

Mitosis

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Mitosis is the part of the cell cycle during which the cell divides, forming two genetically identical cells.

Mitosis is a daily event in skin, hair, and mucous membranes. Blood and bone cells reproduce frequently, as well. But cartilage, tendons, and ligaments only rarely divide. Neurons and muscle cells never divide once they are mature.

A chromosome is a long piece of double-stranded DNA. You have two copies of each chromosome - one from your mother and one from your father. Humans have 46 strands of DNA in each cell - these 46 chromosomes are organized in 23 homologous pairs. You can, in an extremely simplified concept, think of homologous pairs as having a "back up" copy in case of mutations, as well as providing great variety in our appearance, metabolism, and health. They are numbered from biggest to smallest for pairs 1 through 22. The 23rd pair are the sex chromosomes. These are only homologous if you are female; males have two different types of chromosomes for their 23rd pair.

Chromatin is the term we give to the strands of DNA when they are loosely coiled (this loose coiling means the strands are so long and thin they are not yet visible in a microscope). Just one human cell contains about 2 meters of linear strands of DNA!

The centrosome is composed of two centrioles that organize the microtubules to make spindle fibers during the upcoming mitotic process. An important reminder is that spindle fibers are made of microtubules.

Mitosis begins once all the DNA and all the other cell contents, including structures like the centrosome, have been replicated, and all preparatory and appropriate interphase cell cycle checkpoints have occurred.

In prophase (pro means first), the long chromosome strands condense so much that they become visible in a regular microscope. The term chromosome literally means "colored body" to indicate this exciting visibility early microscopists viewed. The duplicated strands are called sister chromatids, and they are held together at a DNA sequence called the centromere. The nuclear envelope breaks down, and the duplicated centrosomes take up positions at opposite sides of the cell. From these, spindle fibers begin to emerge, poking and prodding their way toward the chromosomes. The nucleolus breaks down.

In prometaphase, kinetochores, massive protein machinery, assemble on the centromere. There are something like 100 proteins involved in forming each of these. The spindle fibers connect to these kinetochores, and start getting the chromosomes lined up.

Metaphase is given to the relatively short time period in the cycle when the spindle has lined up the chromosomes in the center of the cell (meta can mean middle), but hasn't yet begun to pull them apart.

The final cell cycle checkpoint occurs at the end of metaphase; if the spindle fibers haven't attached properly, then cell division will not proceed.

During anaphase, the sister chromatids officially separate (ana means to separate), and as they are pulled through the thick fluid of the cytoplasm, their arms drag.

Telophase shows the chromosomes far apart on opposite sides of the cell (telo means far); the strands of DNA uncoil, the nuclear envelope reforms, the nucleolus reappears, and the spindle breaks down.

Cytokinesis literally means "cell movement", and here the final separation of the two identical daughter cells occur. The pinching in of the membrane as it separates is called the "cleavage furrow".