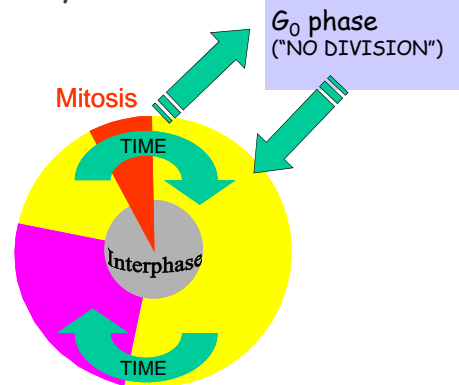


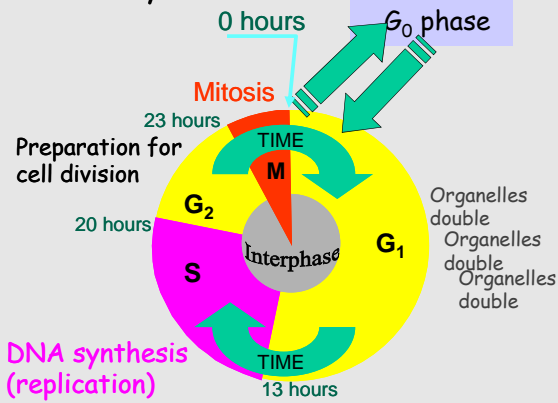
Cell Division. Mitosis and meiosis. Cell as a part of a tissue.

Main text: Vander's Human Physiology textbook,
Movies from Lodish et al "Molecular Cell Biology"

The cell cycle

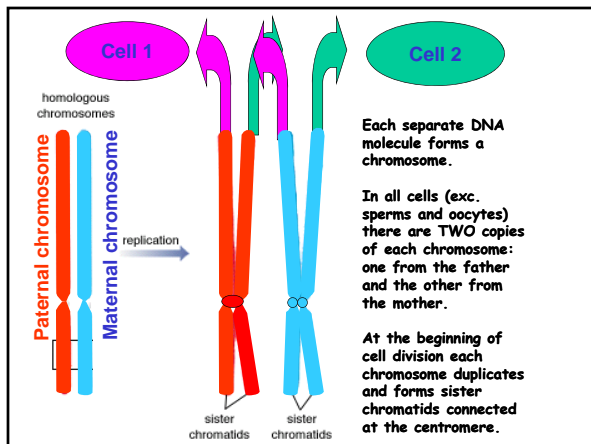


The cell cycle



1. All cells originate from the single source: the fertilized oocyte.
2. All cells except for male and female sex cells (sperms and oocytes) are produced by the process of cell division called **mitosis**.

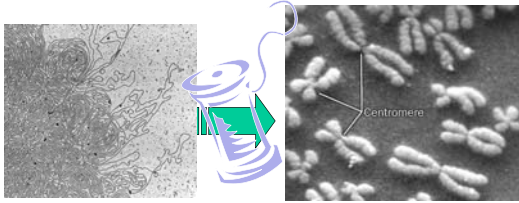
Fundamental feature of mitosis:
both descendant cells contain the same genetic material (DNA) as the parent cell.



As a result of mitosis each descendant cell gets two copies of each chromosome, one maternal and one paternal, exactly as in the parent cell.

If the parent cell had $2 \times N$ chromosomes,
both descendant cells will have also $2 \times N$ each.

Before dividing the cell must not only duplicate, but also assemble DNA into a manageable form.



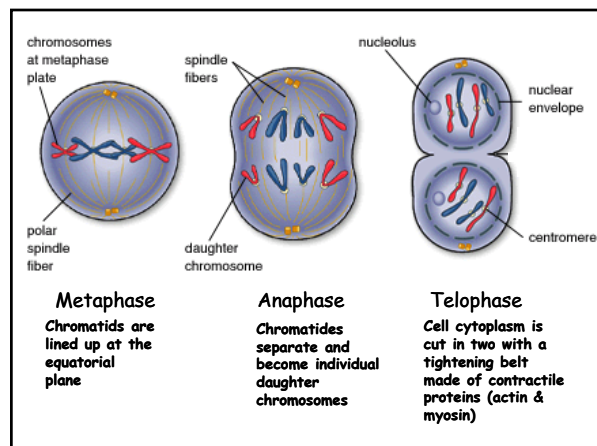
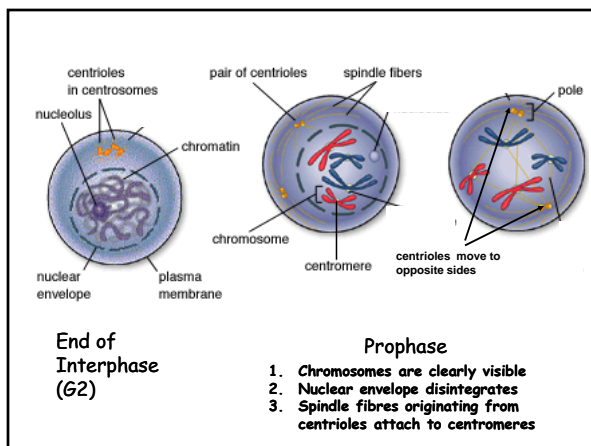
At the beginning of cell division DNA is coiled into rather short and thick "trunks" visible under light microscope. It is this form of DNA which was originally identified as chromosomes.

