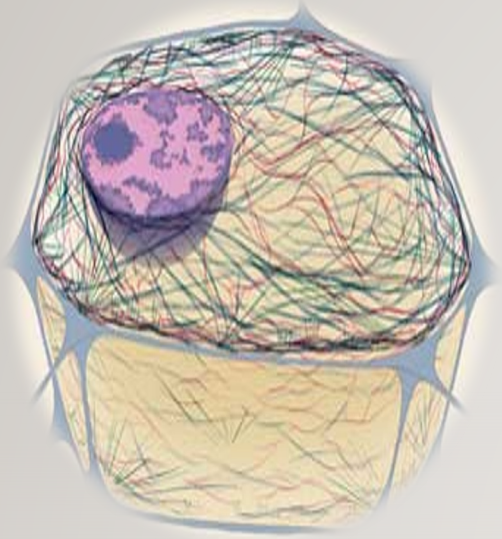
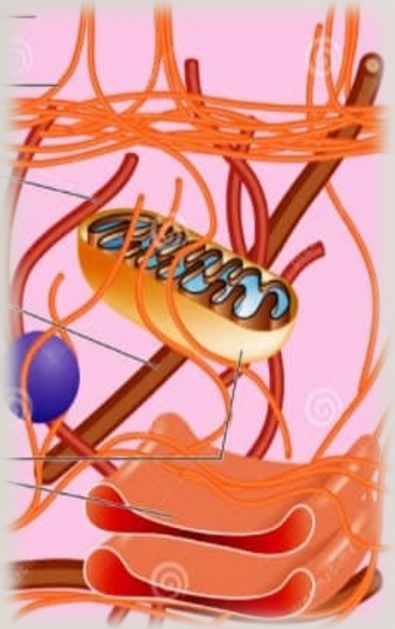
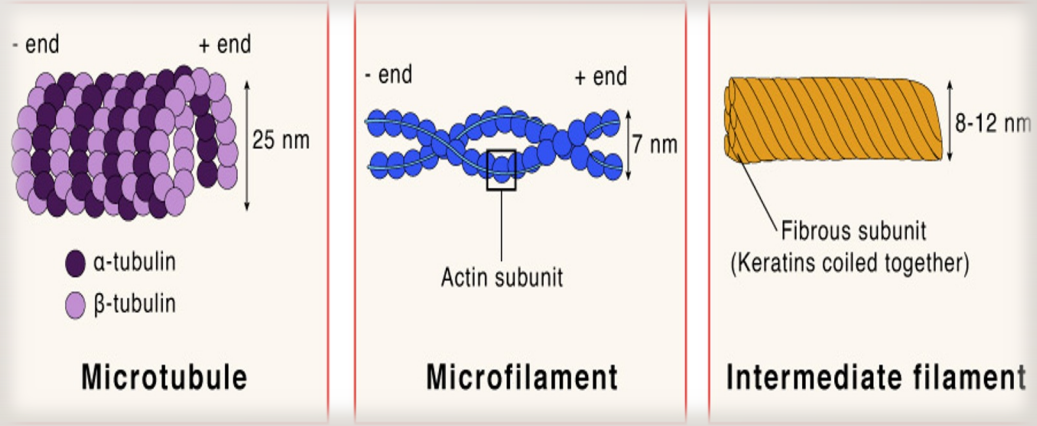


