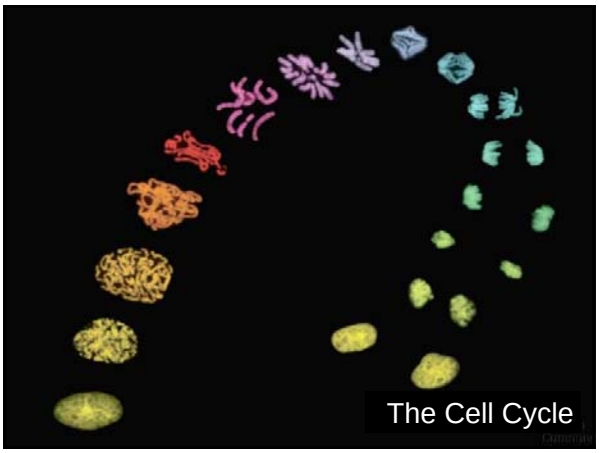
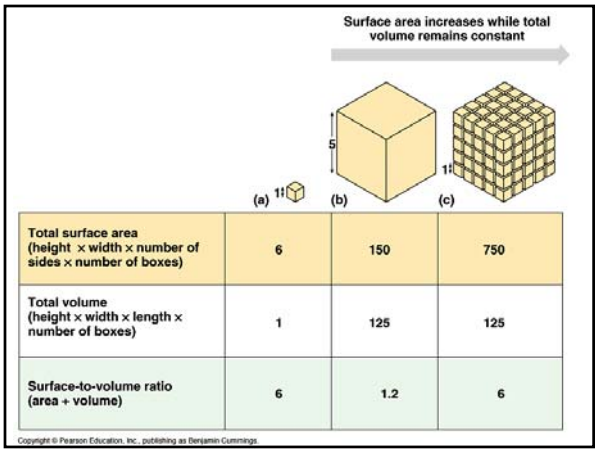


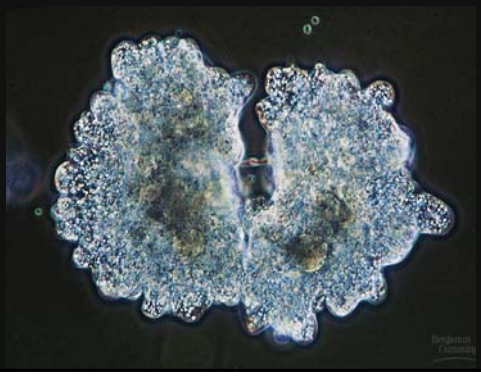
Why Are Cells Small?



	(a)	(b)	(c)
Total surface area (height × width × number of sides × number of boxes)	6	150	750
Total volume (height × width × length × number of boxes)	1	125	125
Surface-to-volume ratio (area ÷ volume)	6	1.2	6

Where do cells come from?

All Cells Come From Other Cells



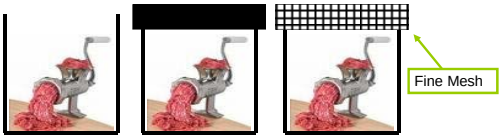
But where do maggots come from?

To find out Redi performed a famous experiment in 1668 which is still regarded as one of the first steps in refuting spontaneous generation - also known as abiogenesis.

At the time people thought that maggots formed naturally from rotting meat.

At the time people thought that maggots formed naturally from rotting meat. In his experiment Redi took three jars and put meat in each.

- **one was left open**
- **one was tightly sealed**
- **one was covered with a fine mesh stocking.**

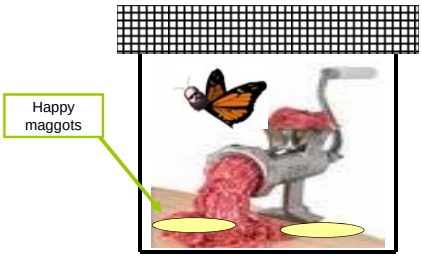


He waited for several days, and saw **that maggots appeared on the meat in the open jar**, but not in the sealed one.

