sponsible for the low record of human cases of necrobacillosis. Material containing a pleomorphic bacillus with beaded threads should be grown under anaerobic conditions, in or on mediums containing serum. Anaerobic cultures of the blood should be made in all cases of infectious jaundice. Some of the tubercular hips are, in all probability, necrophorus infections.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD AND THE APPARATUS FOR THE STUDY OF PERMEABILITY OF GASES THROUGH THE BIRD'S EGG-SHELL

OUR previous study[1] of such physical factors of the eggshell as breaking strength, thickness, and relative number and size of pores (observed microscopically) convinced us that the eggshell has definite characteristics peculiar to the species of bird, the flock of birds of the same species, the birds of the same flock, and in a less degree to the eggs laid by the same individual.

Yet the structural and physical properties of the eggshell are found to be very important in regard to the storage and preservation of eggs for future use. For example, an egg with a thin or very porous eggshell would likely more rapidly evaporate or lose moisture, more readily absorb outside odors and gases, and allow more easy penetration by micro-organisms. All these conditions eventually would lead to some changes in physical state and possibly in chemical composition of the egg-contents and thus soon to a decrease in the nutritive value of the eggs.

Furthermore, the structural and physical properties of the eggshell have their biological significance. There is a constant loss of moisture and interchange of respiratory gases through the eggshell during the incubation. This rate of interchange of gases, or absorption of oxygen and elimination of carbon dioxide, is gradually increasing in volume per time with the embryonic growth and development. On the other hand, the eggshell furnishes the largest portion of the calcium needed for the building up of the skeleton of the developing embryo, thus leading to some changes in its physical properties. An egg with extremely thin or thick shell may therefore present an important biological problem in relation to the developing embryo.

It is evident, however, that from both the economic and biological points of view a reliable quantitative direct method of measuring the quality of a bird's eggshell would be very desirable.

In view of the above facts, during the past three years, our laboratory of experimental embryology has developed and improved primarily for scientific use a special electric apparatus for the direct and accurate measurement of the permeability of the bird's eggshell to various gases.

The apparatus, as shown diagrammatically in the accompanying Fig. 1, operates on the principle of

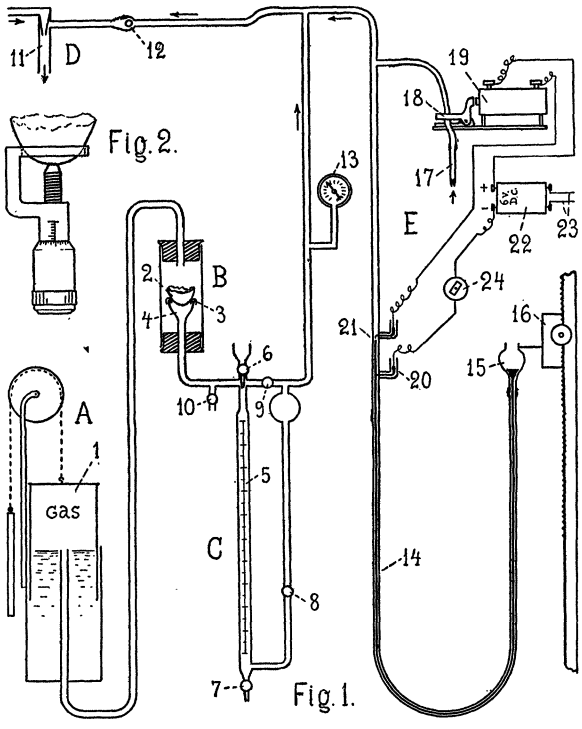

FIG. 1. A diagram of the apparatus for measurement of the permeability of a gas through the bird's eggshell. A, gas holder (1) with a gas; B, eggshell chamber, shown with eggshell (2), rubber gasket (3), and funnel (4) of one-inch inside diameter; C, micro-gas meter, consisting of a 50-cc. burette (5) funnel with glass stopper (6) for refilling of the burette (5) with water, drain stopcock (7), control stopcock (8), set up stopcock (9), vacuum relief stopcock (10); D, vacuum pump, including water suction pump (11) and back pressure valve (12); E, automatic vacuum controlling mechanism, consisting of vacuum gauge (13), adjustable monometer (14) with level bulb (15) and slide with screw (16), capillary tube (17), lever (18), induction coil (19), fixed contact point of the monometer (20), break point of the monometer (21), rectifying transformer (22), line of alternating current (23), and switch for the vacuum-controlling mechanism (24).

