for man and where found; and a summary of diagnostic features of parasites. In some cases a limited or partisan point of view is presented; *e.g.* (p. 169), the statement is made that *Ascaris lumbricoides* L. occurs in pigs and man, which ignores the work of Mrs. Caldwell, Schwartz and other parasitologists in the United States.

Plant and Animal Ecology. By J. W. STORK and L. P. W. RENOUF. Murray, London. 5 s. x + 197.

A little book which should be useful to those who have had limited training in biology but who are interested in outdoor life.

A. S. PEARSE

DUKE UNIVERSITY

SOCIETIES AND MEETINGS

THE NEW HAMPSHIRE ACADEMY OF SCIENCE

THE fourteenth annual meeting of the New Hampshire Academy of Science was held from June 2 to 4, 1933, at Glen House, at the eastern base of Mount Washington.

Interest in the meeting centered about the Mount Washington Observatory, which has been maintained since last October on the summit at an elevation of 6,284 feet. The observatory cooperated with the International Polar year and with the Blue Hill Observatory of Harvard University. It was aided by a grant from the academy.

Mr. Joseph B. Dodge, director, spoke on "The Organization of the Observatory." Mr. R. S. Monahan, one of the observers, gave an illustrated talk on "Some Experiences on the Summit," and Professor Charles F. Brooks, of Harvard University, discussed "The Scientific Value of the Mount Washington Observatory." Several members made the trip to the summit and inspected the equipment of the observatory.

Other papers of major interest were "Cosmic Rays," with demonstrations by Professor G. F. Hull, "Bacterial Variations," by Professor K. N. Atkins, and the presidential address on "The Chemistry of the Atom," by Professor N. E. Gilbert, all of Dartmouth College.

The following officers were elected for 1933–34: *President,* Mr. Samuel P. Hunt, Manchester; *Vice-President,* Mr. Henry S. Shaw, Exeter; *Secretary-Treasurer,* Professor George W. White, department of geology, University of New Hampshire; *Member of the Executive Council,* Professor Norman E. Gilbert, department of physics, Dartmouth College.

THOMAS G. PHILLIPS,
Retiring Secretary

SUMMER MEETING OF THE MINNESOTA ACADEMY OF SCIENCE

WITH an attendance of 125, the reorganized Minnesota Academy of Science held its first annual summer meeting on the farm of Dr. R. B. Harvey, in the St. Croix River Valley near Stillwater, Minnesota.

Following a short business meeting for the election of new members the following papers were presented.

"Anthropology of the St. Croix," R. D. Brown, University of Minnesota.

"Things of Interest in the Geology of Central Minnesota," Professor Geo. A. Thiel, University of Minnesota.

"Animal Life in the St. Croix," Professor Samuel Eddy, University of Minnesota.

"Flora of the St. Croix," Professor A. H. Larson, University of Minnesota.

The afternoon was devoted to field trips of interest to all. Two Indian caves containing remnants of pottery were visited first. Plants and animals encountered were discussed. From the caves, the party visited two Indian burial mounds which had been excavated by members of the academy. Two skeletons, estimated to be from 400 to 500 years old, and a number of fragments of pottery were found. The third excursion was to view a number of well-preserved Indian pictographs on the sandstone bluffs of the St. Croix River.

Much enthusiasm was evidenced by the members and it is planned to make the summer meeting an annual affair, meeting in different sections of the state, where objects of scientific interest are available.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A MICRO VESSEL FOR GLASS ELECTRODE DETERMINATIONS OF HYDROGEN-ION ACTIVITY OF BIOLOGICAL FLUIDS

INVESTIGATIONS of the hydrogen-ion activity of body fluids of insects during metamorphosis by means of the glass electrode have led to the development of a micro vessel which may be filled by approximately 0.03 cc of fluid and which prevents errors due to the loss or addition of gases such as CO_2. The vessel is of simple construction and it permits the manipulations to be made easily and quickly. It is used in combination with a glass membrane mounted on a tube according to the method of MacInnes and Dole[1]

[1] D. A. MacInnes and M. Dole. *Jour. Am. Chem. Soc.,* 52: 29, 1930.

and a silver-silver chloride electrode prepared as described by Stadie, O'Brien and Laug.[2]

The micro vessel into which the glass electrode fits is essentially a modified 3-way Pyrex glass stop-cock. A view of the vessel and electrode is shown in Fig. 1.