Maggots did appear on the mesh above the meat but did not grow or hatch.

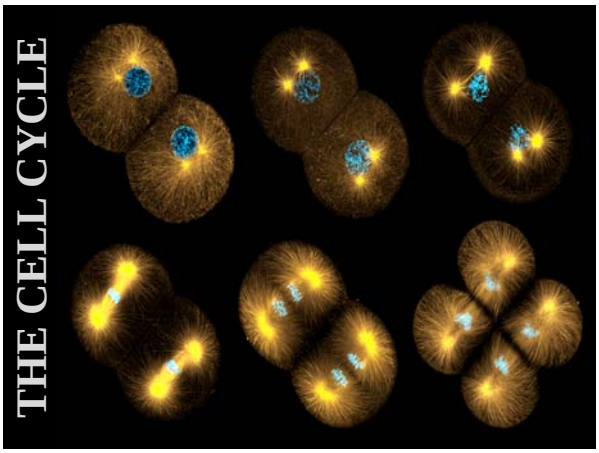
He concluded flies had landed and laid eggs o

He continued his experiments by capturing the maggots and waiting for them to hatch, which they did, becoming common flies. Also, when dead flies or maggots were put in sealed jars with meat, no maggots appeared. When the same thing was done with living flies, maggots did appear.



Redi was able to disprove the idea of spontaneous generation of animals

Where do new cells come from?

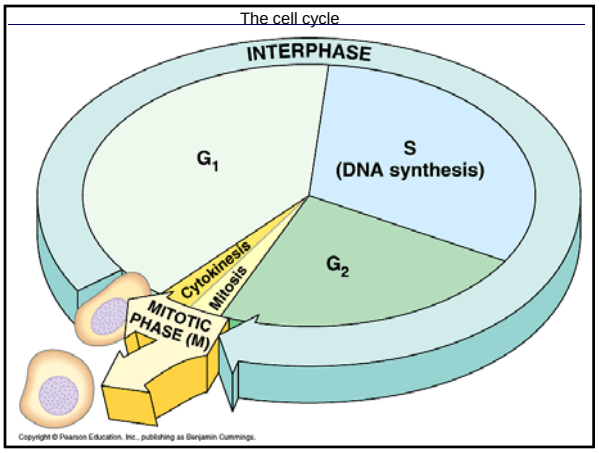


THE CELL CYCLE

• The ability of organisms to reproduce more of their kind is one characteristic that best distinguishes living things from nonliving matter.

• The continuity of life from one cell to another is based on the reproduction of cells via cell division (called Mitosis).

• Mitosis occurs as part of the cell cycle, the life of a cell from its origin in the division of a parent cell until its own division into two.



Cell Division

•Cell division requires the distribution of identical genetic material - DNA - to two daughter cells.

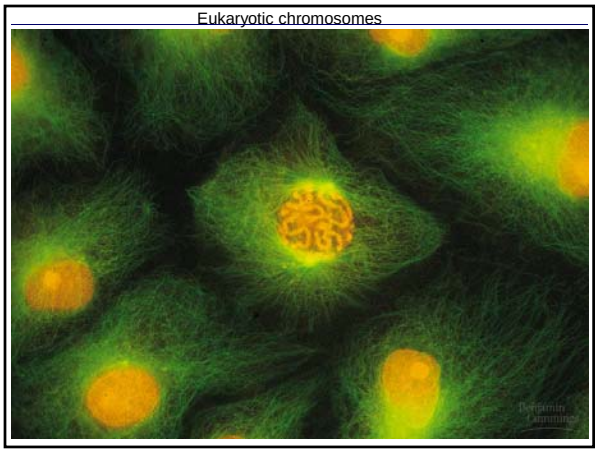
•A dividing cell duplicates its DNA (using replication) and then allocates the two copies to opposite ends of the cell. Then it splits into two daughter cells.

