How to Begin.

It matters little what part is selected for a beginning. As the study commences in winter, the shoots of trees, two or more feet long, may be used. Select a tree in which the scars left by the fall of the foliage, leaves, and bud scales of the preceding season are quite conspicuous, such as the cottonwood, poplar, hickory, or horse-chestnut. Set the students at work to examine these before they have been assigned any study in the book. Have them examine all the markings they can find; compare the buds; study the relation between the buds and the scars; determine the extent of the preceding season's growth and of the season before that. When as much of the external anatomy has been seen as possible, let them carefully dissect the buds, studying the nature and shape of the scales; the character of their surfaces, whether hairy or resinous; the young foliage leaves for the next season; the young stem, comparing the shoot for the coming season with last season's growth, noting differences and resemblances. This dissection should be made partly by tearing off the parts, partly by cutting thin slices crosswise and lengthwise with the knife.

When the students have seen everything that they think there is to be seen, let them write a description of what they have observed. They should be asked to make this description as terse as possible, using their own language and not resorting to the book for terms.

The teacher should then examine these descriptions, in which he will doubtless find much omitted. I should then make the study of the same shoot the subject of the next class exercise, in which I should point out each feature that I wished examined, giving sufficient time for the inspection of each part. I should also endeavor to show that for the circumlocutions in their descriptions there are often single words (technical terms). The pupils will thus come to know something of the method of accurate and thorough observation, and will discover that technical terms are not hard words invented for their discomfiture, but short ways of expressing the ideas gained.

At the close of this exercise I should call upon each pupil to draw carefully a portion of the shoot showing as many of the facts observed as possible. Drawings should also be made of the dissected parts. Here the teacher will be met by the objection on the part of the pupils that they cannot draw; but as that is only another way of saying that they cannot see accurately, he will have to insist on their doing the best they can, with the assurance that as power of accurate observation increases the accuracy of the drawings will increase in the same ratio. He should be able to lead here as at other difficult places. Happy he if he be not a blind leader of the blind.

After studying several other shoots in the same way, I should assign the lesson in the text on buds and branching.

The points specially emphasized here are: 1. Study of the plants themselves. 2. Drawing and describing observations. 3. Afterwards the study of the text-book. 4. Supplementary reading, particularly as to the function of the parts studied.

Topics for Further Study.

Following this method with each organ, the following topics are suggested:

Underground stems: potato (tuber); onion (bulb); cyclamen or Indian turnip (corm).

Structure of stems: cut thin slices of both herbaceous and woody stems and examine in water. Bean, sunflower, geranium, hyacinth, and twigs of forest trees may be used.

Leaves: structure of blade and petiole; forms of stipules; character of venation, particularly with reference to function of veins. Reference readings on the function of foliage leaves are particularly important. Study of the unfolding leaves in spring is specially desirable.

Flowers: parts; forms; flower clusters, etc. I need enter on no details as to these parts, since they are treated so fully and have always received overmuch attention because of their importance to classification.

Let it be remembered in the study of all these topics that it is not a memorizing of the technical terms of descriptive botany that is wanted, but a study of structure of the parts with reference to function. Insist on the pupil constantly asking himself, "What is this for?" As to technical terms; if they are not acquired as a convenience they would better not be acquired at all.

Some time should be taken before the close of the year to study the lower plants. It is an excellent plan in the spring to organize "forays," on which pupils can collect every form of plant they can lay their hands on, ferns, toadstools, lichens, parasitic fungi, algæ, etc. Preserve these[1] and have them studied. Directions for such study can be found in Arthur, Barnes, and Coulter's "Plant Dissection" (Henry Holt & Co.); Bower's "Practical Botany" (Macmillan & Co.); Bessey's "Essentials of Botany" (Holt); Campbell's "Structural and Systematic Botany" (Ginn & Co.).

Questions will be freely answered regarding any matters not elucidated above, and further suggestions will be made if desired. I should be glad to be of assistance to teachers in improving the work in botany.

