

- aa. The **cytoskeleton** consists of filaments and cylinders of special proteins that constitute an internal framework within the cytoplasm.
 - bb. **Microtubules** are rigid, hollow cylinders of protein used for:
 - i. Positioning organelles
 - ii. Moving transport vesicles and other organelles
 - iii. Generating force to propel the cell
 - cc. **Intermediate filaments** are ropelike cables of protein that provide mechanical reinforcement to the cell.
 - dd. **Microfilaments** are thin, flexible proteins that create cell shape and generate crawling movements in some cells.
 - ee. **Microtubules** are made of protein subunits called **tubulin**.
 - ff. **Intermediate filaments** are thinner than microtubules and provide structural and mechanical support.
 - gg. Microfilaments are thin strands of protein called **actin** that can lengthen and shorten to create movement in a cell.
 - hh. Many protists and animals have cells with numerous hair like projections called **cilia** (singular: cilium).
 - ii. Some bacteria, archaea's, protists, and the sperm cells of some plants and animals use a **flagellum** (plural: flagella) to propel themselves through fluid.
4. Cell Structure and internal Compartments Chapter summary
- a. Cells: the smallest units of life
 - i. The cell is the basic unit of all living organisms
 - ii. Most cells are small because the ratio of surface area to volume limits cell size as a cell's width increases its volume increases vastly more than its surface so a larger cell has proportionally less plasma membrane area to import and export substances but must support a much larger cytoplasmic volume
 - iii. Broadly speaking larger organisms are more effective predators less susceptible prey and better able to obtain and store nutrients
 - iv. A multicellular enabled organism to attain larger size and it conferred the added advantage of greater efficiency through division of labor among the multiple cell types
 - b. The plasma membrane
 - i. Every cell is surrounded by a plasma membrane that separates the chemical reactions of life from the surrounding environment
 - ii. Per the fluid mosaic model the plasma membrane is a highly mobile assemblage of lipids and proteins many of which can move within the plane of the membrane
 - iii. Proteins in the plasma membrane perform a variety of functions receptor proteins facilitate communication transport proteins mediate the movement of substances across the membrane and adhesion proteins help cells attach to one another.
 - c. Prokaryotic and eukaryotic cells
 - i. Living organisms are classified as either prokaryotes or eukaryotes