

dozen, or at most a score of these elements, which need to be particularly considered by the farmer; and of these we shall speak more in detail hereafter. Earth, air, fire and water, were by ancient writers called elements. It is not certain in what precise sense they used the term; but none of these substances are elements in the sense above explained. They are all *compounds*; that is, they are made up of two or more elementary bodies. The composition of earth is very various, consisting of salts, organic matter and metallic bases. Air is a mechanical mixture, consisting chiefly of two elements, in a gaseous form, oxygen and nitrogen; while water is the result of a chemical combination between oxygen and another gas, termed hydrogen. It is therefore evident that soils, plants, animals; all substances, in fact, with which the farmer has to do, are *compound* bodies.

Now chemistry explains *the laws* by which two or more elementary substances unite to form a *compound*, which is a substance different in its nature from any of the elements of which it is composed. Simple or elementary bodies do not combine with one another at random, but always in certain proportions; thus demonstrating the wisdom and goodness of the great Author of nature. The tendency which bodies have to unite with each other is called *affinity*, or *chemical attraction*—a force very unequal in different substances. In obedience to the laws of chemical affinity and definite proportions, among the elementary particles of matter, is to be traced much of the beauty and endless variety of the material world!

As a familiar illustration of *combination*, take spirit and water, which readily unite on being mixed, forming one homogeneous liquid. Sugar and salt also combine with water. A small piece of iron hoop immersed in diluted sulphuric acid, causes an intense chemical action to ensue; the iron disappears—its particles, uniting with those of acid and oxygen, forming a greenish liquid—the hydrogen (the other element of the water) being disengaged in the form of gas. As an instance of *decomposition*, take a piece of limestone and expose it to the heat of a furnace, *carbonic acid gas*—an invisible air, consisting of two elements (carbon and oxygen)—will be driven off, and *quick-lime*—a compound of oxygen and calcium—will remain.

The decomposition of a body consists in the separation of its elements, either by the action of heat and the other inponderable agents, or the application of chemical tests, for which the elements of the compound have a stronger affinity than for each other. This process is denominated *analysis*, or the separating of a compound into its original constituents. The reconstruction of the compound, by causing its separated elements to combine again, is termed *synthesis*; that is, putting

together. These two processes comprehend the whole of inorganic chemistry.

Hitherto, we have considered matter as subjected merely to the laws of chemical action; but this arrangement would exclude many of the most interesting objects of the farmer's care and investigation. His pursuits lead him beyond the more inert soil which he tills, or the manures he may apply, to the consideration of living beings possessing higher and more complicated forms, and under the control of a distinct system of laws. These bring us at once within the dominion of *life*, and present us with totally distinct classes of matter. A stone, or a piece of earth, possesses no apparatus or organs for supporting its existence or increasing its bulk; it is a dead, inert mass, and it is hence denominated an *inorganic* substance. A plant or an animal is likewise matter, but differing most widely from the stone in possessing a regular organisation, by which it can assimilate food for building up its own structure, and is endowed with the power of reproducing its own species. Plants and animals, therefore, are denominated *organic* beings, endowed with the principle of life.

"Of the laws which produce the condition to which we apply the term *Life*, we know nothing but from certain phenomena which the living body presents. The essential cause is amongst those ultimate truths which human reason cannot reach. No approach has been made to solve the mystery of *Life*; and at this hour we are as ignorant of the cause of life, and of the agency which connects the powers of mind and the mechanism of the body, as at the first dawning of human inquiry."

Although the organic and inorganic departments of nature admit of a very clear distinction, yet there exists between them an intimate and beautiful connection. For instance, the plant is enabled by its peculiar organization, to extract its food from the dead earth and surrounding atmosphere: from these two sources alone it derives the materials which it works up, under the influence of the vital force, into its own structure. The animal is immediately dependent upon the plant for the means of its support, not having, like the plant, the power of obtaining nourishment directly from the mineral. We can here perceive a few links in that great chain of mutual dependence which harmoniously binds together the multitudinous works of the Creator.

The properties imparted to organic bodies by the agency of life, are of a most singularly striking kind. For example, as soon as the vital principle becomes extinct, the body is placed under the laws of common matter, and decomposition, which subverts the union of its particles, at once commences. It is therefore the possession of the vital force only that enables the animal or plant to control the naturally powerful agents of decomposition by