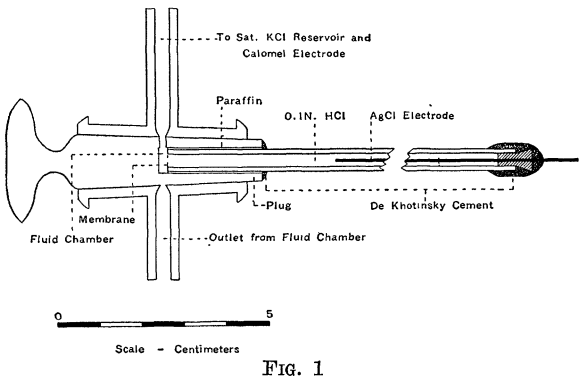

FIG. 1

The center arm of the collar of the stop-cock is modified to form a small funnel through which the sample is introduced into the fluid chamber in the center of the plug. This is pictured in Fig. 2 which shows a view in cross-section through the center of the fluid chamber looking towards the glass membrane. The arm of the collar which in the accompanying diagrams is indicated as being the longer connects with the reservoir for saturated KCl and with the calomel electrode. The opposite arm of the collar serves as an outlet from the fluid chamber and is used in filling as an exit for excess fluid and in flushing out the chamber to wash it and the membrane.

The plug of the stop-cock is modified by drilling a circular hole, 7 mm in diameter, from the end of the plug opposite the handle to the center of the plug (Fig. 1) and just through two holes, 1.5 mm in diameter (Fig. 1 and Fig. 2, a and b) drilled at a right angle to each other to communicate with the bores of the arms of the collar. This 7 mm hole serves to accommodate the glass tube bearing the membrane.

The glass tube with the membrane is mounted in the stop-cock plug so as to leave a small fluid chamber at the end of the glass membrane. The capacity of the fluid chamber depends upon the level at which the glass membrane is placed when the tube is mounted in the plug. By means of paraffin, the tube is sealed into the plug or it may be mounted by means of a piece of thin rubber tubing placed between the tube and its support according to the method of Stadie, O'Brien and Laug.[2] The former type of mounting can be conveniently carried out in the following manner. Each of the two small holes at the sides of the plug is closed by sticking a small piece of adhesive tape over the hole and a small quantity of clean mercury, equal in volume to the desired capacity of the fluid chamber, is placed at the bottom of the 7 mm hole in the plug. The tube with the glass membrane is introduced into the hole so that the membrane touches the surface of the mercury and flattens it out somewhat. Clamps are employed to hold the tube and plug in the proper position, and melted paraffin is allowed to run into and fill the entire space between the tube and plug so as to touch the mercury. After cooling, a small ring of de Khotinsky cement is placed around the end of the plug to further seal the tube to the plug (Fig. 1). The adhesive tape and mercury are then removed from the plug.

A film of paraffin is placed around the inner surface of the tube bearing the membrane to form a ring about 2 cm wide with the center of the ring about 2 cm from the open end of the tube. The glass electrode is partly filled with 0.1 N HCl so that when the silver-silver chloride electrode is inserted into the acid and sealed in place the meniscus of the acid solution will be in about the center of the paraffin ring. This leaves a small air space at the end of the column of the acid to compensate for expansion and contraction due to temperature changes which may occur when the electrode is not in use and which might otherwise cause breakage of the membrane. The paraffin ring on the inside of the tube permits the formation of a proper meniscus. A piece of fairly thick silver wire (No. 20) projecting about 7 cm into the tube is used in forming the silver-silver chloride electrode. The wire is held rigid by a small cork covered with a fairly thick coating of de Khotinsky cement. These precautions eliminate the danger of vibration and rotation of the wire in the acid during manipulation. In agreement with MacInnes and Belcher[3] we have found that the silver-silver chloride electrode does not give constant potentials if it moves in the acid solution so as to disturb the surface of contact. The entire outside surface of the glass electrode tube is finally given a thin uniform coating of clean paraffin. The plug is lightly greased, except for a narrow ring in the middle part, and placed within the collar.

In mounting the vessel and glass electrode in the constant temperature chamber a piece of rubber tubing is placed over the arm of the glass electrode vessel, which connects with the KCl reservoir and calomel electrode. A supporting clamp fits over this rubber tubing and the vessel is mounted with the funnel on top and the handle of the plug placed so that it may be rotated by the left hand.

[2] W. C. Stadie, H. O'Brien and E. P. Laug. *Jour. Biol. Chem.*, 91: 243, 1931.

[3] D. A. MacInnes and D. Belcher. *Jour. Am. Chem. Soc.*, 53: 3315, 1931.

