The cell cycle

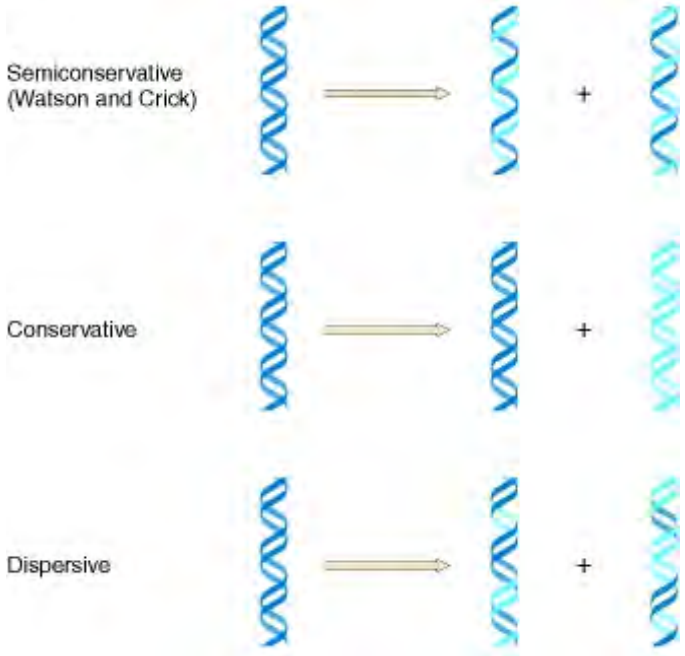
Cell division occurs in two main stages:
- **Nuclear division** is the process where the nucleus divides. There are two types of nuclear division, mitosis and meiosis.
- **Cell division** follows nuclear division and is the process where the whole cell divides.

Before a nucleus divides its DNA must be replicated. This is to ensure that all the daughter cells have the genetic info to produce enzymes and proteins they need.

Semi-conservative replication

For this to take place there are four requirements:
- The four types of nucleotide, each with their bases must be present.
- Both strands of the DNA molecule must act as a template for the attachment of these nucleotides.
- The DNA polymerase is needed to catalyse the reaction.
- A source of chemical energy is required to drive the process.

The process of semi-conservative replication takes place as follows:
1) The DNA helicase breaks the hydrogen bonds linking the base pairs.
2) The double helix separates into its two strands and unwinds.
3) Each exposed polynucleotide acts as a template for complementary nucleotides to attach.
4) Energy is used to activate the nucleotides.
5) The nucleotides are joined by DNA polymerase to form the missing polynucleotide strand on each of the 2 original polynucleotide strands.
6) Each of the new DNA molecules contains one of the original DNA strands.



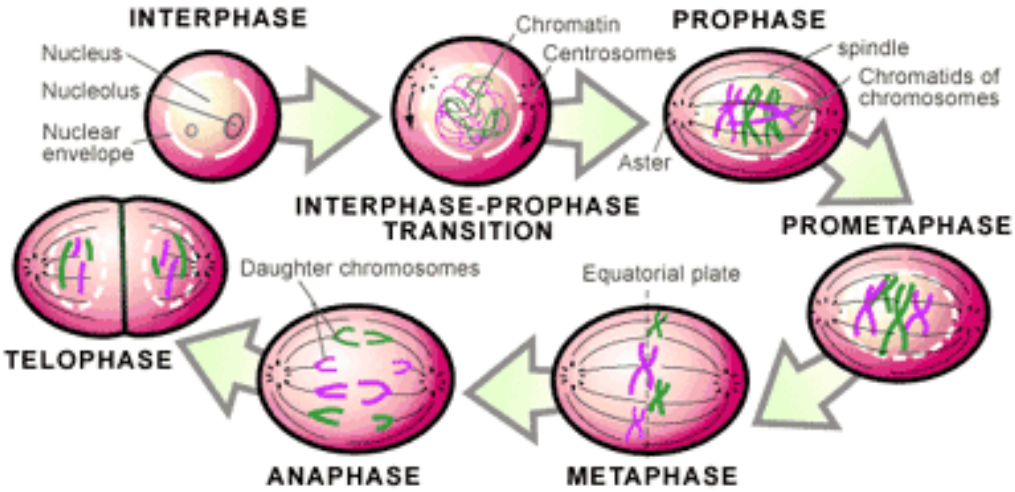
Mitosis

Nuclear division can take place by either mitosis or meiosis:
Mitosis produces two daughter nuclei that have the same number of chromosomes as the parent cell.
Meiosis produced four daughter nuclei, each with half the chromosomes of the parent cell.

Mitosis

This is the division of the nucleus of a cell that results in each of the daughter cells having an exact copy of the DNA of the parent cell. Except in the event of a **mutation**.
Mitosis is always preceded by a period during which the cell is not dividing. This is called **interphase**. It is a period of considerable cellular activity that included the replication of DNA.

1) **Prophase** in which the chromosomes become visible and the nuclear envelope disappears.
2) **Metaphase** in which the chromosomes arrange themselves at the centre of the cell.
3) **Anaphase** in which each of the two threads of a chromosome migrates to an opposite pole.
4) **Telophase** in which the nuclear envelope reforms.



The importance of mitosis

Mitosis is important because it produces daughter cells that are identical to the parent cells.
- **Growth**: when 2 haploid cells fuse together, the diploid cell has all the genetic info needed to resemble its parents, all cells grown from this need to possess the same info.
- **Differentiation:** these cells change to give groups of specialised cells. The different cell types each divide by mitosis to give tissues made up of identical cells.
- **Repair:** if cells are damaged or die it's important that the new cells have an identical structure and function to those lost.

The cell cycle

The cell cycle takes place in three stages:

1) **Interphase:** this occupies most of the cell cycle and is known as the resting phase because no division takes place.
   (a) First growth phase when proteins from which cell organelles are synthesised are produced.
   (b) Synthesis phase when DNA is replicated.
   (c) Second growth phase when organelles grow and divide and energy stores are increased.
2) **Nuclear division** when the nucleus divides either into two or four.
3) **Cell division** which follows nuclear division and is the process where the whole cell divides into two or four.

The length of a complete cell cycle varies greatly; a mammalian cell takes about 24 hours to complete a cycle of which about 90% is interphase.

Cancer

Cancer is a group of around 200 diseases caused by a growth disorder of cells.
It's the result of damage to the genes that regulate mitosis and the cell cycle.
This leads to uncontrolled growth of cells and a tumour develops and expands in size.
Cancers are most commonly found in the lungs, prostate gland, breast and ovaries.

Cancer and its treatment

The treatment often involves blocking some part of the cell cycle. In this way the cycle is disrupted and cell division and cancer growth ceases. Drugs used to treat cancer disrupt the cycle by:
- Preventing DNA from replicating
- Inhibiting the metaphase stage by interfering with the spindle formation.

The drugs also disrupt the cell cycle of normal cells.