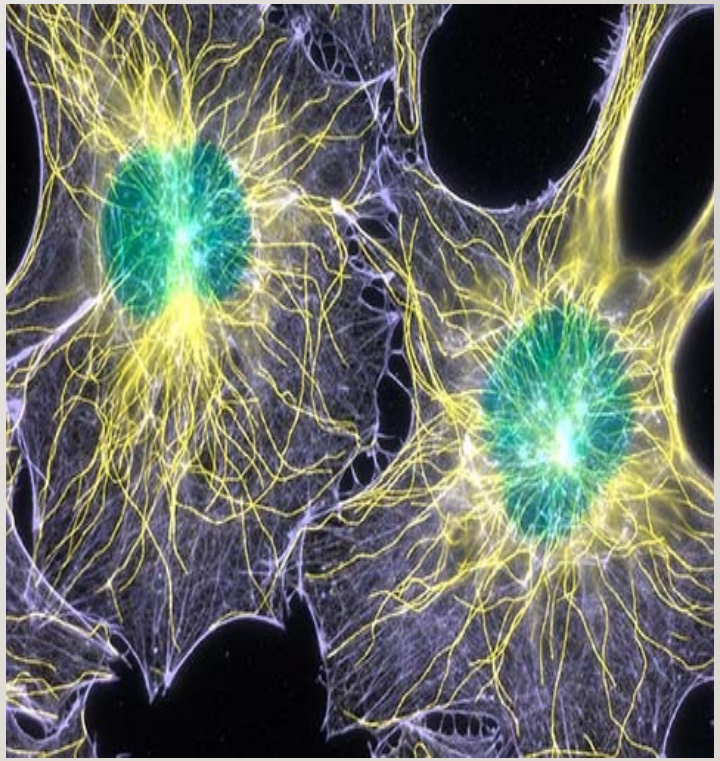
CYTOSKELETON AND ITS ROLE IN CELL SUPPORT AND TRANSPORT





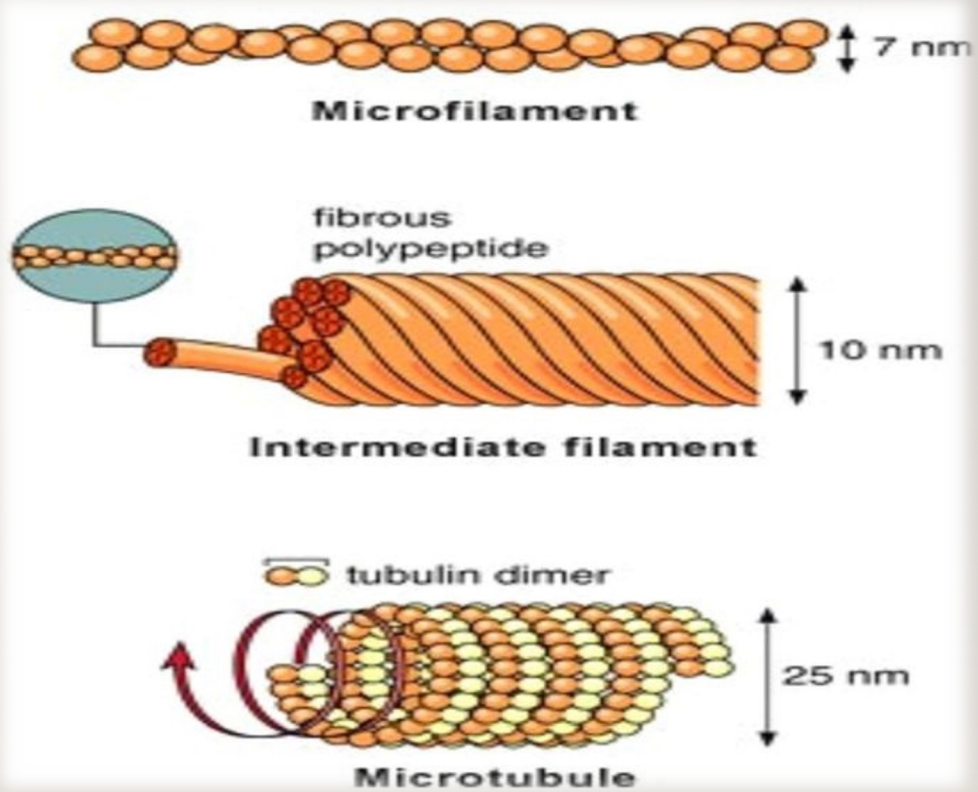
INTRODUCTION :

- Among all the functional components of a living cell, **cytoskeleton** is considered to be the **backbone of a cell as it provides the cell its shape and structure and It is controlling inter- and intracellular transportation**.
- And it also provides **mechanical support** that enables cells to carry out essential functions like division and movement.
- cells have a network of filaments known as the cytoskeleton "cell skeleton", which not only supports the plasma membrane and gives the cell an overall shape, but also aids in the correct positioning of organelles, provides tracks for the transport of vesicles, and in many cell types allows the cell to move.



