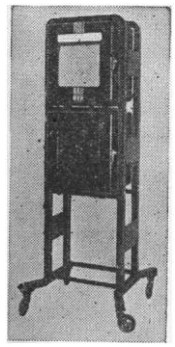
Whether used in measuring radiation from a distant star or the frequency of a 2,000,000 KW power system, Leeds & Northrup

Jrl Ad E(5)

Upper-Air Weather Radioed To Speedomax Recorder

Small Balloon Sends Data From 60,000 Ft.

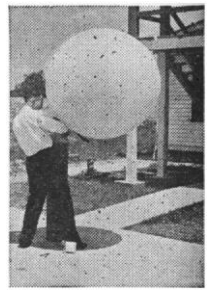
Weather reports from altitudes up to 60,000 ft. are being gathered throughout the country. Useful in forecasting weather, these Radio - Meteorographs also give flyers valuable information about weather conditions and wind directions.



Speedomax

Temperature, humidity and altitude are radioed to a L&N Speedomax Recorder on the ground. Upper-air wind speeds and directions may be determined by means of direction finding features of the radio equipment.

The transmitting equipment is contained in a balsa wood box and weighs about two pounds. Attached to a small, free balloon, it rises about 600 feet per minute. The balloon goes up until it bursts, and a parachute drops the mechanism to earth.



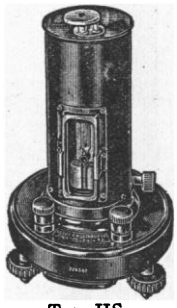
Speedomax is a completely self-contained automatic recorder. Sensitive and accurate, it is unaffected by vibration . . . records any change in its range in less than two seconds.

Radio-Meteorographs are used by the Department of Agriculture's Weather Bureau, and by the Coast Guard which has had four on board ships.

This is only one of the many Speedomax applications. If you have a high speed recording problem, we'll be glad to discuss the possibility of solving it with Speedomax.

How to Select a Galvanometer

If you are faced with a galvanometer problem, Note Book ED(1) "Notes on Moving Coil Galvanometers" may help you. It tells what factors to consider in selecting a galvanometer, and the basic theory underlying each type, including the ballistic galvanometer and the fluxmeter. A copy of this useful pocket size note book will be sent on request.



Type HS Galvanometer

galvanometers can be depended upon to meet the characteristics claimed for them. There is one for practically every use, and all the laboratory models are listed in Catalog ED. Write for a copy.

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SCIENCE

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MINUTE AMOUNTS OF CHEMICAL ELEMENTS IN RELATION TO PLANT GROWTH[1]

By Professor D. R. HOAGLAND

UNIVERSITY OF CALIFORNIA, BERKELEY

A GENERAL survey of the history of plant and animal nutrition during the past two decades records notable advances in scientific knowledge, many of which have been made possible only because of the recognition and experimental control of organic and inorganic substances in micro-quantities. The investigator of the nutrition of higher plants, which can grow in solutions of purely mineral character, has certain advantages of technique not enjoyed by the investigator of animal nutrition, in the study of the relation to the growth of the organism of very minute amounts of chemical elements. Yet the plant physiologist has not always profited by these advantages. For a long period the standard teaching was that only ten chemical elements (nitrogen, phosphorus, sulphur, calcium, magnesium, potassium, iron, carbon, hydrogen and oxygen) were generally indispensable for the growth of higher plants. Many other elements, if found to be effective at all, were regarded merely as plant stimulants or poisons. Following earlier work in France, Mazé[2] presented in 1914 certain evidence, based on controlled water-culture experiments, of the requirement for normal growth of the maize plant of chemical elements not included in the list of ten, but his experiments

[1] Presented before the National Academy of Sciences, April, 1940, as a highly condensed review, for the information of those who have not had occasion to refer to the literature of this field.

[2] P. Mazé, *Ann. Inst. Pasteur.*, 28: 21–68, 1914.

tions in the smears, greatly facilitating their interpretation. Attempts to simplify the technic as well as to avoid the necessity for relying on imported stains such as Ponceau de Xylidene and Light Green have since been carried out. These have been greatly facilitated by the report of Lillie[3] that domestic Biebrich Scarlet and Fast Green FCF may be substituted for Ponceau de Xylidene and Light Green respectively; and that a mixture of equal parts of 5 per cent. phosphomolybdic and phosphotungstic acids gives adequate mordanting in one minute. On this basis, it has been possible to simplify and shorten the technic previously described for the vaginal smear and use domestic stains exclusively.

The revised staining technic embracing these modifications is as follows:

(1) From fixing solution, carry through alcohols to water; stain with Harris Hematoxylon for 2 minutes, and wash in running water for 5 minutes.