Cell division distributes identical sets of chromosomes to daughter cells

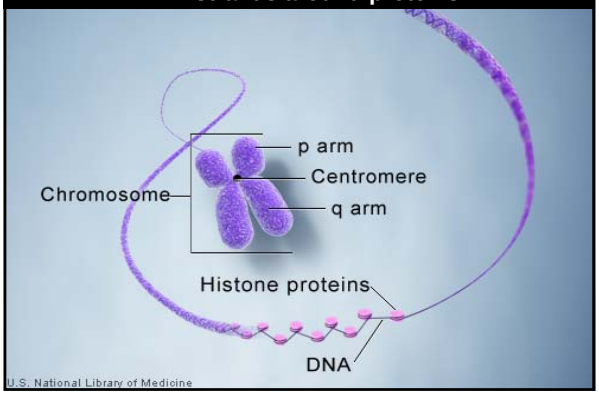
Every eukaryotic species has a characteristic number of chromosomes in the nucleus.

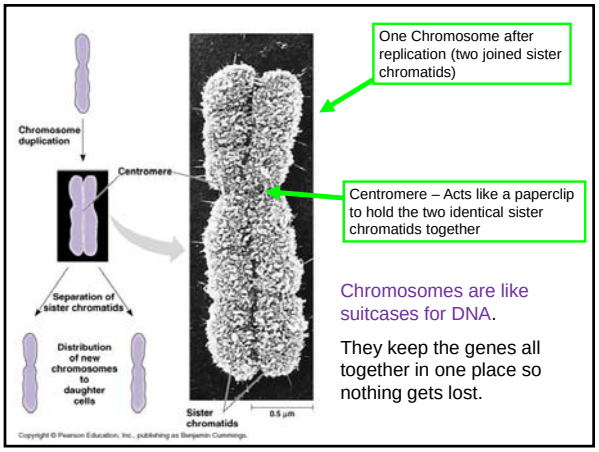
Human somatic cells (body cells) have 46 chromosomes.(Elephants 56, Giraffes 62, Gorillas 48)

Eukaryotic chromosomes



Chromosomes are made by wrapping DNA strands around proteins

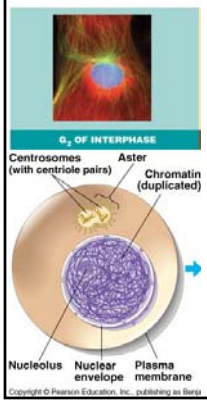




Chromosomes are like suitcases for DNA.

They keep the genes all together in one place so nothing gets lost.

The stages of mitotic cell division in an animal cell: interphase



Interphase: Cells may appear inactive during this stage, but they are quite the opposite. This is the longest period of the complete cell cycle during which DNA replicates, the centrioles divide, the cell is constantly synthesizing RNA, producing protein and growing in size.

After Interphase ends the cells starts Mitosis

***Mitosis*:** Cell growth and protein production stop at this stage in the cell cycle. All of the cell's energy is focused on the complex and orderly division into two similar daughter cells.

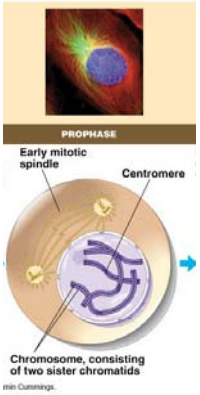
Mitosis is much shorter than interphase, lasting perhaps only one to two hours.

The stages of mitotic cell division: prophase

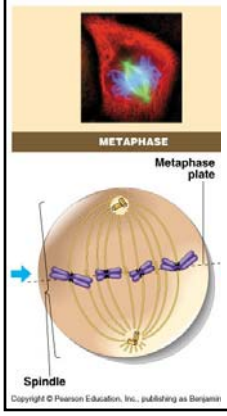
Prophase is the first phase of Mitosis. The Chromosomes condense and become visible.

As the cell nears the end of prophase the nuclear envelope breaks down so there is no longer a recognizable nucleus.

Some mitotic spindle fibers elongate from the centrioles and attach to centromeres between the copied chromosomes.

