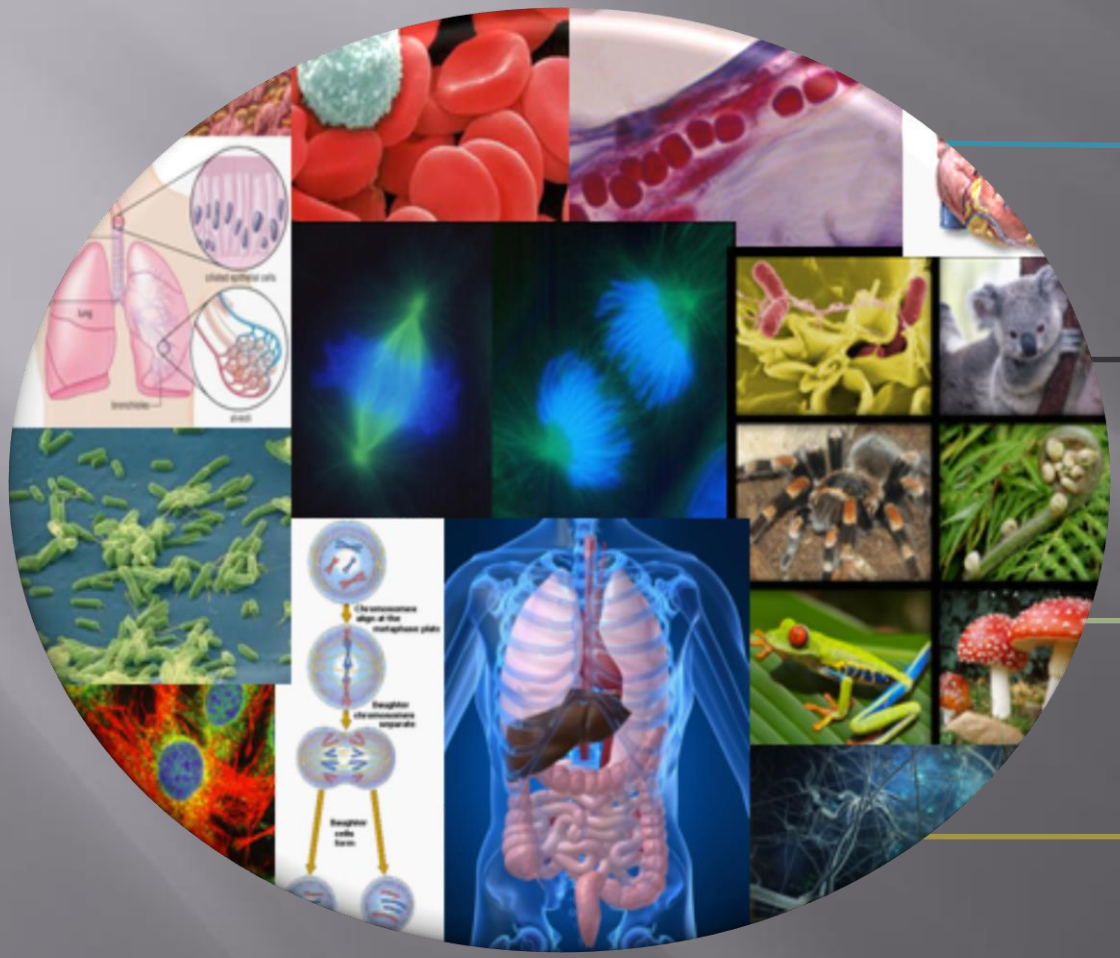
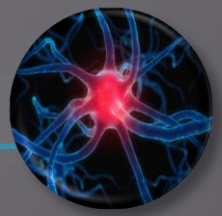
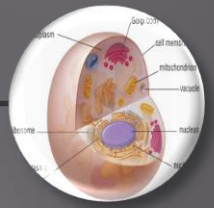
Mitosis & The Cell Cycle