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A NEURO-EPITHELIOMA OF THE RETINA.[2]

THE possibility of the reproduction of the most highly organized structure of the human body has long been doubted and even denied. Until the publication of an instance by Professor Klebs of Zurich, in which the ganglionic cells of the central nervous system were found repeated in a tumor formation, this was not admitted to be possible. Even now not a few competent pathological histologists are not convinced of its occurrence. An interesting and important addition to this subject is that of Dr. Flexner. In this instance the rod and cone layer and the external nuclear layer of the retina were reproduced in a tumor.

The case was that of a child four months old. One eye was affected and removed, and then the remaining eye became the seat of a disease presumably of like nature. But nothing was permitted to be done for the second eye. Several years before this child was born another child in the same family, this one six months old, died in consequence of an eye tumor which returned. Two years after the case just related another child of the same parents, this one four months old, had a tumor of the eye which spread to the brain, also resulting in death. The one which is reported makes, therefore, the third instance of eye tumor in this family. There was no history of eye tumor in the immediate ancestors of the children.

The vitreous chamber of the eye was filled almost entirely with the growth, The latter was attached to the retina throughout a considerable part of its extent, and was seen to originate at a point of microscopical size situated in the external nuclear layer. The cells which made up the tumor consisted of two principal kinds.

[1] Every teacher should have some book with directions for preserving plants. The following are available: Bailey's "Collector's Hand-book" (Bates, Salem, Mass.); Penhallow's "Botanical Collector's Guide" (Renouf, Montreal); Knowlton's "Directions for Preserving Recent and Fossil Plants" (Part B, Bulletin 39, U. S. National Museum).

[2] "A Peculiar Glioma (Neuro-epithelioma?) of the Retina," by Simon Flexner, M.D., fellow in pathology. From the Pathological Laboratory of the Johns Hopkins University and Hospital. The Johns Hopkins Hospital Bulletin, No. 15, 1891.

Those present in predominating number are probably not the entire cells, but are described as such for the sake of brevity. They present the appearance of sharply stained nuclei, with scanty, often indistinct, even apparently absent, cell bodies, and in favorable places their fibre-like processes can sometimes be traced a short distance from the cell bodies. These bodies often appear as round cells, and they are spoken of as such in this article, but they have a more complicated structure than this designation would imply. The next most important cells are larger than the round cells, but their nuclei are not larger than those of the round cells. These cells are usually of a columnar or rod shape, but sometimes they appear to be conical. The nuclei invariably occupy the broader ends of the cells, and each cell presents opposite to the nucleus an acute terminal process. Finally, from the extremity of the cells can sometimes be seen a stalk-like prolongation which passes down between the round cells and probably becomes united with them. The disposition of the various cells of the tumor is important. The columnar cells arrange themselves in the form of circles or rosettes, and this is accomplished through the juxtaposition of the sides of the cell bodies, the acute ends of the cells pointing towards the centre of the circle, while the periphery is formed by the broad ends of the cells containing the nuclei. The latter vary in size, depending on the number of cells concerned in their formation, and where the acute ends of the cells are in opposition, and just before their termination, a very fine, although distinct, membranous ring is formed, and projecting beyond this ring the delicate processes of the cells forming their acute ends may be observed. The round cells above described surround the rosettes. These tumor cells are in many ways identical in appearance with the external nuclei and rod and cone layer of the retina, as the author shows.

"If morphologically it is impossible to distinguish between the round cells of the tumor and the cells of the external nuclear layer of the retina, so do we consider that in each of the numerous rosettes can be seen the rod and cone layer of the retina reproduced in miniature. For it is possible to see in the membranous ring the external limiting membrane of the retina, beyond it, projecting into the lumen of the rosettes, the delicate processes of protoplasm corresponding to the rods and cones, and opposite to these the nuclei to which these processes are united And then surrounding these nuclei, which form a part of the external nuclear layer, as it were, are the numerous round cells which are indistinguishable from the cells of the external nuclear layer. It is not to be considered that in every rosette the matured rod and cone layer of the retina is reproduced· While this is the case in some of them, others show a structure suggesting the embryonic type. Hence this tumor is regarded as one in which the two most external layers of the retina have been reproduced."