(2) Instead of the Ponceau de Xylidene-Acid Fuchsin-Orange G solution, 1 per cent. Biebrich Scarlet, water soluble (Nat'l Aniline and Chem. Co.) and 0.4 per cent. Orange G in 1 per cent. acetic acid. Stain 1 minute and rinse in water.

(3) In place of the 3 per cent. phosphotungstic acid mordant, a mixture of equal parts of 5 per cent. phosphomolybdic and phosphotungstic acids. Mordant 1 minute and rinse.

(4) In place of 0.3 per cent. Light Green, a 0.25 per cent. solution of Fast Green FCF (Nat'l Aniline and Chem. Co.) in 0.3 per cent. acetic acid. Stain 2 minutes. Do not rinse.

(5) Differentiate in 1 per cent. acetic acid for 1 minute, carry through alcohols to xylol and mount in damar.

It is possible to omit the hematoxylin stain under certain conditions, as in the routine treatment of the menopause with estrogens. With this omission, the smear can be stained in 5 minutes.

The assistance of Eugene J. Cohen in working out these modifications is gratefully acknowledged.

EPHRAIM SHORR

THE NEW YORK HOSPITAL AND
THE DEPARTMENT OF MEDICINE,
CORNELL UNIVERSITY MEDICAL
COLLEGE, NEW YORK, N. Y.

SOLUTIONS OF CHLOROPHYLL IN SALT WATER

ALTHOUGH a number of workers have studied aqueous extracts of chlorophyll from fresh leaves, only Inman[1] seems to have discovered that the addition of salt to the water is beneficial. Since Inman seems never to have published his findings in this respect, and since the author hasn't time to do adequate research with the method, it seems worth publishing this statement.

As various workers have stated, chlorophyll can be suspended in water if fresh leaves are ground in water, either with or without an abrasive. However, the suspended chlorophyll settles out within a few hours (with a few exceptions). Smith[2] has found that the addition to the colloid solution of a detergent will keep the chlorophyll in suspension. Less drastic treatment than that will stabilize the colloid. It is only necessary to grind the leaves with a salt and water solution rather than pure water.

Na_2SO_4 and NaCl have been found effective. The optimum concentration for NaCl is between 2 per cent. and 5 per cent. Since it has seemed desirable to control the pH, M/15 phosphate buffer of pH 7 is being used at present, and it gives very satisfactory solutions. $CaCl_2$ will not maintain the colloid in suspension. Buffers of pH 6 and below are not satisfactory, for the chlorophyll tends to decompose. Borate buffers at pH's 8 and 11 seem satisfactory, but it is feared that the high pH may change the chlorophyll in some way.

The chlorophyll suspension obtained in salt solutions is never clear. It possesses the various properties reported heretofore. It is relatively photostable, is precipitated by protein coagulants, passes through filter paper, is difficult to centrifuge down, has the red absorption band in the same place as that of an intact leaf, behaves as if negatively charged in cataphoresis, can be precipitated by ammonium sulfate and redissolved by addition of fresh buffer solution.

JOHN SHAFER, JR.

CORNELL UNIVERSITY

[3] *Stain Technology*, 15: 17, 1940.

[1] O. L. Inman and M. L. Crowell, *Plant Physiol.*, 14: 388–390, 1939; also in private conversation.

[2] E. L. Smith, SCIENCE, 91: 199–200, 1940.

BOOKS RECEIVED

BRUMBAUGH, A. J., Editor. *Boucher's Chicago College Plan.* Revised edition. Pp. x + 413. University of Chicago Press. $3.00.

CAMPBELL, DOUGLAS H. *The Evolution of the Land Plants (Embryophyta).* Pp. ix + 731. 351 figures. Stanford University Press. $6.50.

GOLDSCHMIDT, RICHARD. *The Material Basis of Evolution.* Pp. xi + 436. 83 figures. Yale University Press. $5.00.

Highway Research Board. *Proceedings of the Nineteenth Annual Meeting, 1939.* Pp. 573. Illustrated. National Research Council, Washington.

HILGARD, ERNEST R. and DONALD G. MARQUIS. *Conditioning and Learning.* Pp. xi + 429. Appleton-Century. $2.75.

SAND, H. J. S. *Electrochemistry and Electrochemical Analysis: Vol. II, Gravimetric Electrolytic Analysis and Electrolytic Marsh Tests.* Pp. ix + 149. Illustrated. Blackie and Son, Glasgow. 5/–.

Smithsonian Institution. *Miscellaneous Collections: Vol. 100, Essays in Historical Anthropology of North America.* Pp. 600. 34 figures. 16 plates. The Institution.

Woods Hole Oceanographic Institution. *Collected Reprints, 1939.* The Institution.