up the plant. Take a turnip or a potato, and, after weighing it, dry it slowly in an oven; this will reduce the weight very considerably, showing that the greater part of the turnip consists of water. Continue heating, but at a higher temperature, and the turnip will soon be reduced to a black lump like a cinder, but this cinder, as we have already learned, is a form of carbon, so we see that next to water carbon is the substance that enters most largely into the composition of a plant. Now wrap a wire round the charred remains and hold them in a Bunsen flame; soon there is nothing left of our turnip but a little white ash, which represents the mineral matter which is present in the plant.

We have found that the plant is built up of water, carbon, and a little mineral matter, and therefore it must feed on these substances, but how does it obtain them? Let us examine the specimens that we have been cultivating in water. Those that are supplied with the normal solution are in a flourishing condition, showing that they have got all the nourishment that is necessary for their proper growth. The water and mineral matter are contained in the bottle, so the plant evidently absorbs these by means of the tiny rootlets that spread out in the solution. Those specimens that are living in solutions that are deficient of any of the necessary salts are not doing well, the one that has no iron is wanting in color, and the others are stunted and weak. The plant, then, obtains its water and mineral matter by means of its roots, but it must obtain its carbon in some other way, for the normal solution contained no carbon at all. The air, however, contains a small quantity of carbonic acid gas, and it is the function of the leaves to break this up into the carbon and oxygen of which it is composed, retaining the carbon for the use of the plant, and setting free the oxygen.

How the Root Feeds the Plant.—We have seen that the root supplies the plant with the water and mineral matter that it requires. Now let us see how this is effected. All the nourishment that the root obtains from the ground must be in a liquid form; in fact, it is contained in solution in the water that it absorbs, but the point arises, how does this liquid run *up* the tree in order to feed the shoots at the top, the usual order of things being for water to run down. If we take a very fine tube and fasten it in a vertical position, with one end dipping into some colored water, we shall find that the water is drawn some distance up the tube, and if we take several tubes we shall find that the water stands highest in the narrowest tube. Water will rise in a lump of sugar in the same way, for the spaces between the particles of sugar act like very fine tubes. The oil creeps up the wick of a lamp for the same reason; this may be shown by hanging a piece of wet lamp-wick over the edge of a beaker of water and letting the end dip into a pot of red ink; the ink will gradually creep up the wick until it reaches the beaker and colors the water. These examples serve to illustrate the way in which the sap rises from the roots to the highest point of the tree.

How the Leaves Feed the Plant.—We have seen that the leaves supply the plant with carbon by breaking up the carbonic acid gas which is found in the air, but we want to know what there is in the leaves to bring about this decomposition, and next how the carbon, which is a solid, is conveyed through the pores of the plant in order to supply nourishment to every part that requires it. If we soak leaves in water, they do not color the water at all, but if we boil them for a few minutes, then soak them in methylated spirit, they will lose their color, and the spirit becomes green. Evidently, then, the well-known green color of the leaves is due to some substance which is insoluble in water, but soluble in methylated spirit. This substance is called chlorophyll. If a few sprigs of water-cress are placed under water and the whole exposed to the sunlight, the action of the chlorophyll will be shown by the bubbles given off from the leaves. These bubbles will not be given off unless the leaves are exposed to the sunlight, for, as will be clearly shown presently, the chlorophyll will only act upon carbonic acid gas in the presence of light. The duty of the leaf, however, is only half done when it has obtained a supply of carbon, for solid carbon is perfectly useless as a food for the plant. This fact is well known to dwellers in towns, where the leaves of plants are apt to get covered with soot, which is a form of carbon, but these particles of carbon, instead of feeding the plant only choke up the pores of the leaves. Before the carbon can be of any use it must be changed into something that the plant can absorb into its system, viz., starch and sugar.

The properties of sugar are familiar to every child, and starch is known as a white substance that is used for stiffening linen. If we make some thin starch paste and add a few drops of solution of iodine, the starch paste will turn a deep blue color; this is the best test for ascertaining whether starch is present or not. Pour a few drops of solution of iodine into some flour paste, also pour some on a piece of bread and on a slice of potato; in each case we get the blue color indicating the presence of starch. Let us bleach a leaf by boiling it and soaking it in methylated spirits until it has lost its green color; if we now dip it into a solution of iodine it will turn blue, indicating the presence of starch. This is a store of food stuff that the leaf has formed from the carbon, and which is laid up to carry the plant over the sunless periods when the leaves cannot obtain carbon.

Now test a leaf from the plant that has been shut up in the dark cupboard. We shall find that it does not contain starch, for the plant has drawn on its stock of food without the leaf being able to replenish it. We have not quite come to the end of the matter yet, for although the starch has gone from the leaf, the point as to how it went still remains to be settled, for, as we shall see, starch is quite as