The second part of the paper is devoted to a discussion of applicability of the term "glioma" and the suggestion of the name "neuro-epithelioma," and then with a consideration of the question of the embryonic origin of tumors in general.

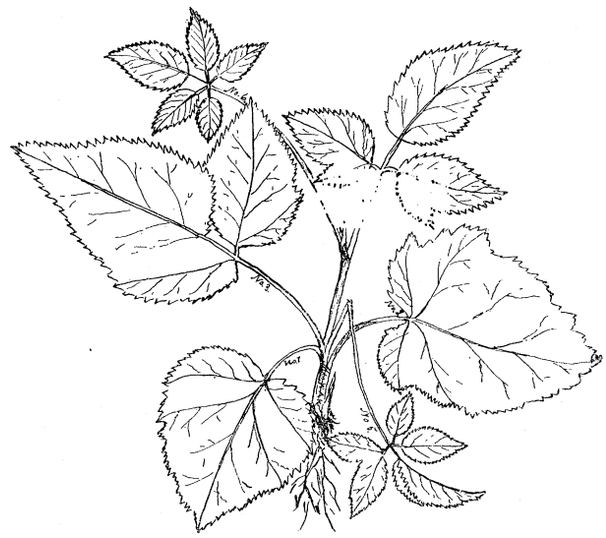
A SEEDLING BLACKBERRY PLANT.

WHEN poor little "Jo" of Bleakhouse was told to "move on," he did not appreciate the fact that everything in nature is impelled by irresistable forces to "move on" to a higher plane of existence, or suffer the only alternative, extinction. Plants and animals must be able to respond to changed conditions, must adapt themselves to their ever changing environment by various modifications.

Grant Allen has written some exceedingly interesting chapters on the genealogy of certain plants. Nature seems to have dropped a magic key into his hands, which admits him directly into her presence, and he relates with charming grace what she imparts to him. Although it requires a skilled expert to "Dissect a Daisy," any one who will, may read the fascinating story of evolution which is written on the leaves of many plants.

Now, here is a little seedling blackberry plant, which we will take for our text. You will notice at the merest glance that the leaves are quite dissimilar. The one nearest the base being simply a plain, ovate leaf, with an irregularly serrated margin. I wish you to notice particularly a certain peculiarity in the venation of this leaf, viz., that the first pair of veins near its base are quite prominent; that, leading from these veins on the lower side, are also well-marked veins; while on the upper side there are none, or very inconspicuous ones. There does not seem to be anything striking or of especial interest in these facts, but, like the "magic pear," which the artist, with a few strokes, converts into a face, this peculiarity becomes gradually emphasized, until later on in the series it may be called a characteristic.

The second leaf differs somewhat from the first one, the outline is more irregular. If, however, we read just a little between the lines, we will see that it really has taken quite a stride in advance; a little more careful examination will reveal, what perhaps escaped our notice at first, that the difference between these two leaves does not consist wholly in difference of outline. Again, it will be observed, the



A SEEDLING BLACKBERRY PLANT.

pair of veins near the base of the leaf are prominent, the smaller veins leading from them being also well-marked, on the lower side only.

With a little imagination, we can perceive that Nature is busy at work with this "magic leaf," and has already conceived the idea of evolving from it the trifoliate leaf. With this idea in mind, we can readily understand the significance of the prominent veins, to which your attention has already been called. We may consider them the frame-work of the undeveloped leaflets. A notch is quite plainly seen on each side of this second leaf, which nature evidently wishes to continue and deepen until a new leaflet is given off on either side. As if to render this result more easily accomplished, she has omitted the frame-work in the portion of the leaf where division is to take place. As proof that our imagination has not led us astray in our prediction as to nature's plan, we have leaf No. 3 of our seedling. This leaf has actually given off a leaflet on one side, and is evidently husbanding its forces for the elaboration of another on the opposite side, the outline of which is already suggested by the characteristic venation on the lower or outer portion. We may almost say that half the leaflet is even now evolved.