necessary for the tree to attain the age at which it has heartwood before it may become infected by this fungus; that is, it seems to be necessary that the tree shall have heartwood and that the heartwood must be exposed by some injury before *Fomes Ribis* is able to obtain an entrance to its trunk. While there is a bare possibility of exceptions to this rule, no such were found. Practically every tree, in which wounds were found by which the heartwood was exposed, was infected and bore one or more sporophores of the fungus. *Fomes Ribis* enters the trunk of the tree apparently in the same manner as do most of the so-called "wound parasites." It obtains a foothold in one of these injuries and gradually progresses into the heartwood of the stem; once entrance has been obtained to this, the rot gradually extends upward, downward and sidewise from its first entrance into the trunk until the tree finally dies or is broken over by the wind. When the heartwood has become completely affected through its entire thickness, the adjacent rings of the sapwood seem to prematurely assume the characters of heartwood, and the rot finally extends into them also; so that in extreme cases the sapwood is found to be even thinner than it normally is. Cases were found where this process apparently extended until the tree was killed outright. A number of other cases were also found in which but a single ring of the sapwood still remained alive.

The heartwood of *Sassafras* is normally of a rather dark brown color, but when attacked by this fungus it assumes a slightly redder and lighter color. This color of the rotted wood is undoubtedly due to the fact that the mycelium of this fungus is itself of a ferruginous brown color, and thus helps to give a brown coloration to the tissues within which it is located. The wood is very porous, and the fungus fills the large vessels and tracheids with its brown mycelium, forming tangled masses which completely fill their cavities. Between the healthy and the rotted wood is a narrow black zone. Microchemical tests indicate that the fungus does not exert a very active delignification upon the cell walls, but that the tendency seems to be for a more or less complete local solution of the entire cell wall. The rotted wood seems to retain much of its original appearance, yet has been very decidedly weakened by the action of the fungus in dissolving the middle lamellæ from between many of the cells, so that they adhere to each other but slightly.

Perley Spaulding

Laboratory of Forest Pathology,
U. S. Department of Agriculture,
Washington, D. C.

NOTE ON THE MOVEMENT OF MOISTURE IN SOILS

In teaching physics it is particularly important, whenever practical, to show how phenomena observed in nature are explained by facts discovered in the laboratory. For this reason it is hoped that the following, though containing nothing new in physics, may be of interest to those who have the honor of instructing others.

It is known that evaporation, condensation and surface tension, all play important roles in the movement of moisture in soils. The U. S. Department of Agriculture has conducted a number of investigations on these subjects, and has reached some valuable conclusions. The effects, however, due to changes in surface tension, produced by changes in temperature, have not been considered in detail, nor do I recall having seen them mentioned anywhere else.

It has long been known that the surface tension of a liquid increases as its temperature is lowered. In the case of water at least this relation continues at the same rate to and below the ordinary freezing point, provided the liquid condition is maintained; and therefore any change in the temperature of the soil, such as takes place to a greater or less extent every day and night, must produce a corresponding movement of its moisture towards the colder parts, where the surface tension is greatest. Besides, evaporation, which is most rapid where the temperature is highest, and condensation, which is greatest on the coldest surfaces, produce moisture movements in the same direction as those made by temperature changes in surface tension, so that the several causes work together. But, owing to a variety of influencing conditions, their relative importance in producing the common effect is not easy to determine.

Evidently, since the temperature is nearly always lower at night than during the daytime, the upper layer of the soil thus cooled is usually damper in the early morning than in the afternoon; and whenever the temperature falls very greatly, the corresponding large increase in the tension and in the condensation at the cold surface will take much moisture from the warmer soil beneath. It is largely, if not wholly, this that leads to wet soils so often seen on cold mornings when there has been no rain, and to the surprising depth of mud that frequently follows a thaw. It accounts too for the considerable supply of moisture from the deeper soil in the production of ice columns—spewing of the ground.

This temperature effect on surface tension, on condensation and on evaporation also greatly conserves that moisture already in the earth and keeps it in motion. That is, the moisture is brought to the surface in greatest abundance only when the temperature there is low and therefore the rate of evaporation into the air small; and whenever the surface temperature is increased, leading to a higher rate of evaporation into the air, the moisture is drawn away to the colder portions of the soil beneath, where it is protected from the winds by the top layers which it has just left.

W. J. HUMPHREYS
MOUNT WEATHER OBSERVATORY,
BLUEMONT, VA.

BOTANICAL NOTES

A NEW EDITION OF ENGLER'S SYLLABUS

THE fifth edition of Engler's "Syllabus der Pflanzenfamilien" (Borntraeger, Berlin) which appeared during the present year, differs very little from the fourth (1904). A few slight changes are made here and there, but the book is essentially unchanged. Yet it has been reprinted from beginning to end, illustrating afresh the fact that in book publishing the Germans do things better than we. Had this book been published in this country the first edition would have been electrotyped, and it is safe to say that this fact would have made it impossible for us to have had four subsequent editions in the short time which has elapsed since the appearance of the first. The electrotyping of a scientific book ought not to be permitted, for it always means that the publisher proposes to keep it in essentially its present form for as long a time as possible. Why should not American botanists insist that their publishers shall not electrotype their books, and that the editions be of a limited number of copies? We ought not to be tied to our dead and disowned ideas merely because our publishers prefer to embalm them by electrotyping.

Another suggestion which comes to one who examines this book is that the term "Thallophyta" is passing. It has long stood as an omnibus term to cover many different groups of plants. In the third edition (1903) the term was abandoned, and in its place appeared eleven coordinate terms, which were reduced to ten in the fourth and fifth editions. One looks in vain for this time-honored name for the lower plants. It has apparently gone to the limbo to which have been banished "cryptogam" and "phenogam." The Vegetable Kingdom is now divided into twelve grand divisions or phyla, namely; *Phytosarcodina, Schizophyta, Flagellata, Dinoflagellata, Zygophyceae, Chlorophyceae, Charales, Phaeophyceae, Rhodophyceae, Eumycetes* (all of which formerly were lumped together as "Thallophyta"), *Embryophyta asiphonogama* (*Bryophyta* and *Pteridophyta*), and *Embryophyta siphonogama* (*Spermatophyta*). And yet we shall doubtless have the text-books speaking about "Thallophyta" for years to come, as though the group had not been long since abandoned.

A NEW LABORATORY MANUAL

AN interesting and no doubt useful laboratory manual is Müller's "Mikroskopisches und Physiologisches Praktikum der Botanik für Lehrer" (Teubner, Leipzig), a little book of 240 pages and 235 text illustrations. Twenty pages are given to the microscope and micro-