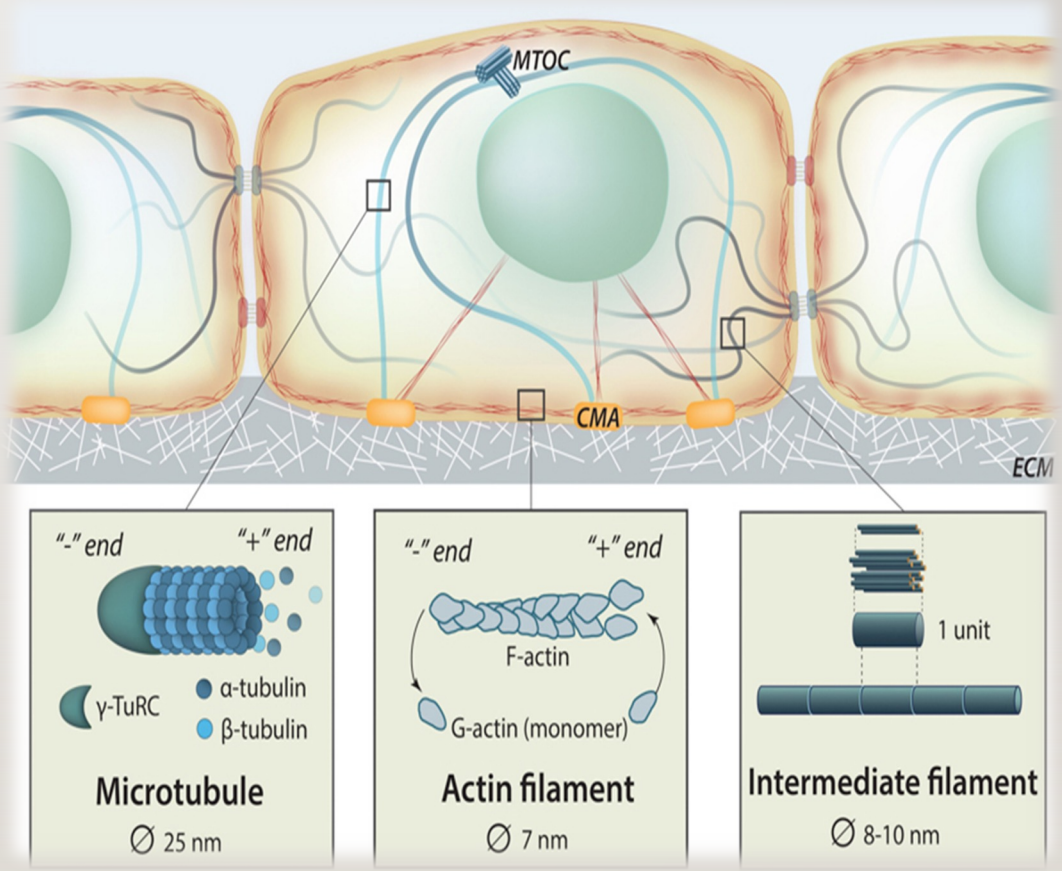
WHAT IS THE CYTOSKELETON MADE OF?

- The cytoskeleton of eukaryotic cells is made of filamentous proteins, and it provides mechanical support to the cell and its cytoplasmic constituents. All **cytoskeletons consist of three major classes** of elements that differ in size and in protein composition :
- **Microtubules** are the largest type of filament, with a diameter of about 25 nanometers (nm), and they are composed of a protein called tubulin.

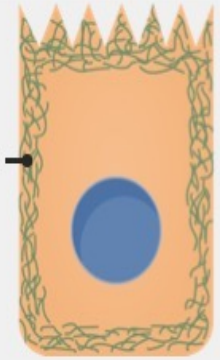


CONTINUE ..

- **Actin filaments** (microfilaments) are the smallest type, with a diameter of only about 6 nm, and they are made of a protein called actin.
- **Intermediate filaments**, as their name suggests, are mid-sized, with a diameter of about 10 nm. Unlike actin filaments and microtubules, intermediate filaments are constructed from a number of different subunit proteins.



Actin microfilaments

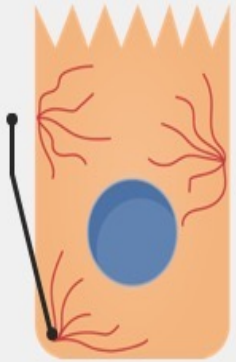


Microfilament

Actin subunit

Dynamic, directional: structure and movement, tension element

Intermediate filaments

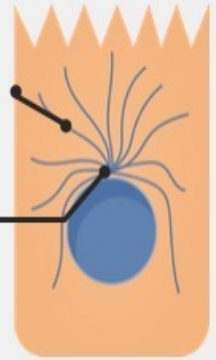


Intermediate filament

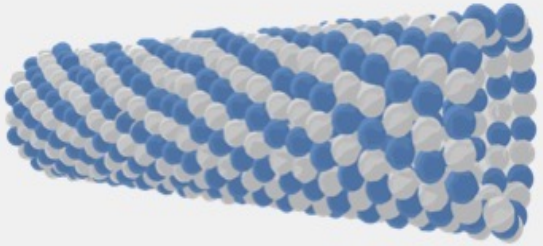
Relatively static: structural integrity, tensile strength

