Primary pit-fields:

As the cell grows, the primary walls of young cells stretch and increase in the surface area and thickness. These stretched primary walls are generally not uniform thickness but have conspicuous thin depressions in them at intervals these are called Primary pit-fields

Pits:

Secondary walls also have cavities due to the uneven deposition of secondary cell walls materials. Such cavities, which are of variable shape, are called pits.

The pits are formed in pairs lying against each other on the opposite sides of the wall, and morphologically more correct they are called 'pit pairs'.

A pit pair is structural and directional unit constituted by two pits lying opposite to each other of contiguous cells.

Fundamentally a pit or pit pair consists of three parts:

1. Pit cavity or pit chamber- the space i.e. the cavity formed by the break in the secondary wall is called pit chamber.

2. Pit aperture-the opening of the pit cavity on the inner side of the cell wall is called pit aperture.

3. **Pit membrane**- It is the thin wall composed of the layers of primary cell wall together with the middle lamella between two adjacently lying cells.

The pit membrane is common to both pits of a pit pair and consists of two primary walls and a middle lamella or intercellular substance. Usually two types of pits are met within the cells of various plants, viz., simple pits and bordered pits. Two bordered pits make up a bordered pit pair, two simple pits form a simple pit pair.

A bordered pit and a simple pit lying opposite to each other in contiguous cells, constitute a half bordered pit pair. A pit occurs opposite an intercellular space has no complementary pit and is known as **blind pit.**

Fundamentally the bordered pit differentiates from a simple pit in having a secondary wall arching over the pit cavity, which constitutes the actual border and becomes narrow like a funnel towards the lumen of the cell. In the simple pit, no such arching of the secondary wall and narrowing of the pit towards the lumen of the cell occurs.

Simple pits:

Simple pit pairs occur in parenchyma cells, in medullary rays, in phloem fibres, companion cells, and in tracheids of several flowering plants. In the simple pits, the pit cavity remains of the same diameter and the pit or closing membrane also remains simple and uniform in its structure.

The simple pit may be circular, oval, polygonal, elongated or somewhat irregular in its facial view. The simple pits occurring in the thin walls are shallow, whereas in thick wall the pit cavity may have the form of a canal passing from the lumen of the cell towards the closing or common pit membrane. The diffusion of protoplasm takes place through these pits.

Bordered pits:

They are abundantly found in the vessels of many angiosperms and in the tracheids of many conifers. They are more complex and variable in their structure than simple pits. The overarching secondary wall which encloses a part of the pit cavity is called, the pit border, which opens outside by a small rounded mouth known as pit aperture.

The overarching rim forms a border around the aperture and thus named ‘bordered pits’. The pit aperture may be of various shapes in the facial view. It may be circular, lenticular, linear or oval. In the case of relatively thick secondary walls, the border divides the cavity into two parts.

The space between the closing membrane and the pit aperture may be called the pit chamber and the canal leading from pit chamber to the lumen of the cell may be termed as pit canal. The pit canal opens in the pit chamber by an outer aperture and at the same time it opens in the lumen of the cell by an inner aperture.

The closing membrane of a bordered pit pair which consists of the parts of two primary walls and the intercellular substance or middle lamella, is somewhat thickened in its central part. This thickening is called torus which remains surrounded by a delicate margin. In many bordered pits, the closing membrane may change its position within pit cavities.

The **torus** may remain in central position or it may shift to the lateral position. As the torus is shifted to the lateral position the pit aperture closes, and the passage of the protoplasm may take place only by diffusion through torus.

Plasmodesmata:

Plasmodesmata is thin irregular cylinder of cytoplasm lined by plasmalemma, passing through fine pores in the cell walls, thus forming a connection between the cytoplasm of adjacent cells.

They are found in higher plants and fluctuate widely in abundance and distribution. They are commonly present in primary pit fields and pit membranes of young and mature living cells respectively. They may be scattered over the entire wall or occur in groups when they are concentrated on

primary fields (e.g. cambium of Pinus strobus, ray cells of Sequoia sempervirens etc.).

In a meristematic cell, the number of plasmodesma ranges from 1000 to 10,000 and their distribution may not be uniform. The frequency of distribution may vary even in different walls of a single cell. Plasmodesmata, at the intercellular canal between the common walls of living cells, are encircled by plasmalemma, which is continuous with that of the adjacent cells.

At the centre of plasmodesma, there occurs a tube of membrane, termed desmotubule. The desmotubule is composed of protein sub-units and contains an axial central rod. Diameter of the lumen of plasmodesma is very narrow, 30 nm to 60 nm in diameter through which the cell organelles cannot move to the adjacent cells. The diameter of desmotubule ranges from 16 nm to 20 nm.

A space is present in between the plasmalemma and desmotubule termed cytoplasmic annulus. Sometimes plasmodesmata are branched; it is observed in the pit membranes of living fibres of Tamarix and between sieve tube and companion cell where it is branched towards the latter side. The above structure of plasmodesmata is revealed by electron microscopic study.

Plasmodesmata originates during cytokinesis when cell plate is formed. It is formed at those regions of the cell plate where the endoplasmic reticulum (ER) is present and prevents the fusion of vesicles.

At this region, the cellulose microfibrils and pectic substances are not accumulated. As a result intercellular canal is formed. It is observed that the desmotubules are continuous with the ER of adjoining cells through the intercellular canals. Therefore, it is regarded that the desmotubules are derived from ER.

Plasmodesmata exist in thick cell wall also, e.g. endosperm of the seeds of Phoenix dactylifera, Coffea arabica etc. They can be easily observed in the endosperm of seeds of Aesculns, Diospyros etc. It is best studied in plasmolysed cells where the protoplast shrinks from all the regions of cell wall, except the places where plasmodesmata occur.

Function:

(1) It helps in the short distance transport of materials;

(2) The relay of stimulus occurs through it;

(3) Viruses can pass through plasmodesmata;

(4) Plant hormones move through plasmodesma;

(5) The movement through plasmodesma is bi-directional. It is suggested that the desmotubules act as a valve and regulate the direction of flow; and

(6) Small molecules and ions pass readily through plasmodesma.