

## AN ECONOMICAL METHOD OF HANDLING LABORATORY MATERIAL.

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One of the greatest problems that the present day teacher of biological subjects must contend with, is the procuring of suitable laboratory material so that it would be available when needed.

Although courses of botany, zoology, and biology are quite flexible and permit the use of almost any available material, one must admit that certain forms or types are superior to others in illustrating given phenomena or in bringing home to the pupils a specific biological truth. Then, too, in spite of the fact that very little has been done along these lines on the high school level, biological subjects can be graded just like English or Latin has been graded with reference to sequence of difficulty or in the arousing of interest. There is very little grading in any course of botany or zoology in which the teacher depends solely upon what happens to be in season. Then too, not much sympathy and goodwill is aroused on the part of our fellow citizens towards those subjects when the laboratory teacher assigns something similar to the following: "During the next week you will kindly collect leaves from at least twenty different trees." Truly, it is a noble idea to acquaint our children with the various trees growing in their vicinity, but certainly it is not always in accordance, with the spirit of conservation and the spirit of respecting other people's property.

You can readily imagine the result of an invasion of good-sized high school classes into our parks or of similar attacks upon street trees, especially if the collection is made without supervision. Very frequently the students pay no regard to the possible damage, and as a rule, they carelessly break off much more than they actually need for class use. At times they fail to take immediate care of what they have collected, thus necessitating a repetition of their unintentional vandalism.

The seemingly favorable remark, as well as the promise of an additional credit on the part of a high school teacher of one of our city schools when he reviewed the fine collection of evergreens of one of his students, lead to a nocturnal raid upon

the premises of a lover of pines. The next morning the owner received the surprise of his life in beholding so many of his young trees badly damaged. In vain did he try to guess who his enemy was, for it appeared to him that it was done in spite. Fortunately that morning some boys hailed him for a ride. Upon inquiring as to what they were doing so far away from their home and school at such an early hour, he learned that they were looking for evergreens, but, they failed to find any that were not on private property. The solution of his pine mystery did not offer him any pleasure. This gentleman, however, realized the futility of his attempts at beautifying his premises as long as a premium was set upon just such unqualified collection. What hurt his feelings most was the knowledge of the fact that this damage was done solely to supply a need and that the want was made by the misdirected efforts of one of our educators. This is truly a failure in education if so much ill-will and violation of property rights is caused thereby.

The scientific method as interpreted by some teachers, calls for too great a carnage of many animal forms and far too great a waste of plant and animal life. Much time is lost in trying to understand and follow out laboratory manuals. These very frequently are written above the level of those who must use them. Nothing can replace the scientific method involving individual dissection as a desirable training of our premedical students and future biological teachers. They must have their individual cats and other animal and plant forms. Along the high school level and in some college course individual dissection could easily be modified with an economy of time, with an economy of goodwill, and especially with an economy of plant and animal life. An individually dissected specimen is at times no dissection at all, but a mere cutting up, and as such, it fails to convey the desired knowledge and training. In the end it generally finds its way to the ashcan or garbage heaps. The next class calls for some more carnage, some more loss of life. This happens so often that some of these forms are already becoming scarce. This is especially true of frogs.

The lecture demonstration method, the verification method, the use of charts and models, and the use of well dissected but preserved and mounted actual specimens, generally conveys more knowledge and information than individual dissection does when poorly done. The spirit of research or the stimulus of scientific thinking so eagerly sought for by many teachers using

the scientific method, can just as well be instilled into the minds of our students with much less carnage and waste of animal life. This may demand more personal attention on the part of the teachers, but the results will always be worth while. If our teachers or those in charge of providing and equipping laboratories could only think ahead, a good deal of time, life, and goodwill could be saved.

Frog skeletons and other osteological preparations are not so hard to make, especially if one takes into consideration the fact that by careful handling the natural ligaments will keep the greater part of the skeleton together. Careful students and potential osteologists can always be found in any class, especially if provided with a mounted skeleton as a model. Of course, the initial cost and initial toll of life must always be met, but in each succeeding year the economy of money, time, and life is felt. For with proper care and storage these preparations can be used over and over again.

Careful dissections can be preserved and mounted in formaldehyde or cleared according to Spalteholtz' method in synthetic wintergreen oil. Tubes and homeopathic vials, sealed with a composition of tar, rosin, and sealing wax go far in relieving one of constantly buying or collecting. Specimens thus protected are permanent and almost always are more conveniently handled.

If one desires to make a comparative study of forms making up a phylum or homology of organs, these sealed vials can very neatly be sewed upon a prepared pulpboard and thus served as a teaching museum.

Some plant and animal forms like leaves, flowers, catkins, fern sporophylls, large pine seeds, lichens, mosses, wheat rust, centipedes, millepedes, scorpions, etc., permit drying and mounting between two plain lantern slides. These are then bound with gummed Hollands. If the material is thick, strips of pulpboard can serve as reinforcements. Desirable forms can thus be collected in season, properly put up, labelled, and stored away. This will then permit the teacher to grade his course, for he will always be sure of his laboratory materials in any season and in any weather. Year by year additions instead of mere replacements can be made. Very soon a wealth of truly, useful laboratory material is thus assembled, and that without much expense and also without a loss of good will of our neighbors.

However, I consider the time saved as the greatest factor. For example, the teacher can then dispense with often poorly understood laboratory manuals, take a slide in hand, the pupils doing likewise, and be free to lead the study, arousing interest and stimulating scientific thought by his questions and explanations.

Take for example the study of leaf venation and transpiration. The leaf of the American elm, being very simple, lends itself admirably for this purpose, for conspicuous veins lead to the jagged edge. A comparison with the leaves of the birch and choke cherry where the veins are not so conspicuous but the edge more jagged plus a covering up or any living potted plant enables the student to group the significance of the structure and to associate it with function. In short he is taught to be a keen observer. Delicate structures like sporangia are preserved between the two slide glasses and not rubbed off and can easily be observed with lens or microscope. The repugnance frequently met with in handling animals like centipedes and scorpions is done away with when put up this way and hence a better study is made, and by far more interest is aroused.