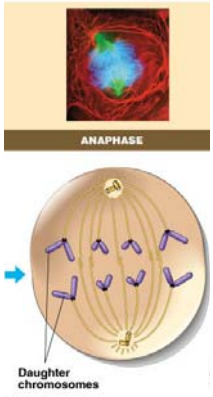


mitotic cell division: metaphase



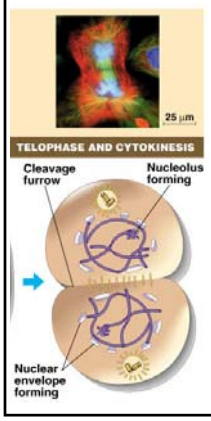
Metaphase: Centrioles have reached the north and south poles. Spindle fibers have attached to the centromere of each chromosome. The spindle fibers pull all of the chromosomes in one plane at the center of the cell.

mitotic cell division: anaphase



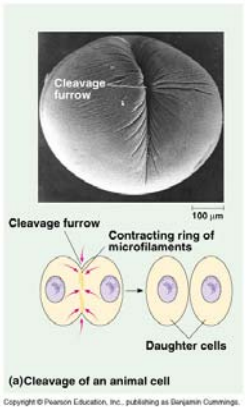
Anaphase: The spindle fibers shorten causing the centromeres separate, and that pulls the sister chromatids apart as a full set of chromosomes begin moving towards each of the cell poles.

mitotic cell division: telophase and cytokinesis.



Telophase: The chromosomes arrive at the opposite poles and the spindle fibers that have pulled them apart begin to dissolve as the chromosomes begin to relax and the nuclear envelope reforms

Cytokinesis in animal cells



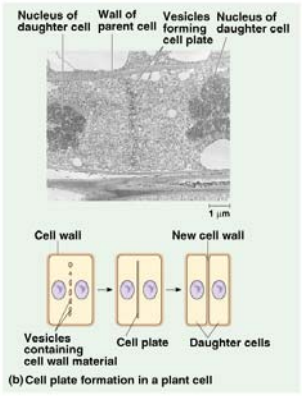
Cytokinesis: the cytoplasm and organelles are divided between the two newly forming two daughter cells.

Cyto = Cytoplasm
Kinesis = movement

Cytokinesis plant cells

Cytokinesis in plants the cytoplasm and its contents are divided between the two newly forming daughter cells by the cell plate.

The cell plate will become the new cell wall



Mitosis

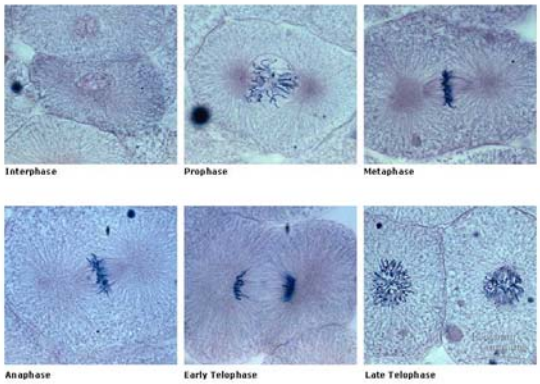


Figure 12.9 Mitosis in a plant cell

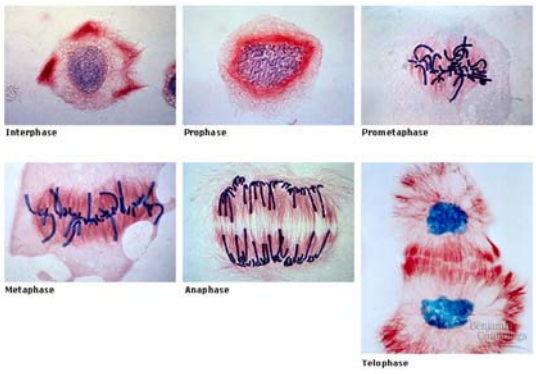


Figure 12-09x Mitosis in an onion root