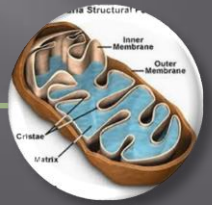




Genetic Material



Interphase

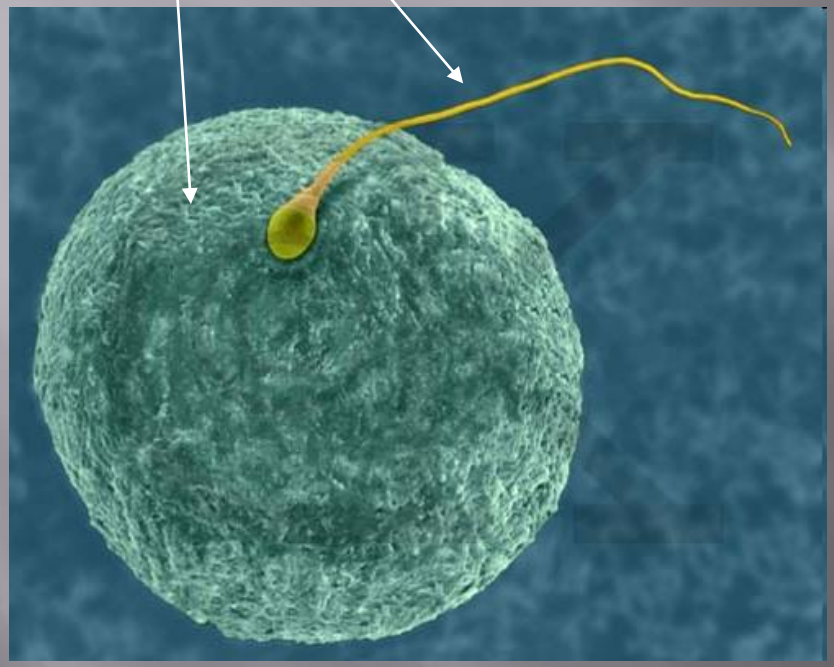


Mitosis and Cytokinesis

Errors in Mitosis

Fertilization is the start of life

Egg and Sperm

