

### **Plant cells are encased by cell walls**

- The **cell wall**, found in prokaryotes, fungi, and some protists, has multiple functions.
- In plants, the cell wall protects the cell, maintains its shape, and prevents excessive uptake of water.
- It also supports the plant against the force of gravity.
- The thickness and chemical composition of cell walls differs from species to species and among cell types.
- The basic design consists of microfibrils of cellulose embedded in a matrix of proteins and other polysaccharides.
  - This is like steel-reinforced concrete or fiberglass.
- A mature cell wall consists of a **primary cell wall**, a **middle lamella** with sticky polysaccharides that holds cell together, and layers of **secondary cell wall**.

### **The extracellular matrix (ECM) of animal cells functions in support, adhesion, movement, and regulation**

- Lacking cell walls, animal cells do have an elaborate **extracellular matrix (ECM)**.
- The primary constituents of the extracellular matrix are glycoproteins, especially **collagen** fibers, embedded in a network of **proteoglycans**.
- In many cells, **fibronectins** in the ECM connect to **integrins**, intrinsic membrane proteins.
- The integrins connect the ECM to the cytoskeleton.
- The interconnections from the ECM to the cytoskeleton via the fibronectin-integrin link permit the interaction of changes inside and outside the cell

### **Intracellular junctions help integrate cells into higher levels of structure and function**

- The ECM can regulate cell behavior.
  - Embryonic cells migrate along specific pathways by matching the orientation of their microfilaments to the “grain” of fibers in the extracellular matrix.
  - The extracellular matrix can influence the activity of genes in the nucleus via a combination of chemical and mechanical signaling pathways.
    - This may coordinate all the cells within a tissue.
- Animal have 3 main types of intercellular links: tight junctions, desmosomes, and gap junctions.

- In **tight junctions**, membranes of adjacent cells are fused, forming continuous belts around cells.
  - This prevents leakage of extracellular fluid.
- **Desmosomes** (or anchoring junctions) fasten cells together into strong sheets, much like rivets.
  - Intermediate filaments of keratin reinforce desmosomes.
- **Gap junctions** (or communicating junctions) provide cytoplasmic channels between adjacent cells.
  - Special membrane proteins surround these pores.
  - Salt ions, sugar, amino acids, and other small molecules can pass.
  - In embryos, gap junctions facilitate chemical communication during development.

### **A cell is a living unit greater than the sum of its parts**

- While the cell has many structures that have specific functions, they must work together.
  - For example, macrophages use actin filaments to move and extend pseudopodia, capturing their prey, bacteria.
  - Food vacuoles are digested by lysosomes, a product of the endomembrane system of ER and Golgi.
- The enzymes of the lysosomes and proteins of the cytoskeleton are synthesized at the ribosomes.
- The information for these proteins comes from genetic messages sent by DNA in the nucleus.
- All of these processes require energy in the form of ATP, most of which is supplied by the mitochondria.
- A cell is a living unit greater than the sum of its parts.