Locomotor apparatus of the cell

The movement apparatus of cells is made up of cytoplasmic proteins and protein membrane structures that serve as "anchors". In eukaryotic cells , it is formed by the cytoskeleton**,** we then speak of the *cytoskeletal principle of organization* .

Cytoskeleton

A dynamic support network that gives cells **shape** and the ability to change it. It also ensures the **intracellular** movement of membrane and non-membrane structures and **cell movement**. It includes a complex network of **microtubules**, **microfilaments**, and **intermediate filaments**.

Microfilaments

A helical strand of actin

They are formed by actin . Their diameter is around **6 nm** . Actin (fibrillar **F-actin**) is a polymer of globular **G-actin** . It occurs in all eukaryotic cells. In the human body, it is very often associated with myosin , which **does not belong** to microfilaments, but to *proteins associated with the cytoskeleton* . Actin forms both mobile and immobile structures (e.g. mechanical reinforcement of villi and stereocilia).

Intermediate filaments

Their diameter is about 12 nm. These are rather static structures. They ensure the mechanical strength of cells. They are formed by larger tetramers of subunit proteins that differ in AK structure , but are very closely related in some sequences.

- cytokeratins – in most covering epithelia, protecting against mechanical damage and loss of water or heat (skin , nails, hooves, feathers...), they form a group of approximately 20 polypeptides
- **vimentin** – creates filaments that characterize elements of mesenchymal origin and embryonic or undifferentiated cells
- **desmin** – in smooth muscle , sarcomeres of striated muscle and myocardium
- **glial filaments** – a characteristic part of glial cells
- **neurofilaments** – they consist of at least three polypeptides of high molecular weight, they are characteristic of neurons

According to the type of intermediate filaments produced, the source of some tumor metastases can be determined.

Microtubules

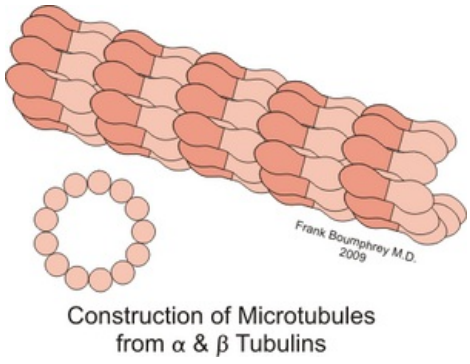

Diagram showing microtubules constructed from alpha and beta tubulin

It creates tubular structures with an outer diameter of 24 nm, the wall is 5 nm thick. The inner diameter is therefore about 14 nm. They consist of a tubulin heterodimer (made up of α- and β-tubulin). The subunits fold in a spiral to form a sort of "spiral staircase" with an opening inside. Their length is different, reaching **several mm** ! They can branch and form bridges between themselves. One complete turn of the helix consists of 13 units. The polymerization of tubulin into microtubulin is controlled by several structures, the so-called **MTOCs** , i.e. *microtubular organizing centers* . This includes the **basal bodies** of flagella and cilia and centrioles. In the cytoplasm, microtubules acquire different spatial arrangements – from random distribution to highly organized structures. They play an important role in the intracellular transport of organelles. *It creates a "rail" along which cellular motors* (associated proteins) move .

According to the speed with which the ends of the microtubule polymerize, a distinction is made between the **fast growing** + end and the **slower growing - end** . This is important in the **orientation of the microtubule**, where in the MTOC there is **always the - end** and the + end extends to the periphery. Also, some *cell motors* can only perform their function in one direction (eg from + to -).

Centrioles

Cylindrical structures (0.15 µm in diameter and 0.3–0.5 µm long), composed of highly organized microtubules. Each centriole consists of 9 sets of microtubule triplets arranged in a gear shape. In a non-dividing cell, there is one pair of centrioles, which are perpendicular to each other with their axes. Before the start of division, in the S-phase, they double, and during mitosis both pairs travel to opposite ends of the cell. Here they play the role of

organizational centres for the emerging **dividing spindle** . Near the centrioles, we often find a dark **pericentrionic body** (microtubules emerge from it). **The cytocenter** consists of centrioles in association with the Golgi complex .

Links

Related articles

- Cytoskeleton

References

- JUNQUEIRA, L. Carlos, José CARNEIRO, and Robert O. KELLEY. *Basic histology.* 8th edition. London : Prentice Hall International (UK) Ltd., 1992. 488 pp. and LANGE medical book; ISBN 0-8385-0587-2 .

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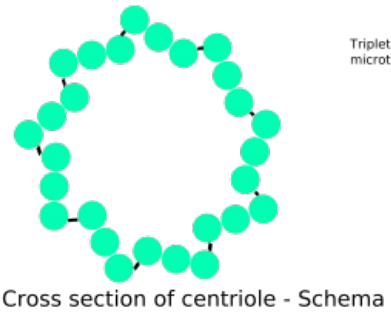

Cross section of centriole - Schema

Slightly better version of centriole schematic.