paper reed of the ancients (Papyrus Sicula), a substance which was employed by the ancients in the manufacture of paper (some of the most ancient manuscripts in existence being written on papyrus.) The cells are arranged in a chain-like form, leaving large intercellular cavities between, which are filled with air. Vegetable tissues when rendered soft and spongy by such a free intermixture of air cavities, become highly inflammable; the use of the pith-like substance of rushes as lamp-wicks is well known.

But it must not be understood that when cells are of a rounded form, that intercellular cavities always exist; for the cells are generally united together by an intercellular substance, and even where the cells of a tissue appear to be spherical, they have often flattened surfaces at all points of contact with each other, and thus no intercellular cavity exists.

In the case of many minute Algæ (Diatomaceæ, Desmidiaceæ, &c.,) the plant consists of a single cell; this is its simplest form. In other algæ, it consists of cells arranged in a linear form giving rise to simple or branched filaments, as in Cladophora fracta, a minute plant which has of late years appeared in such quantities in Duddingston Loch as to have seriously affected the beauty of that fine piece of water in the autumn months; the Town Council have waged war against it, and it has been proposed to make the most of the evil by converting the microscopic plant into paper, for although unsuitable for forming a pulp, its masses of filaments may be pressed into a paper-like substance. It is in such simple plants where there are few cells, and these so arranged that we can examine them in their active state without injuring the tissue, and without placing them in unnatural conditions, that the history and development of the cell is most easily traced. In order, therefore, to understand the growth of his farm crops, the farmer must turn to those organisms which vegetate in the form of green scum on stagnant pools, or which float in masses of green filaments in lakes and rivers. But the whole subject of cytogenesis must remain for future discussion.

The size of cells is very variable in different plants, but in all cases they are very minute; it is only in rare cases and chiefly in the lower plants (algæ) that they are individually visible to the naked eye. In a piece of cork, for example, which is a cellular tissue, more than a thousand cells have been counted in the length of an inch. There are upwards of three millions in a cubic inch of carnation leaf.

Cells, in their active condition, are thin and brittle, filled with juices, &c., and have little cohesion; and plants in their early stages consist for the most part of this kind of tissue, hence in their young state, vegetables are soft, juicy and tender. When the plant increases in age, and woody tissue is developed in its structure, it then acquires a firm and fibry consistence. In age, therefore, many of our culinary vegetables become coarse and useless. In many cases it is the object of cultivation to increase the development of parenchyma-cells in plants, and thus arrest the development of the woody tissue. In turnips and other esculent roots this is encouraged by rich soil and good cultivation; in fact the turnip owes all its esculent value to the abnormal development of parenchyma cells, the thin wiry root of the wild plant containing its normal proportion of cells.

While the cell is formed of a close membrane of cellulose (C_{12}, H_{10}, O_{10}), a substance permeable to fluid, but subject to great variation in its physical properties, such as brittleness, viscosity, and density, and liable also to chemical variation, there are various other matters contained in the interior of the cell. In some cases these occur in the form of a general incrustation over the inside of the cell membrane, as the lignine of wood cells, and the stone of stone fruits; but more frequently deposited matter has a spiral arrangement. Thus, in the ærial roots of epiphytal orchids we have cells with fine spiral threads of lining matter wound round the interior of the cell. In the structure of vessels this is a conspicuous deposit, the spiral vessels which form so important a feature in the anatomy of plants depending upon it.

In the young state of all cells we have a membrane interior to the cellulose one, which is called the primordial utricle. This is present in all actively vegetating cells, and contains the proper cell contents. These are *nuclei* (which are concerned in cell development), starch, gum, sugar, chlorophyll, and all colouring substances, oily, fatty, and resinous matters.

Starch (C_{12}, H_{10}, O_{10}) is an important substance contained in the vegetable cell, whether we regard the part it plays in the plant's development, or the manifold benefits it confers upon man. It occurs in the form of minute colourless transparent granules, which lie loosely in the interior of the cell.

If we examine a thin slice of wheat under the microscope it will be observed that the cells are packed full of the starch granules, while a few of the latter which escaped, are floating freely on the field of the microscope. By applying a drop of tincture of iodine to such a preparation, the starch granules become of a deep blue colour, while the other parts of the tissue remain unaltered; iodine is thus a ready test for starch, so much so that it is not necessary in many cases to use the microscope to determine the presence of starch in an esculent root; the sliced surface of potato, for example, to which iodine is applied, becomes of a deep blue colour, indicating the great abundance of starch in its tissue.

The structure and development of the starch granule have formed the themes of much learned discussion among vegetable physiologists. "No substance has been more investigated, and yet of which there is less known than starch. After the researches of ten years, in the course of which the most varied views have been propounded on the nature of starch, and after all its characteristics as a proximate vegetable substance have been discussed, we are little or nothing in advance of the old point of view; and although we may, perhaps, not be wholly without some addition to our knowledge in secondary points, we are still entirely without any sound reasons to suppose that we have arrived at the truth." In these words did Poggendorf indicate the state of our knowledge on this subject in 1847, and succeeding observers have quoted his words with a kind of gratification which shows the continued want of satisfactory results. Mohl says, "Observation has not yet taught us anything concerning the development of starch granules."

The starch granule of the potato when examined under a high power (say 260 diameters) presents the following characters:—The granules appear in the form of small, solid, but pellucid, more or less ovate corpuscles. Towards the narrow or pointed extremity of the corpuscle a small round dot is seen; this is the "nucleus," and may be regarded as the organic centre of the corpuscle. This "nucleus" is encircled with numerous lines, which at first pass concentrically around it, but gradually become elliptical and eccentric. These are obvious appearances presented by the starch granule; let us see how its structure is explained. Many views have been brought forward, all more or less conflicting, but they have been brought together by Mr. Busk in these terms:—

1. According to one view the starch granule is a vesicular body, the wall of which differs at all events in consistence, if not in chemical constitution from the contents.

2. In the other view the granule is considered as a solid body, constituted either of a homogeneous substance, or composed of concentric layers, deposited, according to one set of observers, around a nucleus, either differing in its chemical nature from the layers around it (Fritsche), or not essentially different in that respect (Endlicher, Unger). Schleiden and others regard the nucleus as a minute cavity or indentation.

The most satisfactory observations that have recently been made on the vexed question of starch, are those of Professor