CYTOSKELETON

Q.What are the major functions of cytoskeleton?

The cytoskeleton provides a structural framework for the cell, serving as scaffold that determines cell shape, the position of organelles and the general organization of the cytoplasm. In addition to playing structural role the cytoskeleton is responsible for cell movements. These include not only the movements of entire cells, but also the normal transport of organelles and other structure.

Q.What are the major types of cytoskeleton?

The cytoskeleton is composed of 3 principal types of protein filaments: *Actin filaments, Intermediate filaments and Microtubules*. These are held together and linked to subcellular organelles and the plasma membrane by a variety of accessory proteins.

Q.Make a brief note on structure and organization of actin filaments.

i)This major cytoskeleton protein (of most cells) polymerizes to form actin filaments— thin , flexible fibrers (7nm in diameter and upto several μm in legth). Another name of the actin filaments is **microfilaments**.

ii)Within cell actin filaments are organized into higher-order structures, forming bundles or 3-D networks with the properties of semisolid gels.

iii)**Actin binding protein—** assembly and disassembly of actin filament, their cross linking into bundles and networks and their association with other cell structures (e.g. plasma membrane) are regulated by a variety of actin-binding proteins, which are critical components of the actin cytoskeleton.

Q.State the possible occurrence of actin filaments

Actin filaments are particularly abundant beneath the plasma membrane where they form a network that provides mechanical support, determines cell shapes and allows movement of the cell surface, thereby enabling cells to migrate, engulf particles and divide.

Q.What is the evolutionary significance of actin filaments?

All of the actins, however, are very similar in amino acid sequence and have been highly conserved throughout evolution of eukaryotes. Yeast actin for example is 90% identical in amino acid sequence to the actins of mammalian cells. The parokaryotic ancestor of actin is a protein called **MreB,** which gives rod-shaped bacteria structure.

The 3-D structure of both individual actin molecules and actin filaments were determined in 1990 by **Kenneth Holmes, Wolfgang Kabsch** and their colleagues.

Structure of actin:

1.Individual actin molecules are globular proteins of 375 amino acids (43kd).

2.Each actin monomer (**globular [G] actin**)has tight binding sites that mediate head-to-tail interactions with two other actin monomers, so actin monomers polymerize to form filaments(**filamentous [F]actin**) (**Figure1)**.

3.Each monomer is rotated by 166^{0} in the filaments, which therefore have the appearance of a double-stranded helix.

4.**Polarity—**As all the actin monomers are oriented in the same direction, actin filaments have a distinct polarity and their ends (called **barbed** or + ends and **pointed** or - ends) are distinguishable from one another. This polarity of actin filaments is important both in their assembly and in establishing a specific direction of myosin movement relative to actin.