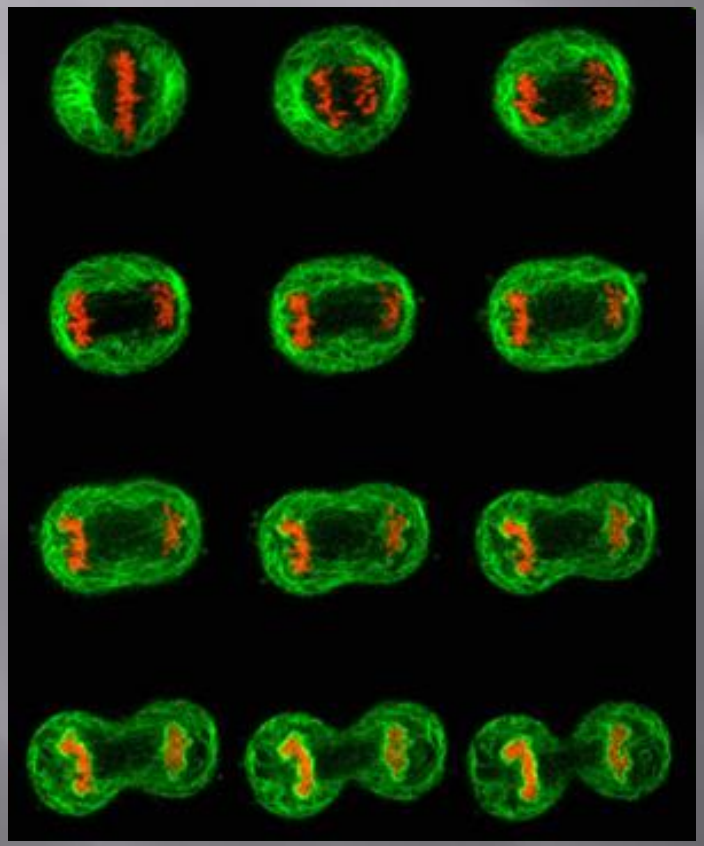


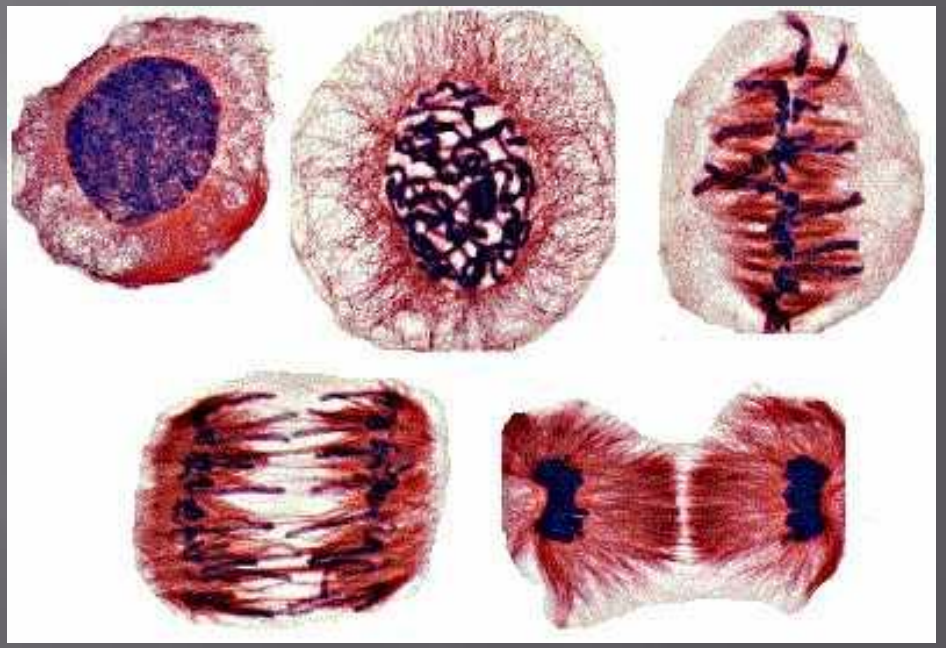
Zygote

A sperm cell and an egg cell come together to form a single cell called a Zygote

Why do animals shed their skin?

