The Cell Cycle

Cells

All living things are made up of one or more cells. An adult human is made up of approximately 100 trillion cells. Cells are the structural and functional unit of all living things. As well, cells come from living cells. The cells in living things are responsible for many cellular processes such as: cellular respiration, photosynthesis, osmosis, and reproduction.

Mitosis

During an organism's lifetime, cells will reproduce to promote growth, replace old or dying cells, or repair damaged cells. Another name for the repairing of injured cells is regeneration.

Did you know?

Did you know that crickets can regenerate their legs? Humans have a limited ability to regenerate lost organs. However, up to 75% of the liver may be lost and have regeneration. Children up to the age of 12 may regenerate severed fingertips.

Before cell division can take place, the genetic material of the cell must duplicate. Surrounding the nucleus is a nuclear membrane that controls the exchange of materials between the nucleus and the cytoplasm. The nucleus has one or more nucleoli.

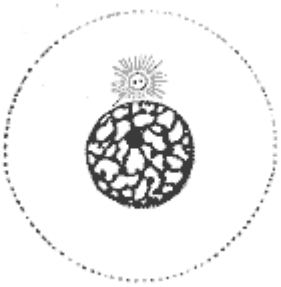
During mitosis new cells are produced with a complete set of DNA. Mitosis is important because it ensures that the genetic material in the daughter cells is identical to the parent cell (original cell).

Did you know?

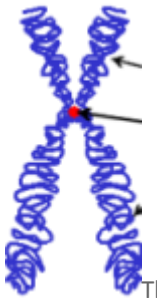
Did you know that the cells that line your stomach do not live much longer than two days? The acids produced in this organ eventually destroy the stomach cells. If the cells were not replaced you would not be able to properly digest your food.

Interphase

The phase before mitosis begins is called interphase. During this phase the cell is carrying out normal cellular activities. The genetic material appears as long, thread-like fibres called chromatin. Close to the end of interphase, the chromatin shortens and thickens into chromosomes and in animal cells, the centrioles duplicate.



Animal cell in the interphase stage. The dark, spherical nucleolus can be seen in the nucleus. The chromatin has not yet condensed.



The chromatin is coiled up to form double stranded chromosomes. The two halves of the chromosome are called chromatids and are held together by a centromere.

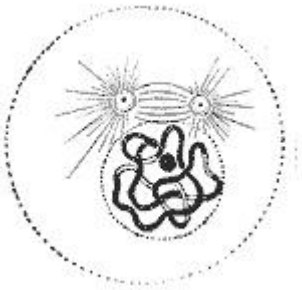
The chromosomes are made up of protein and DNA molecules. A centromere holds the two halves of the chromo

Stages of Mitosis

The four phases of mitosis are prophase, metaphase, anaphase, and telophase. Even though mitosis has been divided into four phases, it is a continuous process with cells constantly going through changes.

Prophase

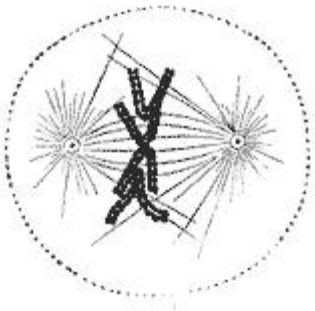
In the first part of prophase, the centrioles move to opposite poles (sides) of the nucleus. The chromatin appears to thicken and become shorter and the chromosomes are visible. Eventually the nucleolus and the nuclear membrane will disappear during this phase. Spindle fibres will form and connect between the two centrioles that are moving to opposite poles of the animal cell.



An animal cell in the prophase stage of mitosis. The two centrioles are moving to opposite poles of the cell.

Metaphase

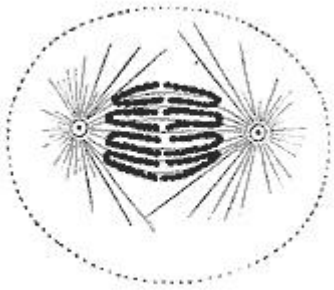
In metaphase, the chromosomes line up in the middle (or equator) of the cell. The spindle fibres are attached to the centromere of the chromosomes at one end and the centrioles at the other end. They help guide the chromosomes towards the poles.



An animal cell in the metaphase stage of mitosis. The chromosomes are lined up along the equator of the cell.

Anaphase

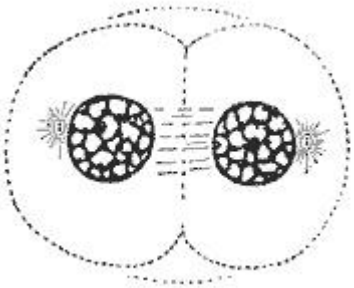
In anaphase, the chromatids separate at the centromere to produce two identical single stranded chromosomes. The chromosomes move to opposite poles of the cell during this phase.



An animal cell in the anaphase stage of mitosis. The chromosomes are beginning to separate.

Telophase

In telophase, the spindle fibres begin to disappear, the nuclear membrane reforms, and nucleolus reappear. The chromosomes begin to uncoil to form thin strands of chromatin. Two distinct nuclei can be seen and the cell is ready to divide.



An animal cell in the telophase stage of mitosis. Two separate nuclei can be seen with the cell membrane beginning to pinch inwards.

Cytokinesis

Cell division usually begins during telophase in animal cells and continues after mitosis.

Cytokinesis is the division of the cytoplasm and organelles. During cytokinesis in animal cells, the cell membrane pinches inward at the equator of the cell producing a furrow. The furrow continues to pinch inward until two daughter cells form.

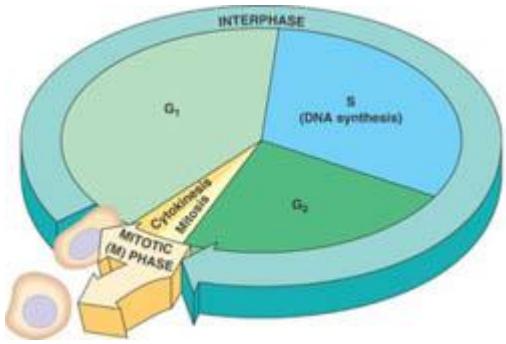
Did you know?

Did you know that the process of mitosis can be disrupted by a mutation? Mutations are changes in the DNA that can be caused by exposure to radiation, ultraviolet light, toxic chemicals, or viruses.

The Cell Cycle

The cell goes through a continuous process of interphase, mitosis, and cell division called the cell cycle.

The cell spends most of its time in interphase where is goes through rapid growth, DNA synthesis, and preparation for cell division. The cell spends the least amount of time going through mitosis and cytokinesis.



Parts of the cell cycle include: G1 phase has rapid growth and metabolic activity; S phase is DNA synthesis and replication; G2 phase includes centrioles replication and cell prepares for division; and mitosis and cytokinesis

Lifespan of Some Human Cells

Cell Type	Lifespan
red blood cells	120 days
stomach lining cells	2 days
skin epidermal cells	2 - 4 weeks
pancreas cells	1 year or more
bone cells	25 - 30 years
sperm cells	2 - 3 days
brain cells	30 - 50 years