

a large persistent parenchyma in which nutritive matters are "stored." They often become tuberous by the excessive development of this parenchyma, and these are well known from the *Orchideae*: *Orchis*, *Spiranthes*, *Platanthera*, etc., also from *Hemerocallis*, *Aconitum*, *Delphinium*, etc.

The structure of such roots offers really a number of interesting modifications, which are very little known so far, and it would be an excellent study to undertake the investigation of their structures, instead of confining ourselves to the other organs alone. It is not, however, an easy matter to study such roots, but by beginning with the more simple types, for instance the annual among the nutritive, the various tissues may be readily perceived and distinguished. The most difficult ones are the tuberous storage-roots, and these must always be studied at the various stages of their growth and during several seasons. There are, also, certain types which are called anomalous, as for instance the beet, which is quite difficult to understand, unless the successive stages have been observed.

With the object of giving some examples of different root-structures we may begin with an ordinary, annual nutritive root of *Streptopus roseus*, of which we have drawn part of a section on Plate I. In this drawing the central cylinder is complete, but the cortex and epidermis is only shown in part. The structure is as follows:

The epidermis (*Ep.*) consists of a single layer and many of the cells are extended into root-hairs (*Rh.*); beneath this tissue is another single layer, the cells of which are quite thickwalled, and this is the so-called exodermis (*Ex.*). The cell-walls are more or less suberized, thus the membranes are almost impermeable to water and render thereby an important protection to the interior tissues. In many cases the exodermis possesses, also, the power of contractility, which may be seen from tangential sections, where the radial cell-walls show foldings or undulations, which continue in the longitudinal direction of the root, resulting in contraction.

Inside the exodermis follows a parenchyma of several layers, the cortex (*C.*); it is in this tissue that nutritive matters are stored in storage-roots. The cells are often loosely connected, thus we