

necessary to the historian long before "scientific method" began to get too much publicity. The best weapon the teacher has against the smoke screen of half comprehended research terminologies is a good laugh and the determination to go on using his brain—if God gave him one—as effectively as possible in guiding the newcomer into unfamiliar territory.

STRINGFELLOW BARR

BIOLOGICAL TECHNIQUE IN THE HIGH SCHOOL

IN TEACHING biology in the high school one of the first considerations of a good teacher should be not only to "put across her subject matter," but also to create in her laboratory periods enthusiasm and willingness among the pupils to learn, see, and know things. Each biology teacher should be trained in certain techniques to be an effective teacher. When a student from college goes into a small high school where there is very little equipment, she will find it necessary to improvise and substitute equipment. A few of the less technical methods which may be used in the high school laboratory are given below.

In the study of plants the "pocket garden" is a simple but effective teaching device. It provides ready material for the study of seedlings, roots, and root hairs. It may be prepared as follows: Clean thoroughly two pieces of glass about 4x4 inches. Cut blotting paper to fit the glass plates. Place the blotting paper on one of the glass plates and place a few radish seeds on the blotting paper near one end. Cover with the second piece of glass and bind together with rubber bands protected from the sharp edges of the glass by strips of paper. Place the "garden" in a vertical position in a glass of water, taking care that the water does not cover the seeds. The blotting pa-

per should not be allowed to dry out. The seeds will germinate in a few days and a good growth of root hair should be obtained on the young roots.

Sections of plant tissue may be made with a fair degree of success by using new safety razor blades. These blades work well at first and may be discarded when they become dull. A razor with a blade which is only slightly hollow ground may also be used, but must be sharpened frequently. A limited amount of slide-making is possible in the high school laboratory, and it may be carried on with very limited equipment. Several methods may be used. Woody stems may be sectioned directly and the sections may be killed in 95 per cent alcohol. Fleshy stems, young stems, soft roots, leaves, etc., will section better if hardened in 95 per cent alcohol for 18-24 hours before sectioning. The pieces of material placed in the alcohol should not be more than half an inch long.

Glycerine-jelly method. This method is suitable for mounts of material which may be mounted entire, such as small moss plants. Thoroughly clean the material and place it in a ten per cent solution of glycerine. Leave the container open to the air, but protect the solution from dust by covering lightly with a paper. When the solution has evaporated until it is the consistency of pure glycerine, mount the material on slides with glycerine jelly. Sections of soft plant tissues may be treated similarly after they have been stained.

Balsam mounts. Section material and kill in 95 per cent alcohol (if not previously killed). Wash with water and cover with an aqueous solution of safranin and leave for 24 hours. Wash sections in water until the water is clear. Destain in a watch-glass of fifty per cent alcohol to which one drop of HCl has been added until the phloem and cortex are a very faint pink. Transfer the material to 95 per cent alcohol for five minutes, then transfer to light green which is made up in 95 per cent alcohol.

This paper grew out of the author's course in Biological Technique. Credit is due to three students, Misses Margaret Beck, Catherine Grimm, and Olive Roberson, for their assistance.

Destain in 95 per cent alcohol, then transfer to xylol, carrying over as little alcohol as possible. It may be worth while to drain the sections on filter paper before placing them in the xylol. Mount in balsam. If the air is too humid the sections may contain water when they leave the alcohol. If the sections are persistently cloudy in the xylol it may be necessary to use 100 per cent alcohol. This may be obtained by placing anhydrous copper sulphate in 95 per cent alcohol and leaving it for several days. The copper sulphate may be dehydrated in an evaporating dish over a flame and so used over again.

Macerated wood mounts. Split pieces of pine or oak board and boil in water until free from air. Cool before cutting. Slice off thin pieces and place them in a mixture of equal parts of ten per cent nitric acid and ten per cent chromic which have been mixed just previous to their use. Allow the acids to act for 48 hours. Wash in water and stain over night in aqueous safranin. Dehydrate in alcohol and clear in xylol. Just before mounting in balsam tease the woody elements apart on the slide.

Methods for making permanent mounts of animal tissues are in general too complicated for the high school laboratory. Time permitting, the following methods may be used:

Epithelial cells from the lining of the mouth may be prepared for study by smearing some saliva on a slide, allowing it to dry in the air, staining for five minutes in Loeffler's Alkaline Methyline Blue, washing off the stain in water, drying completely and mounting in balsam.

Blood may easily be prepared for study by staining by Wright's method. Prepare a film of blood by placing a small drop on a clean slide and spreading it very thin by drawing the edge of another slide across it. Dry the film in the air and fix by passing the slide a few times through a gas flame. Stain with Wright's stain according to directions. The stain, which may be pur-

chased in solution form, should be fresh.

Muscle tissue of any kind—that from a crayfish or the wing muscles of insects is excellent material—may be prepared in the following manner: kill the animal; remove a *small* piece of muscle; kill by placing in Bouin's fluid for two or three hours; wash in 50-70 per cent alcohol until all trace of picric acid is removed. This stains the alcohol yellow, so its absence from the washing fluid is easily noted. This process may take several days or even weeks if the piece of tissue is large. Tease out thoroughly. Place washed tissue in water for a few minutes to remove alcohol. Stain in haematoxylin. Dehydrate with graded alcohols counterstaining with eosin in 95 per cent alcohol. Clear in synthetic oil of wintergreen, follow with xylol, and mount in balsam.

Spreads of mesentery or any fibrous connective tissue may be made by spreading tissue carefully on the slide and proceeding as with the preparation of the muscle tissue.

Methods in Plant Histology, by C. J. Chamberlain (U. of Chicago Press), and *Animal Micrology*, by M. F. Guyer (U. of Chicago Press), will be found very useful for reference.

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THIS HAPPENED IN DETROIT

Teacher: "We have a very fine set of slides today called "The Evolution of the Book."

Tearful Girl: "Please, Miss D——, may I go out in the hall until the lesson is over? My mother wouldn't want me to listen to anything about evolution, because it is against my religion."

HENCE THESE TEARS

Friend: "Do you think the great outstanding poem of the century has yet been written?"

Poet: "It has not only been written, but it has been rejected!"—*Christian Science Monitor*.