CLASSICS OF SCIENCE:

Carbon in Plants

Physics—Chemistry

Liebig gives the following experiment to prove that plants absorb carbon dioxide and give off oxygen: "The leaves and other green parts of a plant absorb carbonic acid, and emit an equal volume of oxygen. They possess this property quite independently of the plant; for if, after being separated from the stem, they are placed in water containing carbonic acid, and exposed in that condition to the sun's light, the carbonic acid is, after a time, found to have disappeared entirely from the water. If the experiment is conducted under a glass receiver filled with water, the oxygen emitted from the plant may be collected and examined. When no more oxygen gas is evolved, it is a sign that all the dissolved carbonic acid is decomposed; but the operation recommences if a new portion of it is added. Plants do not emit gas when placed in water which either is free from carbonic acid, or contains an alkali that protects it from assimilation."

ORGANIC CHEMISTRY in its Applications to Agriculture and Physiology. (1840) By Justus Liebig, M.D., Ph.D., F.R.S., M.R.I.A., &c., Edited from the manuscript of the author by Lyon Playfair, Ph.D. First American Edition, with an introduction, notes, and appendix, by John W. Webster, M.D. Cambridge (Mass.) 1841.

JUSTUS VON LIEBIG

Carbon in Soil Increases

Let us now inquire whence the grass in a meadow, or the wood in a forest receives its carbon, since there no manure,—no carbon,—has been given to it as nourishment? and how it happens, that the soil, thus exhausted, instead of becoming poorer, becomes every year richer in this element?

A certain quantity of carbon is taken every year from the forest or meadow, in the form of wood or hay, and, in spite of this, the quantity of carbon in the soil augments; it becomes richer in humus.

It is said, that in fields and orchards all the carbon which may have been taken away as herbs, as straw, as seeds, or as fruit, is replaced by means of manure; and yet this soil produces no more carbon than that of the forest or meadow where it is never replaced. It cannot be conceived that the laws for the nutrition of plants are changed by culture,—that the sources of carbon for fruit or grain, and for grass or trees, are different.

It is not denied that manure exercises an influence upon the development of plants; but it may be affirmed with positive certainty, that it neither serves for the production of the carbon, nor has any influence upon it, because we find that the quantity of carbon produced by manured lands is not greater than that yielded by lands which are not manured. The discussion as to the manner in which manure acts has nothing to do with the present question, which is the origin of the carbon. The carbon must be derived from other sources; and as the soil does not yield it, it can only be extracted from the atmosphere.

In attempting to explain the origin of carbon in plants, it has never been considered that the question is intimately connected with that of the origin of humus. It is universally admitted that humus arises from the decay of plants. No primitive humus, therefore, can have existed; for plants must have preceded the humus.

Now, whence did the first vegetables derive their carbon? and in what form is the carbon contained in the atmosphere?

These two questions involve the consideration of two most remarkable natural phenomena, which by their reciprocal and uninterrupted influence, maintain the life of the individual animals and vegetables, and the continued existence of both kingdoms of organic nature.

One of these questions is connected with the invariable condition of the air with respect to oxygen. One hundred volumes of air have been found, at every period and in every climate, to contain twenty-one volumes of oxygen, with such small deviations, that they must be ascribed to errors of observation.

Although the absolute quantity of oxygen contained in the atmosphere appears very great when represented by numbers, yet it is not inexhaustible. One man consumes by respiration 45 Hessian cubic feet of oxygen in 24 hours; 10 centners of charcoal consume 58,112 cubic feet of oxygen during its combustion; and a small town like Giessen (with about 7000 inhabitants) extracts yearly from the air, by the wood employed as fuel, more than 1000 millions of cubic feet of this gas.

When we consider facts such as these, our former statement, that the quantity of oxygen in the atmosphere does not diminish in the course of ages,—that the air at the present day, for example, does not contain less oxygen than that found in jars buried for 1800 years in Pompeii,—appears quite incomprehensible, unless some source exists whence the oxygen abstracted is replaced. How does it happen, then, that the proportion of oxygen in the atmosphere is thus invariable?

The answer to this question depends upon another; (*Turn to next page*)

New Fossil Footprints

Paleontology

New finds of fossil footprints in the rocks of the Grand Canyon of Arizona, but this time on the north rim, fourteen miles from the site of previous discoveries on the south rim, are reported by Dr. Charles W. Gilmore of the U. S. National Museum and Glenn E. Sturdevant, government naturalist of Grand Canyon National Park.

Slabs bearing the foot imprints of small reptiles or salamander-like amphibians were found at two levels, one in the Coconino and one in the Supai formation. These correspond with two of the three formations on the other side of the Canyon in which tracks have been found during the past few years, but further exploration and examination of specimens will have to be carried on before it can be determined whether the levels match up exactly and whether the tracks represent the same kinds of feet.

The fossil footprints from the south side of the Canyon thus far discovered represent 36 species, distributed among 28 genera.