Microtubules

Centrosome



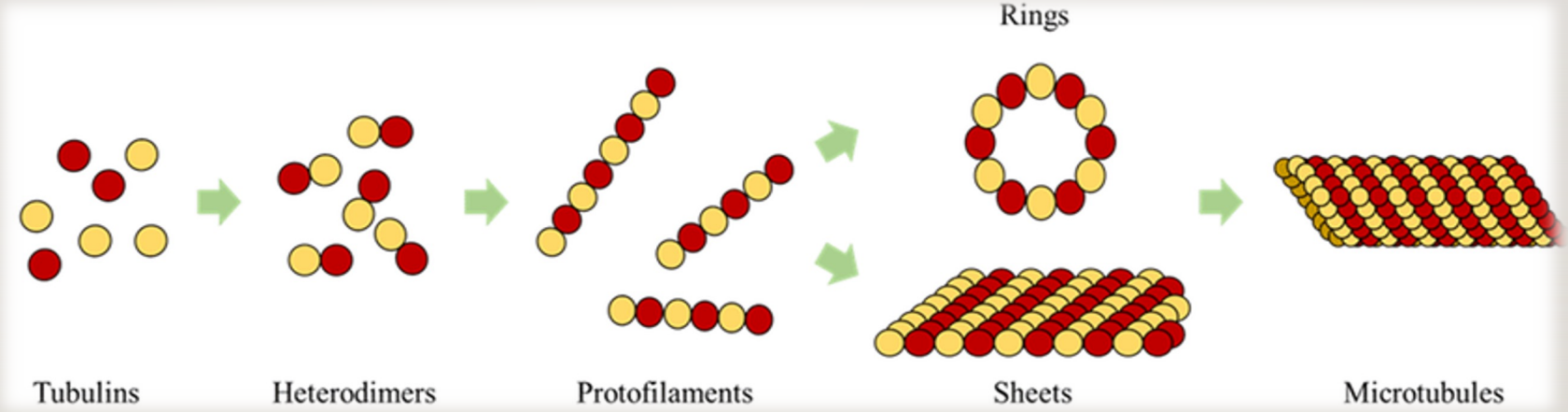
Microtubule



Dynamic, directional: noncompressible strut, intracellular movement, mitotic spindle

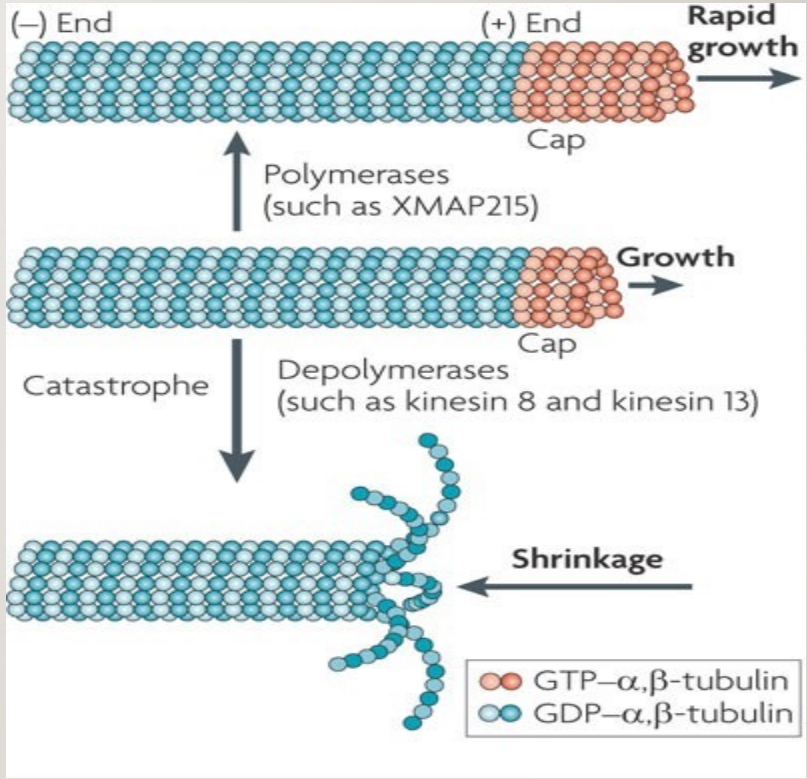
WHAT DO MICROTUBULES DO?

- Tubulin (the tubulin proteins α- and β polymerize into long filaments that form microtubules) contains two polypeptide subunits, and dimers of these subunits string together to make long strands called protofilaments.
- Thirteen protofilaments then come together to form the hollow, straw-shaped filaments of microtubules.