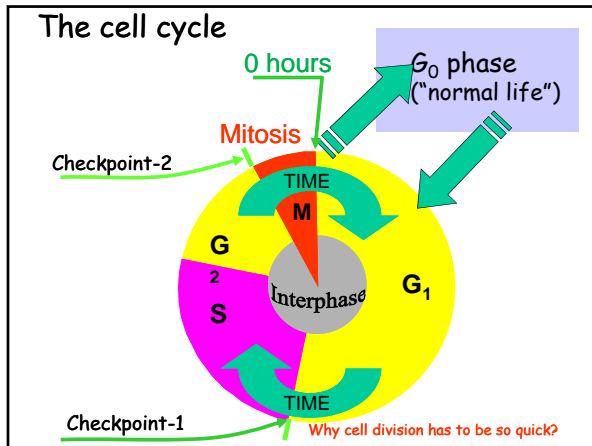
WHAT SHOULD THE CELL DO NEXT?

- Dissolve nuclear membrane.
- Split chromosomes evenly and pull them to the opposite sides of the cell
- Split cytoplasm and organelles into two separate lots, build a wall between the two new cells
- Restore the nuclear membranes.



	...phase
Inter...	
(something in between)	
Pro...	
(before)	
Meta...	
(in the middle...)	
Ana...	
(thereupon ???)	
Telo...	
(completion)	





Cells get "old" - cell senescence

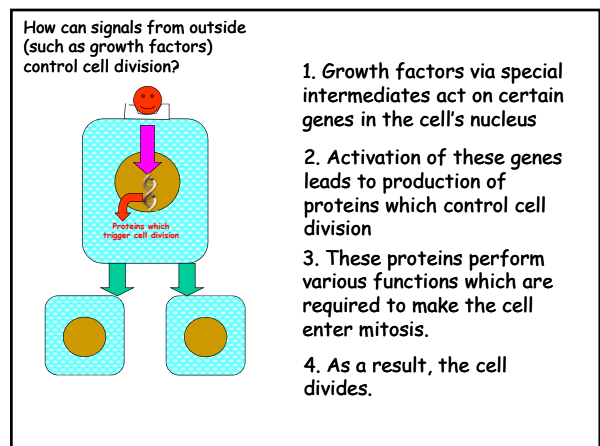
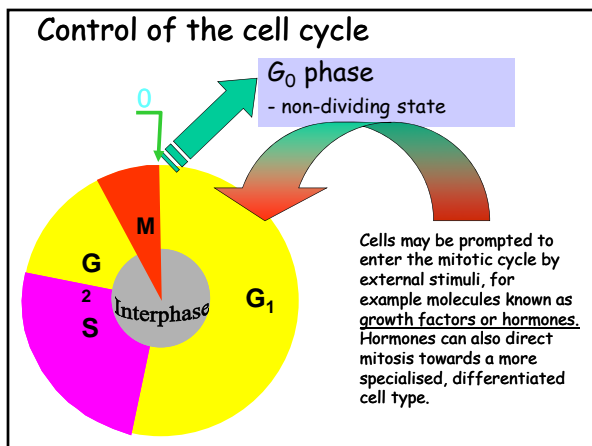
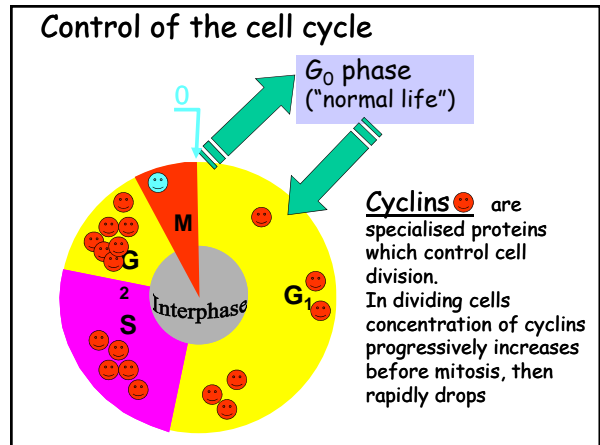
Even in dividing cells mitotic activity may fall with time and eventually they may start dying. One of the reasons for that is accumulation of small damages to DNA acquired throughout life. The other reason for a permanent arrest of cell division is the shut-down of the telomerase, an enzyme which elongates the ends of the DNA of the chromosomes.

