**VEGETABLE PHYSIOLOGY.**

Ιν the Article on the Ανατομυ of Vegetables, a view has been given of the organography of plants, or the struc­ture and forms of vegetables through their several grada­tions from the seed to the perfect plant. We now proceed to consider the functions which the different organs of ve­getables perform, the description of which constitutes what is termed the Physiology of Plants.

In a subject of such extent, and concerning which so much diversity of opinion prevails, we must bespeak the indulgence of our readers, not only for the imperfections but for the errors into which we may fall. From the nar­row limits within which we are necessarily circumscribed, we are constrained to give rather the results than the de­tails of experiments; to avoid ali discussion of disputable points; to reject many practical illustrations and much his­torical narration. Neither have we room to enlarge on the general distinctions between plants and animals; on the importance of vegetables in the scale of being; their geo­graphical distribution ; the nature of their living power or vitality; their sensibility, perceptivity, and many other pro­perties which have been ascribed to them. The Articles Anima; and Physical Geography will however furnish the necessary information on these particulars. Our pre­sent aim will be confined to a general view of the leading and more important functions of the more perfect vegetables.

CHAP. I.—OF THE. GENERAL FUNCTIONS OF VEGETABLES.

Sect. I.—*Of the Germination of Seeds.*

In the article referred to we have detailed pretty fully the anatomy of seeds, and described particularly their tunics and the nucleus contained within them. This nucleus con­sists of the organized parts, or embryo, and the inorganic matter destined to afford it nourishment. In its more com­plete forms, this embryo consists of the radicle, the stem or caulicule, and the plumule. The stem, however, is often not distinguishable. When present. It connects the ra­dicle with the plumule ; and the place of its junction with the radicle is denominated the *neck* of the embryo. In the progress of evolution, the radicle descends to form the root, and the plumule rises and constitutes the first bud of the new plant.

Besides the organised parts just mentioned, there are others called cotyledons, which derive their origin from the embryo. Many seeds have two cotyledons, and some more than two; others have only one, and some seeds have no cotyledon. When present, the cotyledons exhibit different forms; and between them and the embryo, a vascular com­munication is established, as may be seen in the dissection of a bean, represented in Plate XXXIX. fig. 12. Besides vessels, the cotyledons are partly made up of cells, within which the nutrient matter of the seed is contained. In some seeds, however, this matter is only partially contained in the cotyledons; in others, as that of wheat. It is wholly contained in a cellular tissue produced from the inner tunic. Lastly, the cotyledons of some seeds rise above the ground during germination, and perform the function of leaves: in others they continue beneath the soil. In all seeds their existence is temporary, for they perish after having yield­ed their nutrient matter to the embryo.

This matter, called *albumen* by Grew and Gærtner, is a secretion made by the vessels into the cells during the for­mation of the seed; and, though itself inorganic, is con­tained in an organized tissue. It is of various colour and consistence in different seeds. Its bulk, compared with that of the organized parts, is, in some seeds, very small ; in others very large.

Such is a brief notice of the more important parts which construct the seed, and which it is necessary clearly to understand before we can properly appreciate the nature and effects of the actions that go on during its germination. In considering these actions, we have to inquire into the circumstances or conditions in which the seed requires to be placed—the agents which then act upon it—the change of quality and condition which these agents themselves suffer, and the effects which, in consequence, they produce in the seed—and, lastly, the physiological phenomena which thence arise, and terminate in those alterations of form and struc­ture which constitute the evolution of the seed.

In general, seeds, when placed to grow, are buried more or less deeply in the earth, but this condition is not essen­tial; for they readily shoot forth and display their forms, when confined in vessels of air. In whatever situation their ger­mination is attempted, a certain temperature, and a certain portion of moisture, are necessary to its commencement; and the access of air is afterwards required to carry on the process. We have, therefore, to inquire into the operation of water, heat, and air, in commencing and carrying on the germination of the seed.

Water, in the first instance, penetrates the tunics of the seed apparently by simple attraction or imbibition; and the force with which this attraction is exerted is well illus­trated in the experiments of Boyle and Hales. They filled strong bottles with dry beans and peas, over which water was poured, and the bottles were then closely stopped. As the seeds imbibed the water, they readily burst the bottles asundcr; or, if small iron cylinders, closed by a plug, were employed, the plug was gradually raised by the expanding seeds, though pressed by a weight of nearly 200 lbs. It is by the exertion of such a force, that certain seeds, as those of the peach and apricot, are able, says Du Hamel, to burst open their stony envelope. This expansion from the imbibition of water occurs not only in seeds which retain the faculty of germinating, but in those also which have lost it. We must, therefore, regard this first step in germina­tion as similar to the attraction of water by inanimate bo­dies. Accordingly, if, after water has been thus imbibed, air be excluded, the radicle never increases beyond a certain size; and, if the seed be kept wholly immersed in water at a temperature of 60°, decomposition of its substance ensues.

To this imbibition of water, a temperature above that of freezing is necessarily required; and, within a certain range, the rate of expansion will be more or less influenced by that of temperature. Cold, however, does not destroy, but only suspends, the germinating faculty in seeds. Seeds have ger­minated after having been exposed for a short time to a tem­perature of—39° F.

When, by the combined operation of heat and moisture, the seed is brought into a condition fit for germination, then the presence of air is required. Many experiments were made by Boyle and others, to prove the necessity of air to germina­tion ; and since the composition of the atmosphcre was made known, many more have been instituted to ascertain why the air is thus necessary, the nature of the changes it undergoes, the extent to which they proceed, and the manner in which they are accomplished. On all these points much information has been gained, and the results obtained are, in general, so