The meetings in Des Moines were of great interest to the botanist. Besides the meetings of the American Association for the Advancement of Science, there were sessions of the Botanical Society of America, the Ecological Society of America, the American Phytopathological Society, and the American Society of Plant Physiologists. A few of the papers are reported for you here.

Soil of Utmost Importance in the Growth of Plants

Botany

PLANTS, both wild and cultivated, are just as particular about the composition of the water they take from the soil as people are about the water they take from their household faucets. Like human beings and lower animals, they refuse to live where the water is unsuitable, and thrive best where they find the water "right."

How biologists are able to inquire into these soil-solution preferences and what they learn from their inquiries was discussed in a symposium of the Ecological Society of America. Four leading plant and animal scientists led the discussion: Prof. J. F. McClendon of the University of Minnesota, Prof. E. Truog of the University of Wisconsin, Prof. Herman Kurz of the Florida State College for Women, and Prof. E. B. Powers of the University of Tennessee.

Prof. McClendon opened with an outline of the theory of soil acidity and a description of the methods available for testing it. The latter have progressed far beyond the simple slip of litmus paper that used to suffice and is still employed in many places. Several field kits, with graded series of delicate color tests in various solutions, can now be obtained by the student of soil acidity problems, as well as electrical apparatus for more direct measurements.

What crop plants like and do not like in soils was the subject of Prof. Truog's address. It used to be flatly assumed that acid soils were bad for all crops, but the modern doctrine is not so simple as that. There are some crops, to be sure, so sensitive that they will not yield well if the acidity to which their roots are exposed rises above a very low minimum; but there are others, normally neutral-soil plants, that will tolerate a considerable concentration. Such plants are useful "breaking-in" crops for newly drained peat and muck lands, and other places where the acidity is still high. Finally, there are some cultivated plants which in their native state demand a really highly acid soil. Blueberries and cranberries belong to this class. These must be cultivated on land as much like their native habitats as possible. Realization of the acid preferences or phobias of plants has done much to help farmers and horticulturists to adapt their crops to the land available.

A sufficiently skilled botanist can walk on to a piece of land new to him, and by counting certain plants tell the acid concentration of the soil with considerable accuracy before a chemical test is made at all. Prof. Kurz told of studies of the relation of plant distribution to soil acidity.

The pioneer work in this field was done thirteen years ago, by Dr. Edgar T. Wherry of the U. S. Department of Agriculture, who is both chemist and botanist. Since his time the work has been carried on actively by scores of researchers all over the world.

It is possible not only to estimate the soil acidity by studying the plants that grow on it, but to predict with a considerable degree of accuracy the probability of finding a given species of plant if the chemical state of the soil is known, Prof. Kurz stated.

Animals as well as plants are influenced by the chemical nature of the water to which they are exposed. This is especially true of aquatic animals, which are not only very intimately exposed to the water, but are free to move away from a locality they do not like or into one which they do. This aspect of the problem was the theme of Prof. Powers' discussion.

HOW a cornfield to a certain extent makes its own weather was related by Dr. J. M. Aikman of Iowa State College.

As everybody knows, weather has a great influence on crops; but the weather we get from the Weather Bureau might be called just "average" weather. The cornstalk in the field is not interested in averages; what affects its life is how much sunlight reaches its individual self, and to what extent it has to give up, by evaporation, the water it has drawn from the soil.

Dr. Aikman set out to study the "micro-climate" of a cornfield, as affected by the corn plants themselves. He set out instruments to measure the humidity and evaporating power of the air, the temperature of air and soil, and the intensity of sunlight. He measured three different plantings of corn in this way; one a field with two stalks to the hill, one with three and one with five.

In general, he found that the denser the stand the higher the humidity, the lower the evaporation rate among the stalks, and the less sunlight reached the lower leaves. The evaporation rate, for example, was ten per cent. higher in the "thin" field than in the densely planted one. Missing stalks in the hills, causing irregular gaps in the field, introduced wide fluctuations in all the "microclimatic" readings."

Young oak trees must have plenty of sunlight if they are to develop strong root systems, Prof. A. E. Holch, of the University of Nebraska, pointed out. He studied young burr-oaks on an open hilltop, in an open stand of oaks, and in a more densely grown stand of linden. Year-old seedlings in the full light of the hilltop developed a root depth of five feet and a total spread of 2.25 feet. Trees of the same age in the 12 per cent.

light of the oak forest had a root depth of 1.6 feet and a spread of nine-tenths of a foot, while in the shade of the lindens, where there was only a 3 to 4 per cent. light, the roots reached a depth of only eleven inches and had a three-inch spread.

Botanical Society

Individual plant cells, that were alive when Jefferson wrote the Declaration of Independence and Washington fought to make it good, were described before the Botanical Society of America by Prof. J. B. Overton of the University of Wisconsin.

