have described them. It is to be noticed that in the plant there are far fewer forms of "tissues," fewer distinct physiological organs, than in the animal. This is because specialization or division of labor in plants is much less perfect than in animals; and one structure has to perform several duties.

How and what the Tree eats and drinks. Botanists and chemists have joined forces for this study, and they have found that the tree, like all other plants, uses as its food these four substances, carbonic acid gas, water, nitrogen and some common mineral salts. Out of these, and these only, does the tree build up not only its own structure, but also all of the immense variety of products which it yields us.

The carbonic acid gas (CO_2 of the chemists) exists in a very dilute form, about one twenty-fifth of one per cent, in the atmosphere. From this it is taken into the digestive organs, i. e. the leaves, of a Tree directly through the epidermis, which is so constituted as to stop the passage of water vapor, while allowing other gases to pass freely. The water (H_2O) on the other hand, is taken in entirely from the soil through the tiny hair-like outgrowths of the epidermis of very young roots. These hairs can extract, by the physical process of osmosis, even the smallest quantities of moisture from the soil. The water is then conveyed up to the leaves as "sap," through the younger wood, the force which raises it being a combination of capillarity and a certain little-understood property of the living-matter, or protoplasm, contained in the medullary rays or "silver-grain."

Nitrogen (N) is of very great importance to the tree, as it is an essential constituent of the protoplasm. It is nearly all obtained from the soil in some soluble compound dissolved in the water taken up by the roots, and with the water it is taken to the leaves. It gets into the soil in three ways; either from the decomposition of animal or vegetable matter containing it; or from rain-water in which it falls dissolved in the form of nitrous acid formed in the air by electrical action; and lastly from nitrates formed in the soil by the agency of Bacteria or germs.

The mineral salts are without exception taken in with the water in solution through the roots and with the water carried to the leaves. To effect the solution of mineral salts, an acid is formed by the young roots.

How the Tree digests or assimilates these substances. The leaf is the digestive organ of the tree, and the raw food substances being within it, digestion will begin provided there is green matter present and sunlight or its equivalent,—but these two latter conditions are absolutely requisite. The green matter, or chlorophyll, occurs in the protoplasm of the leaf-cells in the form of granules, but nothing whatever is known as to the cause of its peculiar properties. We simply know that without it, assimilation and therefore vegetable and animal life would be impossible. This is perhaps a new view to many of our readers as to the use of the green color of vegetation.

The process of digestion consists primarily in the decomposition of the CO_2 and H_2O, and the formation from their elements of a new substance. That substance is first recognizable as *starch,* ordinary laundry starch. In this process, all the carbon and hydrogen are needed to form the starch, but there is a large quantity of oxygen left over, which is given out again by the plant. The process may be illustrated simply by the following formula which our chemical and perhaps all our readers will understand.

$$6\ (CO_2) + 5\ (H_2O) = C_6H_{10}O_5 + 6\ (O_2).$$

In other words, by the decomposition of six molecules of carbonic acid gas and five of water, there are produced one molecule of starch and six of free oxygen. It is thus that plants purify the air for animals, absorbing the carbonic acid gas, retaining carbon and giving back to the air the pure oxygen.

The atoms of the molecules CO_2 have an exceedingly strong affinity for each other, so much so that a tremendous force is required to pull them apart. That force is supplied by the energy of the sun's rays, which explains the need for sunlight in the process of assimilation. But though forced apart, the atoms still retain their affinity, the carbon of the starch and the oxygen of the air, and they will eagerly re-unite if allowed to do so.

But what of the nitrogen in this process? It takes no part in the formation of starch, but this once formed, a union of some of its constituents with the nitrogen gives us the albuminoid or protoplasmic substances which are of such vital importance. This union for the most part takes place in the stem away from the leaves. All food substances whatever, formed by the tree, pass through stage equivalent to this, that is, they are formed from the starch.

The mineral salts are of subordinate importance.

How the Tree stores up food. It is evident on a moment's thought, that if plants produced only so much starch as they individually need, there would be none for animals, and animal life would be impossible. Plants do more; they store up materials to give them a start in the spring, and to give their seeds a start in life. It is of this store that animals rob them. The insoluble starch formed in the leaves wood, bark, buds, or roots, after being re-converted is converted into scluble sugar and carried back in