"Cell lines" are "immortalised" clones of various cell types. They are essentially "tumour-like" cells in which many essential regulatory processes are disabled or lost. However they may still resemble their "ancestors" in some ways and are widely used in research.

Cells which may divide "perpetually"	Cells which have specialised (differentiated) and seldom or never divide
Blood marrow cells, Skin cells, Cells which line up the intestine	Nerve cells, Skeletal muscle cells

Movie: stem cells in intestine

Stem cells: undifferentiated cells with "indefinite" potential for self-replication which can get transformed (differentiated) into other cells which then lose this ability. Currently much research is going into the possibilities of using stem cells for medical purposes (to replace damaged cells, for example in MI).



Remember: cell division is a tightly controlled process!

CANCER:

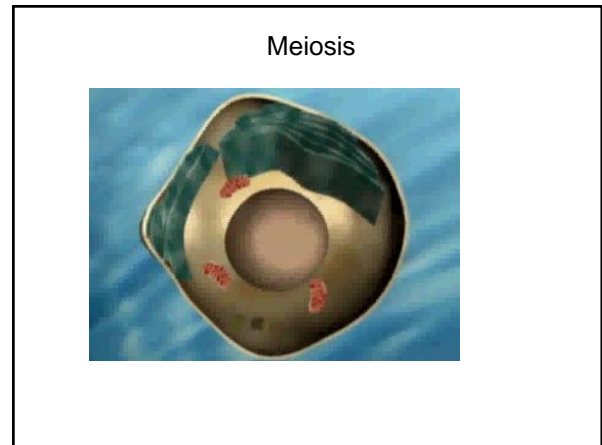
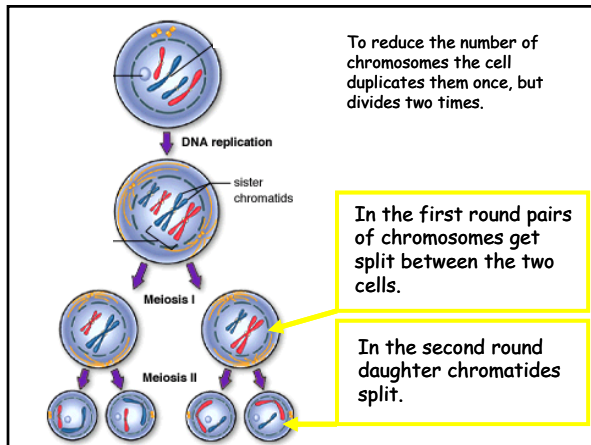
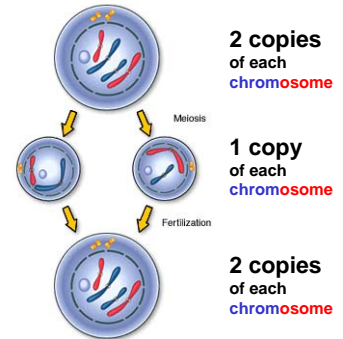
A disease of uncontrollable cell division. Many cancers are caused by mutations in genes which encode for proteins involved in control of cell division.



Movie: cancerA8010006mov

Meiosis: type of cell division which reduces the number of chromosomes by half.

Why do we need meiosis?



- Key points -1:
1. A continuously dividing cell "loops" through G_1 , S , G_2 phases and mitosis.
 2. A cell may get out of this cycle (enter G_0 phase) and stop dividing.
 3. It can be prompted to get out of G_0 and start dividing again by external factors such as growth factors.
 4. Cyclins are specialised proteins which control cell division. Their concentration increases before cell division and then drops rapidly.
 5. Some cells are able to divide indefinitely in non-differentiated state. They act as a source of new cells in some tissues and are called stem cells.
 6. Cancer is the disease of uncontrollable cell division

- Key points -2:
7. In mitosis one cell divides in two and both daughter cells have identical sets of chromosomes to the parent cell.
 8. Formula of mitosis: $(2n \times 2) / 2$.
 9. All cells in our body except for sperms and oocytes are produced as a result of mitosis.
 10. Meiosis is a specific type of cell division used ONLY to produce sperms and oocytes. Formula of meiosis: $(2n \times 2) / 4$.
 11. Sperms and oocytes carry only ONE copy of each chromosome.