Some years ago Dr. D. T. MacDougal of the Desert Laboratory, Tucson, Ariz., discovered cells in certain cacti which live and retain their individuality for more than a century. Prof. Overton, who has been associated with Dr. MacDougal in the study of these cells, has continued the investigation on their structure and chemistry.

In the giant cactus and the barrel cactus some of the cells attain great age—150 to 200 years in extreme cases. Some of the cells of the core, or pith, of these plants have been continuously alive and active since the Declaration of Independence, or even earlier.

These long-lived cells furnish an opportunity for the study of the effects of age on living matter. The young cells are thin-walled, lack a central sap cavity, contain relatively large amounts of water and are rich in mucilages, nitrogen and phosphorus, and the percentage of dry matter is relatively small; while the old cells are thick-walled, contain a large central cavity, have relatively much less water, more dry matter, less nitrogen and less phosphorus.

It is notable that probably some cells of long-lived animals, like those in the central nervous system of the parrot and elephant, live and retain their individuality as long as the individual lives. In these long-lived animals the long-lived cells are very specialized in structure and function, while the long-lived cells of the cacti are of a simple undifferentiated type. The chief differences between young and old cells are not so much structural characters as chemical ones.

All living things generate currents of electricity, minute but measurable, and this electricity is the force that influences their rate of growth and determines their form.

Evidence in support of this doctrine was presented by Prof. E. J. Lund of the University of Texas.

The unit of electrical generation in the living plant or animal, just as in an electrical battery, is the cell—although the living cell is a vastly different thing from the electrician's cell. The voltage of each cell is added to that of the one in front of it in the direction in which the tiny current is flowing, and its amount and intensity have great influence in the activities of the organism as a whole.

It has been possible to find electrical currents in living trees. In the Douglas fir and the white fir the current has been shown to flow continuously upward in the outer layers of wood, and downward through the inner layer of the bark, Prof. Lund said.

The existence of the currents is dependent on the activities of the living cells. They have been made to disappear by applying certain anesthetics and poisons to some cells, by depriving others of oxygen, and by other means. Conversely, subjecting growing plants of various kinds to the flow of an outside current has caused marked modifications in their final form.

"The experiments distinctly indicate," Prof. Lund concluded, "that the existence of continuous bioelectric currents will contribute to an explanation of how ordered growth and regeneration can occur in primitive and embryonic plant and animal tissues where no nervous or hormone mechanism is known. The facts appear to open up a new avenue of approach to many obscure and difficult problems in embryology, growth and regeneration."

Prof. Lund was followed on the program by his associate at the University of Texas, Gordon Marsh, who told of experiments in passing electric currents through roots.

Wandering Plants

THE classic boast of the old cowboy song, that "I've swum the Mississippi and I've clumb the Great Divide," is true for rooted plants no less than for beings blessed with means for bipedal locomotion. Plants also climb the Great Divide, Prof. Aven Nelson of the University of Wyoming, veteran western botanist, told members of the American Association for the Advancement of Science.

One of these passes accessible to plants is in Yellowstone National Park.

"A certain small area in Yellowstone Park," said Prof. Nelson, "is a sort of 'no man's land' out of which the headwaters of three great river systems spring—the Yellowstone, the Snake and the Green as important tributaries of the Missouri, the Colorado and the Columbia system. It is to be remembered that the watershed divide does not necessarily coincide with the high peaks and ranges. The continental divide in certain places is found on high table-lands so level that only the observed drainage or the surveyor's instrument can locate it.

"These high table-lands often of great extent, lying between the interrupted ranges, constitute the passes that permit the construction of great roadways connecting the East with the West,—the Union Pacific Railroad, the Lincoln Highway, and the Transcontinental Airways, for instance. It may be well also to remind ourselves that these passes permit not only the mingling of peoples but of plants. Were the barriers more complete we could speak more definitely of a Pacific and an Atlantic flora.

THE adobe missions of Southern California have become valuable to the botanist as an archaeological source of information on the history of plant life of the southwestern part of the United States.

An accidental find, described by Prof. George W. Hendry, of the University of California, is now revealing extensive knowledge of the sources of plants and weeds of a large section of the country—a subject of which the present world is as ignorant as it is of the sources of the flora of the Roman empire.

Prof. Hendry was looking for the source of black oats, famous in Sonoma county, California, when he noticed that adobe bricks contain well-preserved specimens of vegetation. Since that time, 14 sun-dried brick buildings in different parts of California have been examined, but not one sprig of black oats has been found.

The approximate dates of introduction and sources of many plants and weeds, however, have been accurately determined from a careful study of the ages of the buildings in which they occur. In spite of the fact that much of this valuable vegetation has been embedded in the clay for more than a century and a half, it is still preserved well enough for identification.

Contrary to popular belief, it has been definitely established from these finds that wheat was introduced into California during the Spanish period.