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Living Material in the Laboratory

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LIVING MATERIAL IN THE LABORATORY

Biology

Living plants and animals serve as valuable aids in stimulating interest in the biology course and, during that part of the year when field trips are impossible, provide material for the study of habits and the relation of organisms to their environment. Laboratory conditions are of course artificial but they should be made as nearly natural as it is possible to make them.

Fresh-water algae can be kept for some time in a good vegetative condition by placing the material in a large aquarium jar filled with pond water. Some algae are very sensitive to metal salts and do not do well in tap water. Some of the forms with which we have been most successful are *Oscillatoria*, *Nostoc*, *Spirogyra*, *Rhizoclonium*, *Hydrodictyon*, and *Chara*. In the sediment at the bottom we nearly always can find *Pediastrum*, *Scenedesmus*, *Closterium* and other desmids, several kinds of diatoms, and many other unicellular forms. *Vaucheria* and *Oscillatoria* are best kept in shallow dishes or pans of soil with only enough water to cover. As a rule no reproductive structures will be produced under these conditions although our culture of *Chara* has been fruiting quite regularly for a period of over two years. Zoospore formation can be induced in *Vaucheria* by placing a small amount of material in a 2 or 4 per cent solution of cane sugar in the dark. Sex organs have been found when the material was transferred to bright sunshine.

Duckweeds, which grow commonly on the surface of ponds, as well as *Elodea*, *Ceratophyllum*, and

Utricularia, which grow submerged, will do well under laboratory conditions. Lichens, mosses, and liverworts can be transplanted to boxes or pots of soil and, if covered with glass plates, will keep in good condition for a considerable time. In connection with a study of plant propagation cuttings of geranium, begonia, coleus, *Bryophyllum*, willow, wandering Jew or other available plants can be readily started in sand or sandy loam. Bulbs, corms, and tubers as reproductive organs can be illustrated by means of a number of common house or garden plants. In some cases it will be advisable to force growth by the hot-water or ether methods.

In the pond water with the algae and other aquatic plants will be found a number of interesting animals such as fairy shrimps and other small crustaceans, the nymphs of the dragon-fly, damsel-fly, and may-fly, and pond snails of several kinds. From the surface of the water whilgig beetles, water boatmen, back-swimmers, and waterstriders can be secured and can be kept in the laboratory for several weeks during the fall. A crayfish, a small turtle, and a frog or toad can be found in the vicinity of the pond and used to stock the terrarium described below. In late March or early April it is usually possible to find in the pond the grayish egg-masses of the frog. These, if brought into the laboratory, will soon hatch into tadpoles and provide material for a study of the development of a most interesting animal. A small percentage of the tadpoles will survive and probably none will complete their development under these conditions.

It is possible by means of the terrarium to reproduce fairly accurately the habitat conditions for

a number of interesting land animals. A glass aquarium can be used for this purpose or the terrarium can be constructed from a box with two sides and a part of the top made of screen wire. The bottom should be covered with coarse sand and, to provide more natural surroundings, a clump of moss or chunk of sod together with some leaf mold and dead leaves can be added. A dish should be kept filled with clean water. Some of the best terrarium animals are small garter snakes, toads or frogs, a small turtle, and perhaps a lizard or chameleon. Land snails as well as crickets and grasshoppers can also be kept for a considerable time, in separate cages if desired. For the first group of animals live earthworms and insects of different sorts should be provided since these animals will not as a rule eat dead things. We have kept a tree frog in the laboratory for over a year by feeding it flies and, during the winter, grain moths. For the snails, crickets, and grasshoppers pieces of carrot, apples or banana, and green leaves of grass or lettuce can be provided. The terrarium or cage should be covered with screen wire or cheese cloth and if it becomes too dry inside, a glass plate should be used to partly cover the terrarium. It will be necessary to avoid keeping the terrarium too wet and to remove all unused food before it decays.

The aquarium is quite commonly used for keeping aquatic animals and plants though in many cases it is so small that natural conditions cannot even be approached. It is our opinion that the aquarium should be of 10 or 12 gallon capacity or larger and should be rectangular in shape to allow for a large air surface. The aquarium should have a layer of coarse sand or gravel to a depth of 1 or 2 inches. The sand should be washed thoroughly and after it is placed in the aquarium some pond water, or tap water which has stood for some time, should be added. Among the rooted plants *Sagittaria* and *Valisneria* are probably the most useful as they are excellent oxygenators. *Cabomba*, *Myriophyllum*, and *Elodea* can be weighted down or al-

lowed to float. On the surface duckweeds, *Riccia fluitans*, and *Salvinia* will do well. The principal purpose of having green plants is to liberate oxygen for the animals although they also provide some food. In our opinion it is generally impossible to have too many green plants so long as there is plenty of room for the animals. Pond water is generally best to use especially in communities where the water is chemically treated. Among the animals most commonly used are goldfish or native fish, such as minnows or bullheads, "baby" turtles, newts, and snails. The latter are particularly valuable as scavengers. It is better to have only one or two of each kind of animal excepting the snails of which a larger number will be desirable. Things to avoid are overcrowding of animals, overfeeding, sudden changes of temperature, and too much "fussing" with the occupants. Fish food of various kinds can be used as well as flies and other insects, the larvae of aquatic insects, and small pieces of earthworm. The animals should be fed sparingly. Strong, diffuse light is necessary for the best growth of the plants and direct sunlight for short periods will do no harm. Long exposure to direct sunlight will cause an unfavorable rise of temperature and should be avoided by screening if the position of the aquarium makes it necessary. If there is a proper balance between animals and plants it should not be necessary to restock the aquarium for a year or more.

Aquarium and terrarium supplies as well as instructions concerning the maintenance of living materials can be obtained from the following companies,—

General Biological Supply House,
761-763 East 69th Place, Chicago.

Chicago Apparatus Company,
1735 North Ashland Avenue, Chicago.

Cambridge Botanical Supply Company, Waverly, Mass.

Kny-Scheerer Corporation of America, 10-14 W. 25th St., New York City.

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