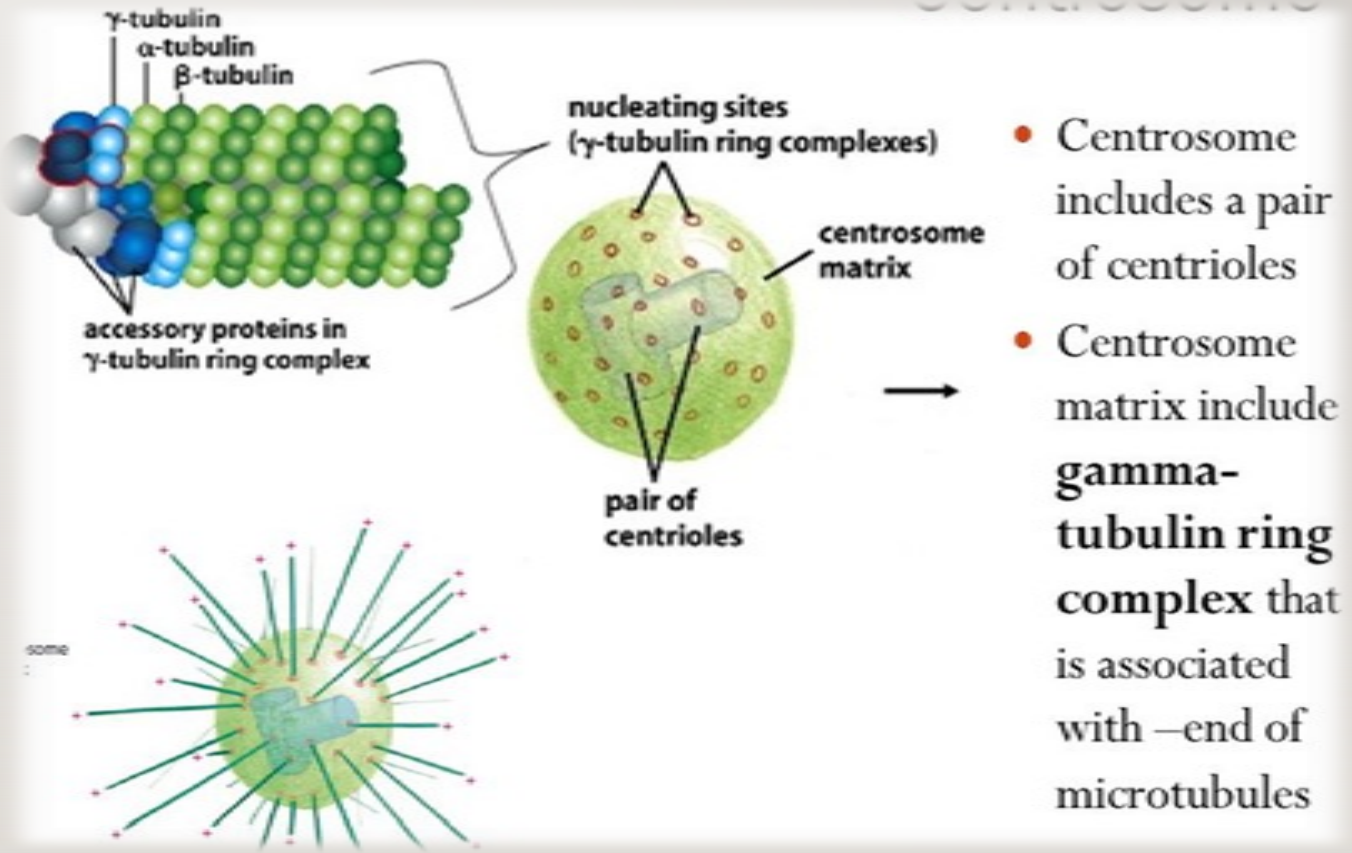
MICROTUBULES :

- **Microtubules** are ever-changing, with reactions constantly adding and subtracting tubulin dimers at both ends of the filament. The rates of change at either end are not balanced — one end grows more rapidly and is called the plus end, whereas the other end is known as the minus end. In cells, the minus ends of microtubules are anchored in structures called **microtubule organizing centers (MTOCs)**.
- The primary **MTOC** in a cell is called the **centrosome**, and it is usually located adjacent to the nucleus.



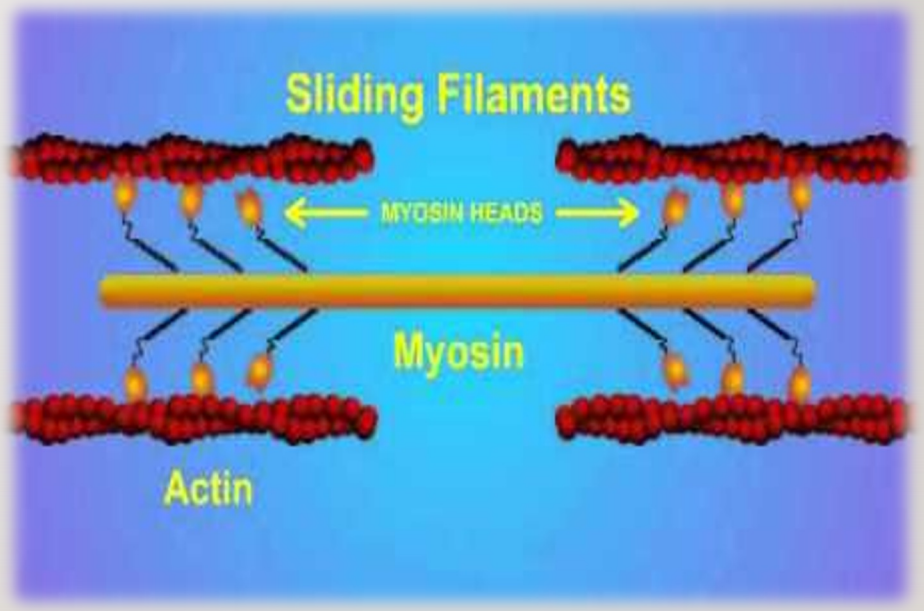
MICROTUBULES :

