be put into the earth, each piece will produce both roots and stems. Of these concealed germs, dissection indicates no trace, until they become sensible in the progress of their development. From whence do they proceed ? From the vessels or the cells ? Or are they formed by the sap ? Do they exist in a form invisible to us before the tree was headed ? This, says he, is pure conjecture, although it is true, that if this operation had not been performed, the sap would have continued its course in the parts already formed, and would not have aided in developing the germs of which we speak. But not to abandon ourselves to imagination. It is sufficient, he adds, to have shown the immense fertility of vegetables, first, by seeds, and, secondly, by invisible germs, of which but a small number of analogous facts are to be found in the animal kingdom. In these remarks, Du Hamel, the Haller of vegetable physiology, evidently leans to the doctrine of pre-existing germs, which at one time so much occupied the attention of naturalists ; but of which he ulti­mately disposes, with that good sense and real candour, which are not less admirable in all his writings than the ta­lent and information which they every where display.

CHAP. III. OF THE V1TAL POWERS, SECRETIONS, SPONTANEOUS MOTIONS, sleep, decay, AND death of PLANTS.

Art. **I** *Of the Vital Powers.*

Such is a brief outline of those vegetable functions which comprehend the evolution, growth, and reproduction of plants. In the description of these functions, we have en­deavoured to keep within the limits of observation and ex­periment ; and, in reasoning from the facts derived from these sources, we have adhered strictly to explanations, which apply only to the *physical* constitution of plants. But we are aware, that, to accomplish these physical changes, not only is a particular structure required, but that structure must be endowed with the property or principle that dis­tinguishes living organized beings from dead and inorganic matter. Without embarrassing ourselves with inquiries into the nature and origin of life, we arc content, on the present occasion, to seek it only in its effects ; to regard it as a power or property not less essential to the constitution of living matter, than gravitation is to that of dead matter; and, rejecting all speculation about its nature, to study only the physical conditions required for the display of its opera­tions, and, as far as we are able, trace the laws by which those operations are regulated. “ It is not,” says Dr. Frank­lin, “of much importance to us to know the manner in which Nature executes her laws ; it is enough, if we know the laws themselves. It is of real use to us to know that china, left in the air unsupported, will fall and break ; but how it comes to fall, and why it breaks, are matters of speculation. It is a pleasure indeed to know them, but we can preserve our china without it.”

Beside the evidences of a living power in plants, derived from the ordinary phenomena of growth and reproduction, the function of secretion by which growth is sustained, and various new products formed, deserves more particular no­tice. Other evidences of this power have been drawn from the various motions exhibited by the roots, leaves, flowers, and fruits of plants ; and also from the phenomena of in­fancy, maturity, and old age, which they exhibit in the suc­cessive periods of their existence. To enable them to ex­ecute these different functions, and exhibit these phenome­na, some physiologists have pushed the analogies between plants and animals to an unwarrantable extent ; and, in addition to all the attributes connected with growth and re­production, have endowed plants not only with irritability but with sensibility, instinct, perception, and volition. In ascribing to them these attributes, more attention seems to have been given to a supposed correspondence in effects, than to a real agreement in the structure and functions of organs. Neither has any very nice distinction been taken between what may be due to physical agents, acting on ve­getable organization, and what, from our present inability to explain on *physical* principles, we are too apt at once to attribute to what are called *vital* principles or causes. It is only, however, where physical explanations altogether fail, that it is allowable to resort to the mysterious aid of vital causes : and as the natural philosopher, in treating of inanimate matter, assumes gravitation as a fact, and, with­out investigating its nature, proceeds to describe the laws of its action ; so the physiologist, in studying living bodies, may regard life, and direct his inquiries rather to the laws by which it acts, than to the nature or principle of its action.

Art. II.—*Of Secretion.*

By secretion is understood the separation of a peculiar matter from the general mass of fluids by some particular structure, and which may either retain its primary condi­tion, or pass into a solid state. Though the mass of fluid from which secretions are produced be one and the same, and the secreting organ, as to external conditions, be often in the same circumstances, yet the matters secreted differ greatly from each other, which difference probably arises from variety of structure in the secreting organs. Thus, an essential oil is found only in the rind of the orange, a fat oil only in the kernel of the almond, and so with regard to other secretions which exist only in particular parts. Be­sides the acids, alkalis, earths, and metals, which, though of a mineral nature, are more or less constantly found in plants, chemists enumerate about forty products of vegeta­tion, which possess distinct chemical characters ; and of many of these products numerous varieties exist. As none of these substances can be detected in the common sap, they must have been elaborated by the specific organs of vegetables, under a process of secretion. By what pecu­liarity of structure, or of function, these organs are enabled to produce such remarkable chemical changes in the com­mon sap, is quite unknown ; neither do we know how much is to be attributed to the action of the organ itself, or to the reaction of the several ingredients on each other, or to the influence of external agents.

Of these secretions, the most important is the *cambium,* the fluid employed directly in vegetable nutrition and growth. By the changes which the common sap undergoes in the leaves, the proper juices of plants are formed. These juices differ greatly from each other both in their sensible and chemical qualities. It is from them that the cambium is directly formed by a process of secretion, and in all plants is said to possess nearly the same characters. It is a mucilaginous fluid, without colour, odour, or taste; while the proper juices themselves exhibit all those pro­perties. The proper juices also are contained in the vessels, and flow out when they are divided ; but the cam­bium transudes rather than flows, and that only in places where new parts are to be formed. Thus, in the pine, says Mirbel, while the proper or resinous juice flows in the large vessels, the cambium transudes beneath the *liber;* and similar observations on the fig show that the cambium is entirely distinct from the proper juice. The cambium, then, we must regard as a *secretiori,* separated from the proper juice by the vascular structure of the liber or al­burnum, when and wheresoever it is required to support nu­trition and growth. Hence, in an experiment of Du Hamel, when a piece of the bark of a peach tree w as engrafted on the wood of the plum, the new wood, formed beneath the bark, was white like that of the peach, not red like that of the plum. Of the other secretions of plants, which, for reasons already assigned, are found chiefly on the *external* parts, as the leaves, flowers, fruits, &c., the number and