

decrease in size, the chlorophyll undergoes modifications or is imperfectly formed, an abnormal red, yellow and green color is developed, and all these conditions continue to increase until the extremes are reached.

The last external characteristic is to be found in the abnormal development of the new wood. The branches of the new growth become more strongly atrophied as the disease advances, until they finally become of a very wiry character and develop upon the trunk and branches in clusters.

The internal features are as strongly marked as the external, and may generally be determined in very early stages of the disease. The first indication is to be found in the very dense accumulation of starch, not only in the pith and medullary rays, but particularly in the bark, from which it should normally be absent to a very large degree. This excessive accumulation of digested material in unusual parts, is at once indicative of an imperfect power of distribution to the growing parts and inability of the plant to convert it into tissues, so that the atrophy of structure appears in the first instance, not to be caused by want of material, but by the absence of certain chemical compounds by which the necessary chemical changes of direct nutrition may be accomplished.

This accumulation of starch increases as the disease progresses, while, at the same time, very important modifications in the tissues themselves, are developed, particularly in the bark. There the cells of the middle bark, or mesophlœum, become relatively thick-walled; the intercellular spaces decrease in size and number and thereby retard the proper respiratory function; the disposition of the cells becomes somewhat regular, the tendency being to the development of layers forming well-defined concentric rings, while the form also tends strongly to an elongated ellipse with its minor axis running in a radial direction.

Contrasting this with the normal, we find in the latter that both the internal and external features are markedly different. The leaves are a deep green, and of large size, as already shown. The young shoots, likewise, are of a lively green color, and two or three times the diameter and several times the length of the diseased. Internally, the starch, in comparatively small quantity, is confined almost wholly to the pith rays and wood, the bark con-