- Microtubules tend to grow out from the centrosome to the plasma membrane.
- **In nondividing cells**, microtubule networks radiate out from the centrosome to provide the basic organization of the cytoplasm, including the positioning of organelles.



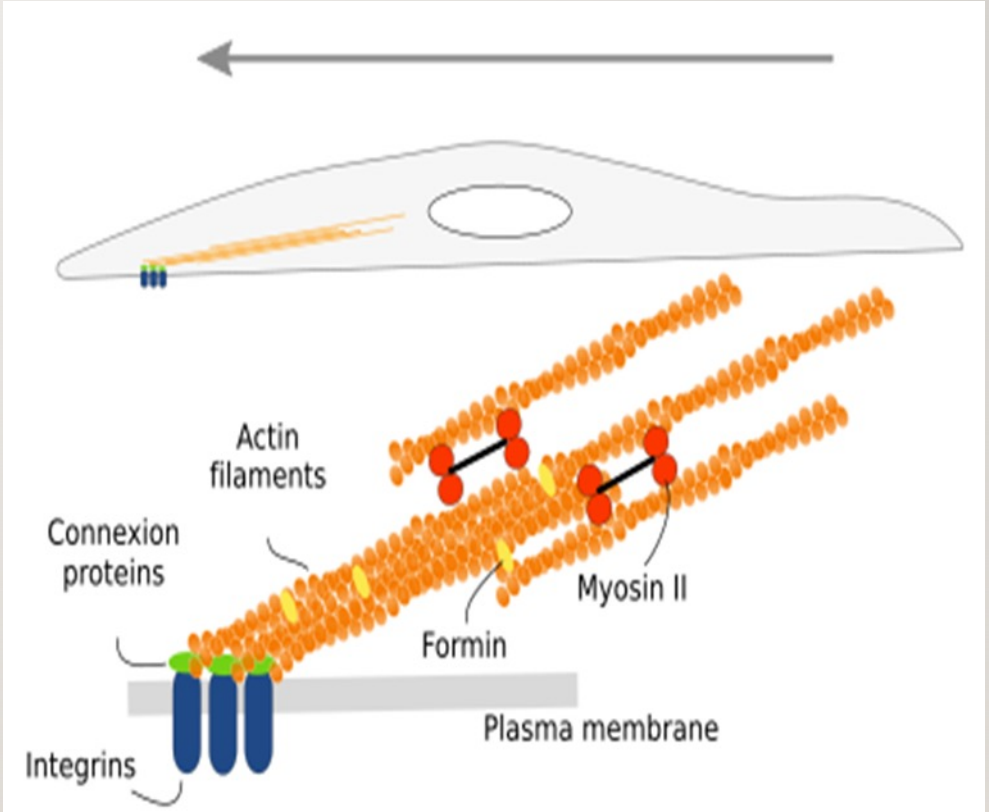
WHAT DO ACTIN FILAMENTS DO?

- **Actin** is abundant in all eukaryotic cells. It was first discovered in skeletal muscle, where actin filaments slide along filaments of another protein called myosin to make the cells contract.
- **In non muscle cells**, actin filaments are less organized and myosin is much less prominent.
- **Actin filaments are made up of** identical actin proteins arranged in a long spiral chain.
- Like microtubules, actin filaments have plus and minus ends, with more ATP-powered growth occurring at a filament's plus end.