Because Of The Cell Cycle

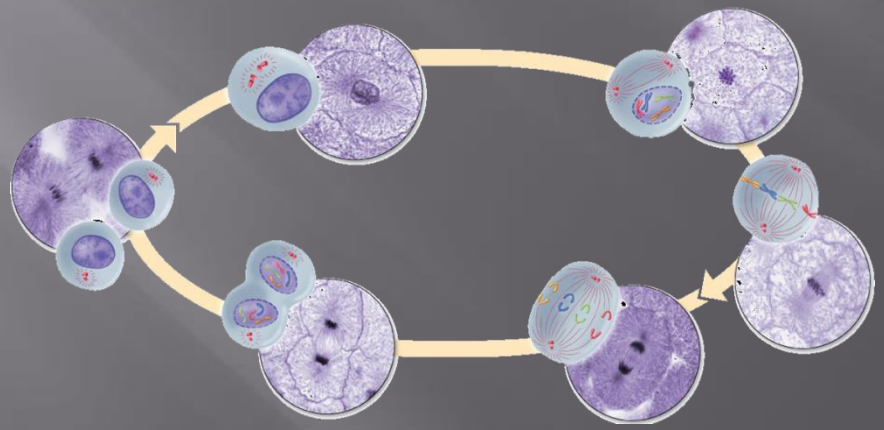




Play Video

Cell Cycle

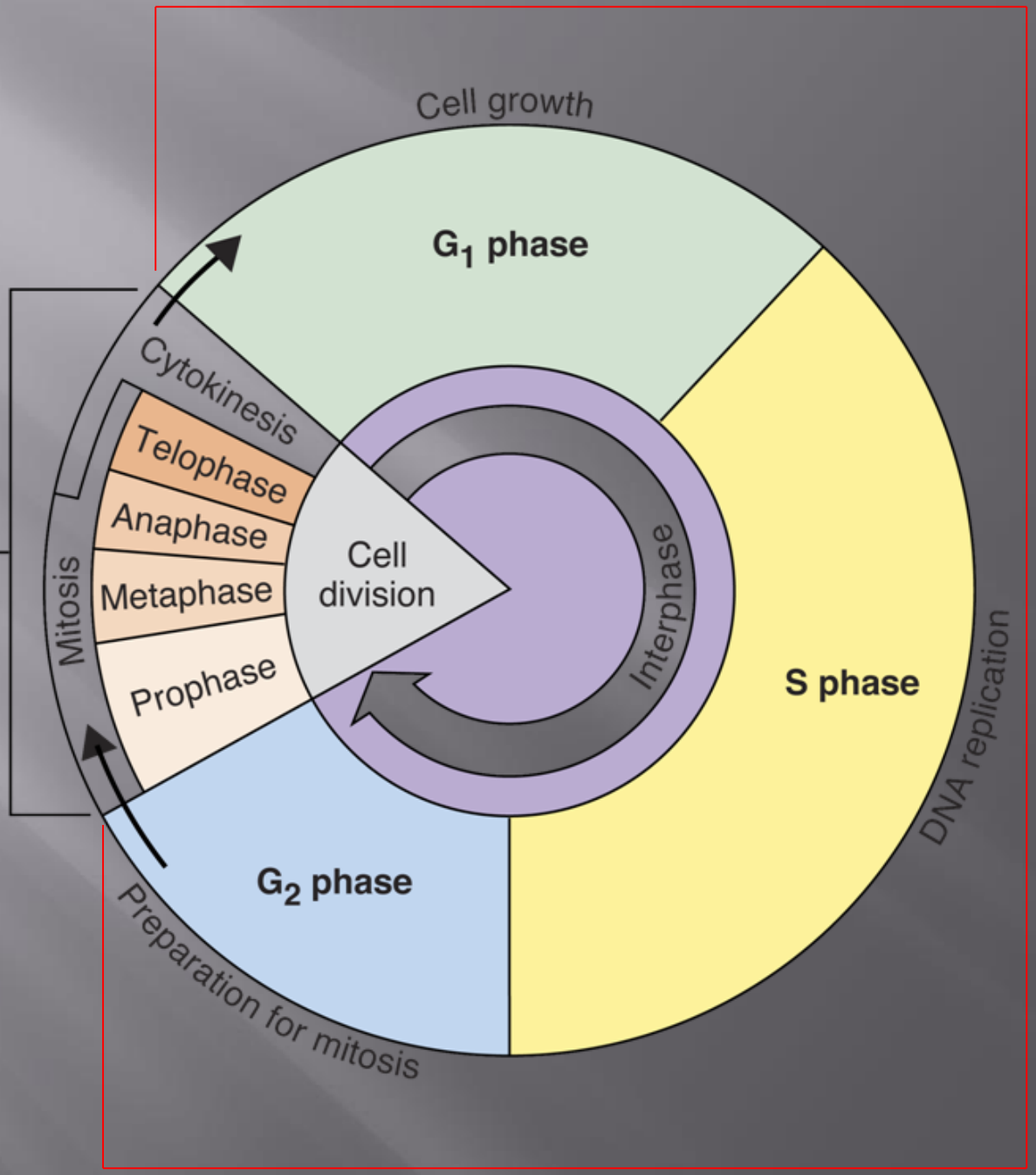
- Replication and division of the cells nucleus where the daughter cells are exact replications of the parent cells.
  - New body cells are produced for:
    - **Growth**
    - **Replacing damaged or old cells**



The Cell Cycle

- Within The Cell Cycle there is the Growth Phase, Division Phase (Mitosis) and Cell Division (Cytokinesis)
- The Growth phase is called Interphase
- Division Phase (Mitosis) is comprised of:
  - **Prophase**
  - **Metaphase**
  - **Anaphase**
  - **Telophase**
- Cell Division (Cytokinesis) causes 1 cell to become 2

