Robert Philip has been appointed as the first professor of the subject.

DISCUSSION AND CORRESPONDENCE

ISOLATION CULTURES WITH SMALL AQUARIA

WHEN raising small forms of vegetable or animal aquatics, it is sometimes desirable to follow the development of several individuals simultaneously, and for some considerable time. This can done of course by removing the specimens to separate small aquaria, but by so doing the temperature and other conditions are likely to offer a considerable range of variation among the different specimens. This invites uncertainty as to the natural rate of development, or in response to any intended variable introduced by the experimenter. The desirable condition is to combine a considerable volume of water with isolation of individuals so that each specimen may have essentially identical conditions of temperature, and concentration as each other, in groups of eight to twelve individuals.

During a study of *Lemna* carried on for several months, it was desired to isolate individual plants in order to watch the rate of growth. As the frond floats freely, some method by which the surface of the water could be enclosed in distinct areas seemed likely to meet conditions. It was found that common cotton cord, waxed with parafine, and tied into loops two inches in diameter, were excellent for this work so long as the water was undisturbed. Any disturbance, however, either accidental or in course of the work, by which the upper surface of the string loops become wet, made these sink quickly after they had been in use two or three days, and the enclosed specimens would then be confused with any others which might be near. Small snails developing in pond water used were quite a source of loss of specimens by their destructive habits, as well as factors of uncertainty, through the displacement of the string loops, drawn below the surface by the movement of the snails in case these crawled across the strands. The vessels used at this time were common glass battery jars, and served very well in keeping the plants in good condition, but they were unnecessarily deep.

Later work was done with large crystallizing dishes, and the separation of individuals was secured by the use of glass dehydrating dishes with short legs and perforated bottoms, for inside dishes. This was found very satisfactory. The volume of water in the crystallizing dish was large enough to retain a much more steady temperature than did the small separate dishes tried for a time, and the perforated walls of the enclosing inner dishes permitted the movement of the water with sufficient freedom to eliminate any variable concentration or composition.

In securing single specimens for the isolation work, some interesting conditions were encountered on account of the toughness of the water film. It was found difficult, for example, to lift a single specimen of *Lemna* or *Wolffia* because the surface film would drag several additional specimens along with the desired individual. This trouble was largely eliminated by giving a smart puff of breath close to the desired specimen, which would cause a general scattering of all the floating particles from that point. As the elasticity of the film was released upon the cessation of the blowing, the dispersed specimens were drawn inward toward the center of the cleared area. On account of size, root development or other causes, the different specimens did not move with equal speed, and any one of the specimens first entering the cleared space could be lifted and removed with ease. It was found that a lance-head needle was an excellent lifter for the specimens.

Of three species under observation, *Wolffia* was the easiest to thus isolate, *Lemna paucicostata* next, and *Spirodella* the most difficult to lift with certainty. This is because *Wolffia* is completely immersed in the slight amount of water adhering to the needle, and sticks closely as this is raised from the dish. The single root of *Lemna,* and the many roots of *Spirodella,* prevent the fronds of these plants from so closely adhering to the flat needle. and their added weight also is adverse. It was found further that a dry needle was far

more satisfactory than one which was wet when introduced into the dish. The water on the needle would promptly unite with the surface water in the dish, and several specimens would then be lifted from the dish in nearly every case, unless previously puffed away with the breath. But by wiping the needle, the individual plant desired can often be lifted out even if others are so near as to nearly touch the selected plant.

The dehydration dishes within the crystallizing pans proved very satisfactory, and permitted the continued cultivation of the particular strain under observation for a considerable period.

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TWO METHODS OF ORIENTATION OF SMALL OBJECTS IN PARAFFIN

THE following method is applicable to all objects which are sufficiently small to admit of embedding in watch crystals. It has been found practical and easy and is given here in the expectation that it will be of assistance to others.

Watch crystals of the Syracuse type with flat bottoms are employed. On the bottom, parallel lines about 2 mm. apart are ruled with a diamond. These are then scraped out with a coarse needle, the sharp edges being broken off and the lines widened to form open grooves. The watch crystals should be washed to remove the small particles of glass and are then ready for use. The watch crystals are prepared for embedding by coating the interior with a film of glycerin as usual, but care must be taken to rub the glycerin into the lines. When infiltration is complete, the watch crystal containing the objects is removed from the oven and the bottom slightly chilled by contact with cold water. It is then placed on the stage of a binocular microscope and the objects oriented with a warm needle, so that the plane of section desired shall be parallel with the lines and normal to the bottom of the watch crystal. As soon as the paraffin on the bottom has cooled sufficiently to hold the objects in place, the entire mass is cooled with water in the usual manner. In orienting the objects it is found that the lines on the bottom of the watch crystal show more distinctly by transmitted than by reflected light. The block when removed shows on its lower surface minute parallel ridges which enable accurate and easy orientation when mounted on the object carrier of the microtome. The block should of course be placed in the microtome with the ruled surface upwards and then arranged with the lines parallel with the edge of the knife and the surface at right angles to the direction of motion, that is horizontal in the ordinary vertical type of Minot microtome, vertical in the horizontal type.

A second method, or variation of the method given above, is to rule the parallel lines on the watch glass with a "china-marking" pencil. These lines, even though the glass is thoroughly coated with a glycerin film, will come away with the paraffin block and may be used as orientation lines. This method may also be used for numbering or otherwise marking paraffin blocks.

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THE AURORA BOREALIS

TO THE EDITOR OF SCIENCE: The display of the aurora borealis mentioned by your correspondent, Mr. Thomas Byrd Magath, in SCIENCE, No. 1186, as seen at Fairport, Ia., on the ninth of last August at about 8.45 (Central time?) was also observed by the writer and others from a yacht anchored at Thimble Islands (Stony Creek), Conn., at about nine, 75th meridian time, of the same evening. The display was quite brilliant, although the streamers did not reach much above 50° in altitude. The region of greatest brilliancy was about N. 25° W., true.

On August 14 at about the same time a more brilliant display was seen at Stonington, Conn. (Lat.41° 19′). The illumination reached much further to the eastward and the streamers were higher. At times masses of pale light detached themselves from the general illumi-