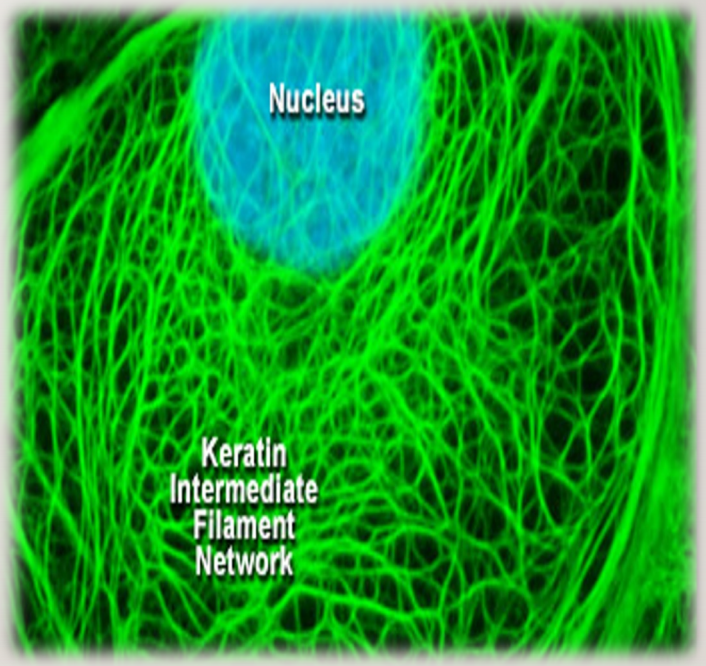
ACTIN FILAMENTS :

- In many types of cells, networks of actin filaments are found associated with cell membrane and beneath it that supports and strengthens the plasma membrane.
- Such networks allow cells to hold and move specialized shapes, such as the brush border of microvilli.
- Actin filaments are also involved in cytokinesis and cell movement.



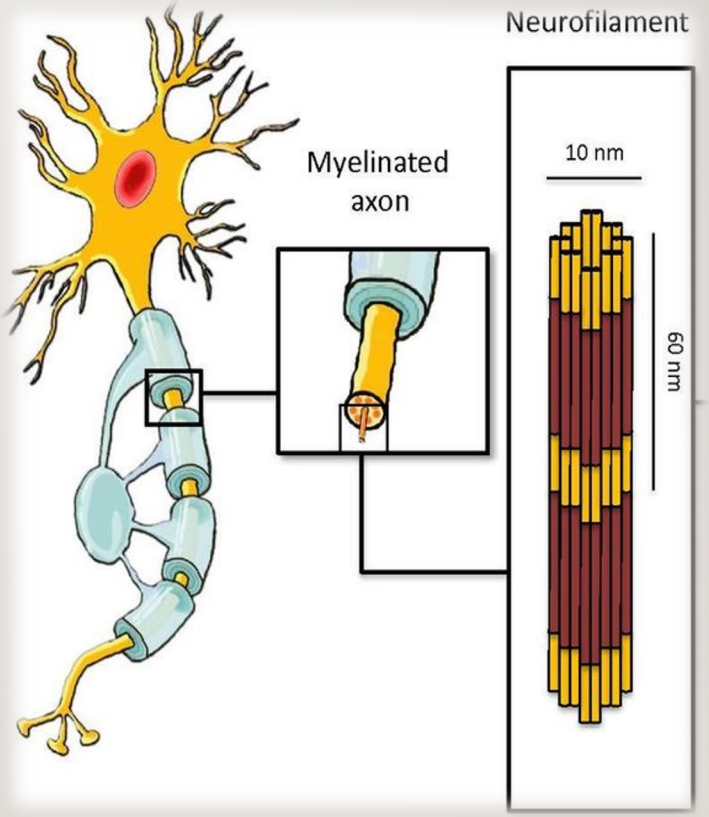
WHAT DO INTERMEDIATE FILAMENTS DO?

- **Intermediate filaments** come in several types, but they are generally strong and ropelike, less dynamic than actin filaments or microtubules, commonly work with microtubules, providing strength and support for the tubulin structures.
- Intermediate filaments come in a number of different varieties, each one made up of a different type of protein. One protein that forms intermediate filaments is **keratin**, a fibrous protein found in hair, nails, and skin.