To make the KCl junction the plug is rotated until the holes (a) and (b) are in line with the inlet funnel and the arm connecting with the KCl reservoir respectively as shown in Fig. 2. When the saturated KCl

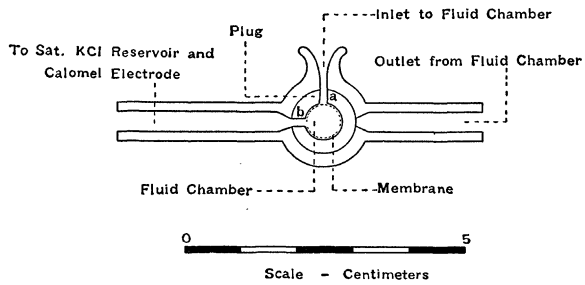

FIG. 2

solution begins to run into the fluid chamber the plug is rotated until the hole (a) communicates with the outlet from the fluid chamber and hole (b) with the inlet funnel. By means of rubber tubing, the fluid is sucked from the chamber through the arm serving as an outlet and into a waste bottle placed in the suction line. Continuing the suction, the fluid chamber is rinsed out by introducing distilled water from a rubber-tipped medicine dropper into the inlet funnel. If necessary, soap solution or alcohol may be used, followed by distilled water, and suction is discontinued when the fluid chamber is practically dry. The fluid whose pH is to be determined is then introduced into the fluid chamber and when it begins to run into the outlet arm, after the chamber is full, the plug is rotated in the same direction as before (clockwise in Fig. 2) until the hole (a) just fails to communicate with the KCl bridge. This closes hole (b) and the E.M.F. is measured. After the freshly greased plug has been wet with KCl solution in the middle by previous rotation of the plug, it is sufficient to bring the margin of the hole (a) in line with the margin of the bore of the KCl bridge without having the two communicate fully with each other in making a measurement. With buffer solutions this procedure is desirable and gives steady and reproducible potentials.

The glass and calomel electrodes are mounted in an electrically shielded, thermostatically controlled air chamber provided with an air circulator. In the measurements of the potentials, we have found the thermionic vacuum tube potentiometer described by Hill[4] to be highly satisfactory.

With this glass electrode assembly accuracy usually reported by other workers may be attained. Over 600 determinations of hydrogen-ion activity made on 16 different standard phosphate buffer solutions, ranging in pH from 5.24 to 7.22, have shown that an accuracy within 0.01 pH unit is readily obtainable. It is not unusual, in making 15 to 20 consecutive measurements on a given buffer solution, taking a different sample each time, to obtain voltage readings whose variations correspond to a difference not greater than 0.003 pH unit. Measurements on body fluids of larvae and pupae of more than 500 individual insects in different stages of metamorphosis[5] indicate that this micro vessel with the glass electrode is highly suitable and convenient for use with biological fluids.

IVON R. TAYLOR
JAMES H. BIRNIE

BROWN UNIVERSITY

SPECIAL ARTICLES

THE RÔLE OF PEROXIDASE IN THE DETERIORATION OF FROZEN FRUITS AND VEGETABLES

OXIDATION, especially following injury to the tissues by freezing, apparently is responsible, at least in part, for the discoloration, browning, loss in flavor and production of certain objectionable unnatural flavors which occur during the freezing, storage and thawing of fruits and vegetables. These changes, which occur in the presence of air, apparently are catalyzed by the oxidases present in "oxidase plants," such as apricots, peaches, etc. Loss of organic peroxide or removal of oxygen from the tissues by biological or other means, or inactivation of the oxygenase present markedly improves the keeping quality of the oxidase plants. However, we find that "peroxidase plants," such as pineapple, orange, peas, string-beans, spinach, asparagus, etc., are also subject to marked deterioration during freezing storage. We have found that slices of pineapple exposed to air darken in color and deteriorate in flavor upon prolonged storage at 0° F. The deterioration in flavor of frozen orange juice and to some extent of pineapple juice is largely due to oxidation. It is difficult to believe that this deterioration is due to the peroxidases present, and that an incomplete oxidizing system will catalyze the type of changes observed. The evidence for orange juice leads us to believe that the oxidation is non-enzymatic in nature. However, oxidizing systems other than the conventional one composed of oxygenase, peroxidase and catechol may be involved.

Unnatural hay-like flavors develop in vegetables during freezing and subsequent thawing. These

[4] S. E. Hill. SCIENCE, 73: 529, 1931.

[5] The results of this work will be reported at an early date.