FIG. 2. A micrometric spherometer shown with a portion of eggshell, the surface of which is to be measured.

[1] A. L. Romanoff, "Study of the Physical Properties of the Hen's Eggshell in Relation to the Function of Shell-secretory Glands," *Biol. Bull.*, 56: 351–356, 1929.

suction of the gas in question through the portion of the eggshell (B-2). The passing gas is measured in an especially designed micro-gas meter (C) and a constant predetermined vacuum is maintained by an adjustable self-controlled monometer (E), operated automatically by electricity.

The volume of gas which passes through the portion of eggshell is read in cc./min./sq. cm. The data are obtained from the table of calculated and corrected values obtained after measurement of the curvature of eggshell by a special micrometric spherometer (Fig. 2).

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A METHOD FOR THE PREPARATION OF FOSSILS

IT is a common practise of paleontologists, when preparing fossil shells, to cement the specimen to be cleaned in plaster of Paris, thereby insuring rigidity and stability against the strain of cleaning. This method is particularly useful in cleaning delicate shells otherwise too fragile to allow complete freeing from their matrix. There is a distinct disadvantage, however, in the use of plaster of Paris because it forms a permanent base concealing one surface of the fossil shell from view.

While preparing Paleozoic star-fishes, echinoids and brachiopods for study, the writer found paraffine to be much more desirable than plaster of Paris as a support for the fossil during cleaning. The advantage of paraffine over plaster of Paris is its easy removability from the cleaned specimen, so that a free valve or star-fish, etc., is obtained as a result of the cleaning. After the matrix has been cleaned from one surface of the fossil, the specimen is cemented in wax poured into a box or other container, with the cleaned surface down in the wax. The matrix is then worked off the opposite surface, leaving a completely cleaned specimen embedded in the wax. For greater rigidity, the specimen and its paraffine base can be cemented in plaster. After cleaning, the plaster is broken away from the wax base and the paraffine dissolved away by xylol or cotton soaked in xylol for very delicate shells. In this way a number of Paleozoic star-fishes of all sizes have been freed completely from their matrix, and many rare and new brachiopod shells have been cleaned internally and externally.

The method has proved useful in preparing such delicate structures as the loops of the Terebratulidae. The loop is exposed on one side, then wax is poured on this exposed surface of the loop. This gives a rigid base which will allow working the matrix away from the loop from the other side. Dissolving the paraffine leaves a free loop.

In order to prevent the paraffine from softening during the cleaning, which is commonly carried out near a strong, hot light under a binocular microscope, it is frequently necessary to plunge the embedded specimen into cold water. As long as the wax is kept cool and stiff it is quite as safe a bedding medium as plaster of Paris. It is sometimes desirable to perform the entire cleaning process under water. Besides keeping the wax stiff, this has the advantage of making a strong contrast between shell and matrix.

By the above method it is possible to secure the interior of either valve of brachiopods in which both valves are in conjunction. The particular valve desired is cemented in the paraffine base. Then the valve whose interior is not wanted is ground away and cleaning of the desired valve progresses.

In making preparations such as those described above, the dental engine is very useful, but for the most delicate work against the shell, needles sharpened to a chisel edge are the best tools.

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SPECIAL ARTICLES

THE UTILIZATION OF ADSORBED IONS BY PLANTS[1]

RESTRICTED Brownian movement of ions is one of the great differences between a nutrient solution and a natural soil. In culture solutions the nutrient ions are free to move (diffusible), while in soils they are "adsorbed" on colloidal particles, fixed in crystals and thus exist under conditions of constraint.

In the study of the liberation of adsorbed ions by the plant itself it is necessary that at the outset the nutrient ions be present in adsorbed form only. Otherwise the free ions in the liquid phase could replace the adsorbed elements (ionic exchange)[2] and the problem would approach a mere nutrient solution experiment. Soybean plants were grown in systems containing but *one nutrient ion* (calcium), which for purposes of comparison was either free in solution or adsorbed on colloids or fixed in the interior of crystals.

EXPERIMENTAL METHOD

(a) *Free calcium ions in the soil solution.* Ca-acetate and $CaCl_2$ are very soluble. $CaCO_3$ furnishes Ca ions according to the CO_2 content of the system.

(b) *Adsorbed Ca ions on colloids.* Prolonged electrodialyses of soil colloids removes all free and adsorbed

[1] Missouri Agricultural Experiment Station, Journal Series No. 329.

[2] H. Jenny, *Jour. Phys. Chem.*, 36: 2217–2258, 1932.