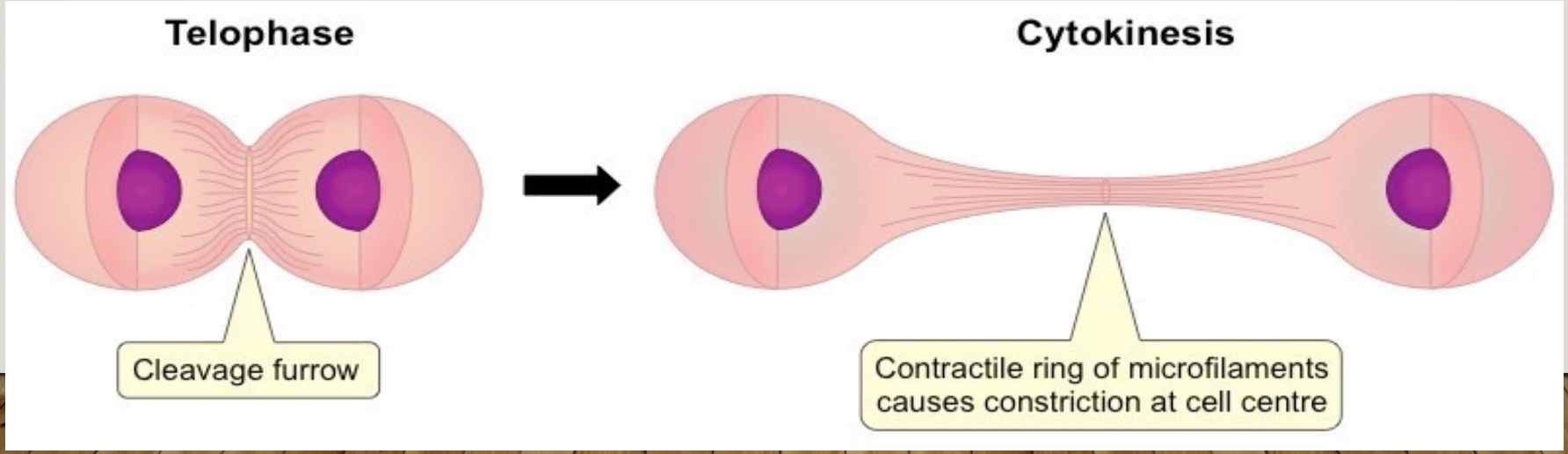
INTERMEDIATE FILAMENTS :

- Some cells have multiple types of intermediate filaments, and some intermediate filaments are associated with specific cell types.
- **For example**, neurofilaments are found specifically in neurons most prominently in the long axons of these cells, and keratins are found specifically in epithelial cells.



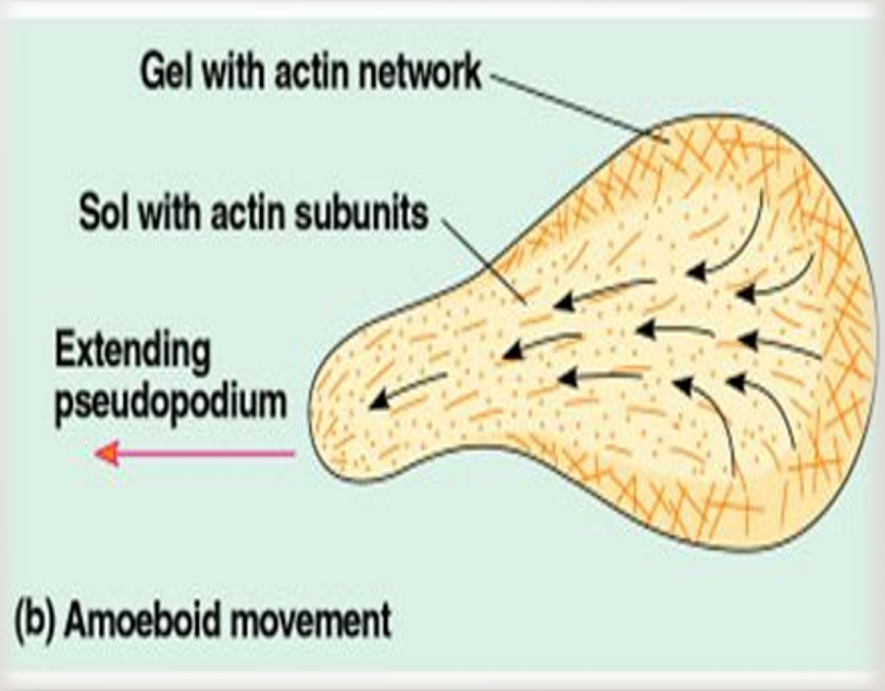
HOW DOES CYTOSKELETON SUPPORT CELL MOTILITY?

- Cytoskeletal filaments provide the **basis for cell movement**. For instance, cilia and flagella move as a result of microtubules sliding along each other.
- Other cell movements, such as the pinching off of the cell membrane in the final step of cell division, also known as cytokinesis are produced by the contractile capacity of actin filament networks.



HOW DOES CYTOSKELETON SUPPORT CELL MOTILITY?

- Actin filaments are extremely dynamic and can rapidly form and disassemble. This dynamic action underlies the crawling behavior of cells such as amoebae.
- At the leading edge of a moving cell, actin filaments are rapidly polymerizing, and at its rear edge, they are quickly depolymerizing.



DOES THE CYTOSKELETON HELP WITH TRANSPORT?

- One function of the cytoskeleton is to move cellular components from one part of the cell to another. These cellular components are called "cargo" and are often stored within a vesicle for transport. You can think of the cytoskeleton as "tracks" providing support and directionality inside of the cell.
- Actin filaments may also serve as highways inside the cell for the transport of cargoes, including protein-containing vesicles and even organelles. These cargoes are carried by individual myosin motors, which "walk" along actin filament bundles.