TALK WITH THE BOYS.

No. 6.—Carbonic Acid in the Leaf —The Philosophy of Burning Charcoal — The Way Plants Draw their Solid Substance from the Air.

"What were we going to talk about to-day, boys?"

"You were going to tell us, sir, how carbonic acid gets into the leaves of trees and plants, and what becomes of it there."

"Oh, yes! And of all the operations of this wonderful substance there is none more interesting than this, and none which has been the subject of more delicate and rational investigations. When carbonic acid, floating along in the atmosphere, comes in contact with a growing leaf, it is absorbed by the leaf and decomposed; that is, in each of its atoms the oxygen is separated from the carbon, the former escaping into the air, while the carbon is carried by the sap to all those parts of the plant in which new wood is being formed, and is deposited in the proper places to perform its part in building up the structure of the plant. If you take a piece of wood and heat it in a close oven, or under a covering of turf, so as to keep the oxygen of the air away from it, and thus prevent the carbon from burning, the more volatile constituents of the wood will be driven off in the form of gases and the carbon will be left. Charcoal is almost pure carbon, and if you examine a piece of charcoal you will see the form in which carbon is deposited by the sap in the structure of the tree."

"But, father, how do they know this?"

"A very proper question, and one to be asked in relation to all assertions. It would, however, require volumes to give a full account of the experiments and observations which have been made in the investigation of vegetable physiology. One of the simplest observations is made by bending a branch of a growing plant under the edge of an inverted jar filled with water, and exposing the jar to the action of light. Little bubbles are seen to collect on the surface on the leaves and float up through the water, in time filling the top of the jar with gas. On examining this gas it is found to be pure oxgen, and if the water contains carbonic acid, or if carbonic acid be put into the jar, just enough of this to yield, the oxygen produced is always found to disappear. If there is no carbonic acid in the jar, no oxygen will come from the leaves.—These experiments have been made in the most thorough and careful manner by different men, and not only has the general law been fully established, but the slight modifications of it have been noted and fully discussed. For instance, it is found that, under certain circumstances, the oxygen given off by the leaf is not quite equal to the amount contained in the carbonic acid absorbed, from which it is inferred that the oxygen resulting from the decomposition of the carbonic acid is not always all given off, but that sometimes a portion of it is appropriated to the growth of the plant. On the other hand, if the roots are placed in substances full of oxygen a portion will be absorbed by them, and the leaves will give off a little more oxygen than is contained in the carbonic acid absorbed."

"What did you say about setting the plant in the light?"

"It is found that this decomposition of carbonic acid only goes on when the plant is exposed to the action of light. During the night the process is reversed; the plant absorbs oxygen and gives off carbonic acid. The quantity of carbonic acid given off in the night however, is not nearly equal to that absorbed during the day. If plants are wholly excluded from the light they will grow for a while; but, having no carbon, which is one of the elements necessary to a perfect plant, they will present a pale and sickly appearance, as you have doubtless observed in the case of potatoes growing in a dark cellar."

"Is all the carbon in plants absorbed from the air by the leaves?"

"That question has given rise to several long series of very laborious experiments.—It is found that a portion is absorbed by the roots, and that the relative proportion taken in by the roots and by the leaves varies with circumstances, and with the different kinds of plants. Boussingault found that the Jerusalem artichoke obtained the largest prorortion of its carbon from the air, of any plant that he tried. Some plants, under certain circumstances, obtain nine-tenths of their carbon from the air, but two-thirds is probably not very far from the average."

"What was that you said last week about shears?"

"Oh! I said that we would discover the two blades of the shears that cut the atoms of oxygen and carbon, which form carbnic acid, asunder. One of the blades is light, the other is the force of vegetable life."

"How do they divide the atom of carbon from the two atoms of oxygen?"

"That is a question which any boy can ask, but which no man can answer. Notwithstanding all that we know about chemical affinity, and how its power varies over the several substances which we meet with, what is its essential nature—how it gets hold of one atom and draws it to another—is an absolute mystery. In every department of inquiry, a few steps bring us to the boundaries of knowledge.—There is one singular thing about this action of plants on carbonic acid—the petals of the flowers exhale this gas both day and night"

"Do you say the carbon is carried down from the leaf by the sap?"

"Yes; the course of the sap has been carefully observed. It enters the roots, passes up through the pores of the wood, and after being spread through the leaf, returns again through the pores of the bark, depositing as it goes down, the materials by which the growth of the plants is carried forward between the wood and the bark. The sap is thickened in the leaf by the evaporation of its watery portion. A large tree draws up from the earth and gives off into the air an enormous amount of water. You now have a general idea of the way plants grow; and next week I will take you away back into the depths of time, and show you how carbonic acid was being decomposed and its carbon packed away in the hills long ages before man was created, where it could be preserved for this steam engine generation. This will bring us back to illuminating gas, where we first started, and will complete the history of the great circle thro' which carbonic acid passes in the operations of nature.—*Scientific American.*

IRREGULAR ATTENDANCE AT SCHOOL.

The cause of irregular attendance is generally charged to the indifference of parents and guardians to the advantages of knowledge.—But why? unless, from a mistaken idea of education. It is a common idea that education begins at school and ends at school, whereas it is a life-long business. Schools are purposely to furnish the means only for that education which begins and ends with life and sense. The process of education is altogether too slow for the mind to note the progress, and the results too far in the future for this *fast age*—an age that wants a quick return for every outlay. In my opinion, the chief cause of irregularity is the reluctance of pupils to attend. Parents do not like to drive their children to school from profitable labor, with no prospect of immediate, or, of ultimate advantages, especially if against the child's desires; and, on the other hand, but few parents would prohibit going to school against an earnest desire of the child to attend. But why is this repugnance to the school, when knowledge is mental nourishment, and *mind* has instinctive, resistless desires for it? Why? because schools are not what they should be—fountains of knowledge for all. The kind they supply is not adapted to the wants and needs of the reluctant pupils at least. Children think and act like children, and if "thought is the parent of action," it is also the offspring of action. Confine or prohibit action, thought becomes dull, the mind diseased and the system deformed. Room and opportunity for action and expansion must be had, or else the demands of nature are denied, and then nature revolts.

The common school is a compound of all the degrees of mind, from lisping infancy to the fullblown "Young American,"—a peculiar institution to instil theories of science for far-off future use, so uncertain that positive benefit is doubtful—so abstract that no pleasure is given to the mind that asks for simple facts only, to understand and amuse, as well as to instruct.

Pleasure in the pursuit and delight in the possession are natural guides to useful knowledge; and it is not satisfactory evidence to the young, that such pursuits will not prove useful to them, because adults doubt the utility, and advise or insist on higher aims and pursuits, that afford no delight. But it is satisfactory evidence, if the knowledge obtained in the pursuit is adapted to the capacity to understand sufficient to exercise and discipline the mental and physical powers, to