Except carbon, all these exist when by themselves in a *gaseous* or aeriform state.]

If the origin of organic substances is thus traced to substances existing in the atmosphere, the next question is, how were those airy substances converted into *solids*—into animal and vegetable solids, which we can see, feel, smell, and taste; which support life while they *live*, and yield organic matter to the soil when they die.

It is the principle of LIFE existing in the vegetable and animal economy, which has done this—and which hourly, daily, yearly, and from age to age, still maintains the same wonderful and sublime operation. Let us trace the steps of this beneficent working power.

God makes a *seed*, and endows it with vegetable LIFE. If that seed be kept in a dry place, its principle of life will remain dormant, and it will not increase in size or weight, nor alter its form for ages, but suppose that seed to be planted in any soil entirely devoid of organic matter, as, for instance, ground flints or ground glass, and subjected to the action of the atmosphere, with its warmth and moisture, it will germinate and grow. It will expand from its original small size into a large and beautiful form. The seed, which would weigh one-tenth of an ounce, will expand into matter weighing several ounces. During this process, the soil in which it is planted will scarcely, if at all, decrease in weight. If you planted a seed weighing 4 grains, in 2lbs. of ground flints, (previously made red hot, to burn out all vegetable matter,) you would find that when the plants weighed an hundred times the weight of the original seed that there would still be 2lbs. of ground flints.

Whence, then, has this substance, weight, or bulk been derived. If we analyze the plant, we will probably find.—1st, water—2nd, starch and fibre—3rd, gum—4th, sugar—5th, albumen—6th, salts; and, upon resolving these into their original elements, we shall find *carbon, oxygen, hydrogen, and nitrogen.*—These must have been derived from *the atmosphere.* They had not been taken from the soil, as it has lost no weight.—From the carbonic acid gas, the oxygen, and the nitrogen, in the air, these substances have been derived—from the water has been contributed the hydrogen, and the whole resolved into a solid form, by the active functions of life in the plants, exists in that plant as organic matter.

Let that plant grow, and die; and mingle in the soil of ground flint, and it will by another season, contribute to that soil some *organic matter*, which will enable future plants to grow more rapidly.

In every-day life we frequently see bulbous plants whose roots, by merely sinking into pure water, (hyacinths, for instance), grow rapidly, increase in weight, bulk, and substance—these must draw their solid substances from the air.

De Saussure found two beans when caused to vegetate in the open air on pounded flints, double the weight of *carbon* they originally contained.

In the Western woods, where vegetation has silently progressed for centuries, the amount of vegetable matter in the soil is extremely great. Whence is it derived? If from the soil, then, that soil must always have had the same amount, as the trees would merely return as much, and no more, as they took out of the soil: but the organic matter *perpetually increases*—it must therefore be, that vegetation is continually absorbing from the air organic food; and on its decay, gives the substance of that food to the soil; and hence the increase.

We see, therefore, that the *origin* of organic matter is found in the atmosphere. From the atmosphere the first plants obtained their vegetable substance, when as yet it existed not in the soils. How plants absorb this substance, and how they convert it into solids—in fact, *how they grow*, will be discussed in future chapters "on the growth of plants." The animal portions of organic matters in soils, are derived from the decay of animals, the source of whose substance is apparent without explanation.

From the Scottish Farmer.

WATER.

This well-known and invaluable fluid is a compound of the two gases oxygen and hydrogen, united together in the proportion of eight parts by weight of the former, to one of the latter. When these two gases are mixed together in these proportions, and inflamed, a violent explosion ensues, the gases disappear, and water is formed. It is also produced more tranquilly, but with the evolution of intense heat, when a jet of hydrogen is inflamed in air, or in oxygen, as we mentioned in our last paper. With what tremendous chemical action, therefore, must the formation of the incalculably great quantities of water upon our earth's surface have been accompanied! To what terrific convulsions of nature must this have given rise!

To a person unaccustomed to contemplate the numberless analogous phenomena which chemistry incessantly presents, the facts we have just stated, in reference to the composition of water, must appear almost incredible; and it certainly *is* extraordinary that a fluid so common as water—one which we consume so largely every day, and which is so great an enemy to combustion—should be formed by the union of two curious gases, the one of which is a most perfect supporter of combustion, and the other a combustible of the most inflammable character.

Water is known to us in four states of cohesion,—in the solid form, which we call ice—in the liquid, as water—in the vesicular, as mists and clouds—and in the gaseous, as steam. In each of these states water is possessed of peculiar relations to Agriculture, which we shall proceed to explain.

(a) In the solid form.—At thirty-two degrees of Fahrenheit's scale, water freezes, or assumes the solid form, and by this change of form its bulk is considerably increased. During its solidification, it moreover crystallises in beautiful specular crystals, which shoot out in various directions. This crystallisation of water may frequently be observed in the gutters on the roadside during winter. Let us now examine how these phenomena affect the Farmer.

The rain falls upon his fields—it is absorbed by the soil, penetrates the hard clods, and fills up the pores or interstices between the particles of soil. When the atmospheric temperature is so much reduced that it freezes, the soil contracts, the water contained in it solidifies and crystallises, shooting out numerous hard sharp points in every direction through the clods, thus forcing asunder the cohering particles of soil. When the temperature increases, these icy fetters thaw, and the lumps crumble down, layer by layer, into a far more completely comminuted state than the Farmer could possibly achieve with his most perfect implements, and by the expenditure of much time and labour, if unassisted by this peculiar property of water. The atmosphere is thus enabled to permeate and act upon the soil in every direction, and, by thus mellowing it, to fit it for the production of the next year's crop. It is for these reasons that the Farmer practically is made to feel the want of frost in mild winter, by the difficulty he experiences in breaking up and sufficiently pulverising his land.

In the form of snow, also, solidified water performs a most important part in reference to Agriculture, by defending the young crops from the action of severe frosts. Snow is composed by the aggregation of innumerable minute crystals of ice. On account of the large quantity of air which these crystals inclose, it is found to be a very bad conductor of heat. When therefore, the surface of the ground is covered with snow, and a severe frost sets in, the soil parts with heat so slowly that its temperature always continues higher than that of the surrounding air, and thus the young crops are protected from the injurious action of so low a temperature. The Farmer has found out this fact also, practically; for he well knows how different are the effects of a *black frost*,—that is, a low temperature acting upon his crops when unprotected by a covering of snow, and consequently when nothing prevents the rapid radiation of heat from the soil and crops.

HAVE A CARE OF THE WATER-POT.—A short time back, calling on a friend and looking through his houses, where a considerable quanity of Pelargeniums are raised and grown, I observed a fault in management, to which if I advert it may lead his gardener and others to consider the error of a too liberal and erroneous use of the water-pot. It was in the be-