**CELL – WALL**  1. Cell wall is a characteristics feature of the all plant cells. 2. It is the outermost layer of plant cell, which covers the plasma membrane. 3. It is rather rigid, strong, thick and porous. 4. It is a non-living structure and is secreted by the living portion of the cell. 5. It starts to formed at the beginning of the telophage stage. 6. It is believed to be formed by the fragments of the Endoplasmic recticulum. 7. In young cells, the cell wall is thin, elastic, soft and about 1 – 3 in thickness. 8. In old and mature cells, the cell wall becomes stiff and 5 – 10 in thickness. 9. The cell wall of parenchymatous cells are comparatively thinner than the collenchymas, sclerenchyma cells and xylem vessels. **STRUCTURE OF CELL WALL** 1.The cell wall are complex structure and are differentiated in some tissues. 2.A plant cell wall can be differentiated into following layers :- I. Primary cell wall II. Secondary cell wall III. Tertiary cell wall IV. Middle lamellae. 3. Generally the primary and secondary cell wall are found in the cell. 4. Tertiary cell wall are rare and are found in the xylem tracheids of gymnosperm. 5. These walls are deposited in layers one after the other during growth.

  **I. PRIMARY CELL WALL** 1. It is the outermost layer of the cell. 2. It is the first deposition product of the cell. 3. At first the primary cell wall is rather elastic, thin & becoming thick & rigid with the approach of cell maturation. 4. In dry weight composition, it contains hemicellulose upto 50%, cellulose upto 25% and smaller amount of pectic substances, polysaccharide (xylans, mannans, galactans etc) and forms matrix of the wall in which cellulose microfibrils are embedded. 5. In many fungi, the cell wall is composed of chitin. **II. SECONDARY CELL WALL** 1. Next to the primary cell wall is another layer known as secondary cell wall. 2. It is thicker than the primary cell wall. 3. It is generally found in the mature, permanent or non-growing cells. 4. This is formed by the deposition of cellulose on primary wall. 5. It mainly consist of cellulose, but in addition it contains pectin, non-cellulosic material, lignin and a phenolic polymer. 6. It provides hardness and mechanical rigidity to the wood. 7. In certain cells, it is further differentiated into outer, middle and inner layer. **III. TERTIARY CELL WALL** 1. Rarely in certain cells, a third layer is added inside the secondary wall which is known as tertiary cell wall. 2. The presence of tertiary cell wall was described by Buchner(1953) in the xylem tracheids of gymnosperm. 3. It differs from the primary and secondary cell wall in its morphology, chemical composition and staining properties. 4. The cell wall is mainly composed of xylan instead of cellulose. **IV. MIDDLE LAMELLAE** 1. The primary cell wall of two adjacent cells are separated by a layer or structure known as middle lamellae. 2. During the development of cell walls, the middle lamellae is formed first. 3. It consist of Ca and Mg pectates composed of chains of hexuronic acids. 4. These pectates are viscous and gelatinous. 5. It binds the adjoining cells firmly. 6. In mature and aged (old) cells, the middle lamellae is dissolved and consequently the cells are loosened. 7. During the maturation of fruits, the pectic substances of the middle lamellae become soluble due to action of pectolytic enzymes. So the ripe fruit becomes soft.

**CHEMICAL COMPOSITION OF CELL WALLS**  Structurally the cell wall looks like a interwoven network of cellulose varying in complexity and size. **CHEMICAL COMPOSITION OF PRIMARY CELL WALL** 1. The primary cell wall consist of interwined cellulose fibres, which are a deposition of pectin, lignin, hemicelluloses etc. 2. The cellulose molecules are the polymers of disaccharide cellobiose having approximately 3000 glucose units (hexose). 3. These glucose are arranged in the form of chain and are linked. 4. The cellulose fibrils are about 0.25 wide and upto 1 long. 5. Many chains of cellulose molecules lie parallel to each-other to form the bundle. 6. A bundle of 100 cellulose molecular chain forms the elementary fibril known as miscelle. 7. The miscelle are the smaller sub-units arranged parallel to form a bundle known as microfibril. 8. About 20 miscelle arranged parallel to form tha microfibril. It is about 250 A\* thick. 9. Similarly, the 250 microfibrils forms the large size bundle known as macrofibril. 10. These macrofibril ultimately form the main framework of the cell wall.

11. The hemicelluloses are the polysaccharide of sugar like arabinose, xylose, mannose and galactose. 12. The pectic substances are the long chains of units of uronic acid derivatives of hexoses, glucuronic and galacturonic acid. 13. Lignin is composed of coniferyl alcohols and cutin of many amino acids. 14. Chitin is a polymer of glucosemine.

**CHEMICAL COMPOSITION OF SECONDARY CELL WALL** 1. The secondary cell wall is also composed of cellulose and lignin. 2. The formation and structure of microfibrils are same as in primary cell wall. The only difference are in the arrangement, The cellulose microfibrils in the macrofibril are compactly arranged than the primary cell wall.

**CHEMICAL COMPOPSITION OF TERTIARY CELL WALL** The tertiary cell wall is composed of xylan instead of cellulose.

**CHEMICAL COMPOSITION OF MIDDLE LAMELLAE** The middle lamellae is composed of Ca & Mg pectates.

**FUNCTION OF CELL WALL** 1. It protects the cell from adverse environment conditions. 2. It provides a definite shape to the cell. 3. It provides strength to the cell. 4. It permits the entry of molecules of different sizes. 5. It determines the manner of cell division and growth. 6. It has plasmodesmata through which cells remain connected with adjacent cells. 7. It separates one cell from the other. 8. It protects the plasma-membrane. 9. It prevents the plant cell from desiccation.

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