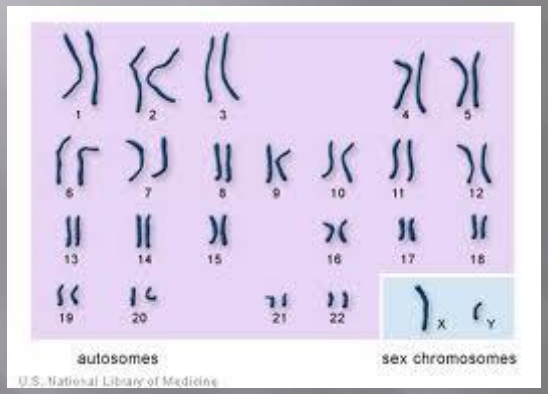
Mitosis and Cell Division



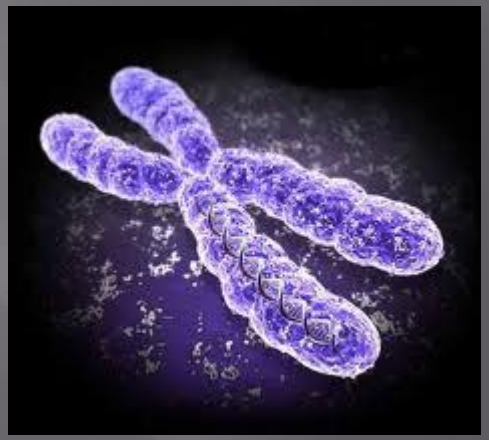
Interphase

Genetic Material

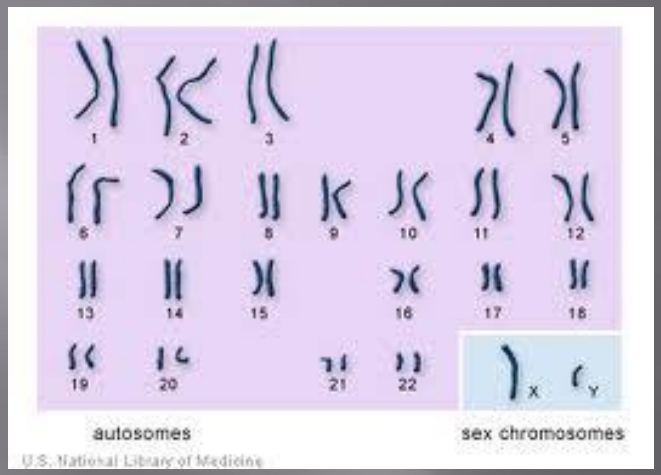
DNA - **Deoxyribonucleic acid**



Chromosomes



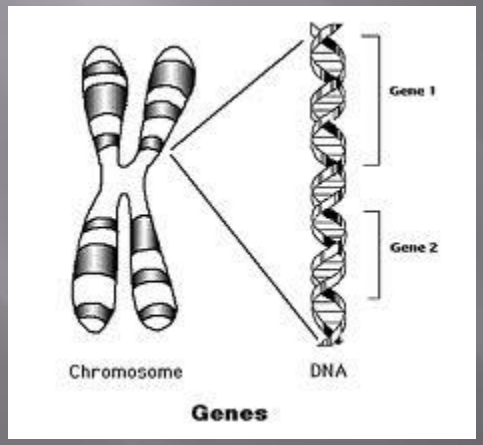
Genetic Material

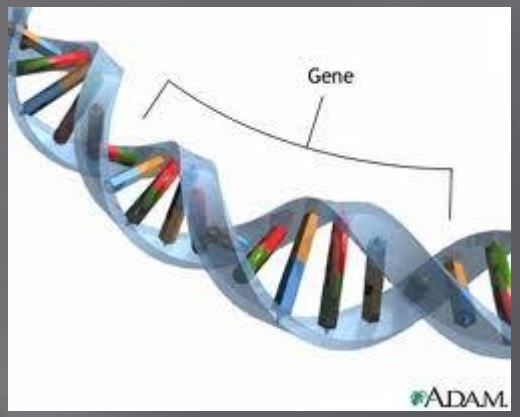


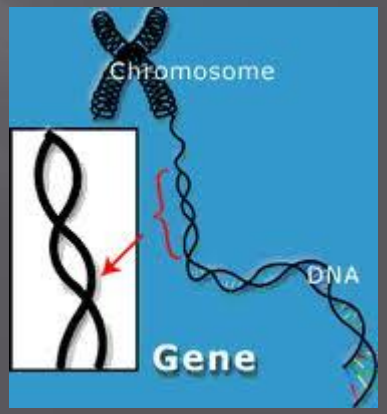
- All of your genetic material is packaged into 46 chromosomes
- **<u>23 chromosomes come from dad and 23 from mom</u>**
- Chromosomes are composed of DNA which is the code that makes you who you are.

Genes

- Chromosomes are made up of proteins and a code called DNA which is made of 4 compounds (A,T,G,C)
- Chromosomes are divided into sections called **genes**





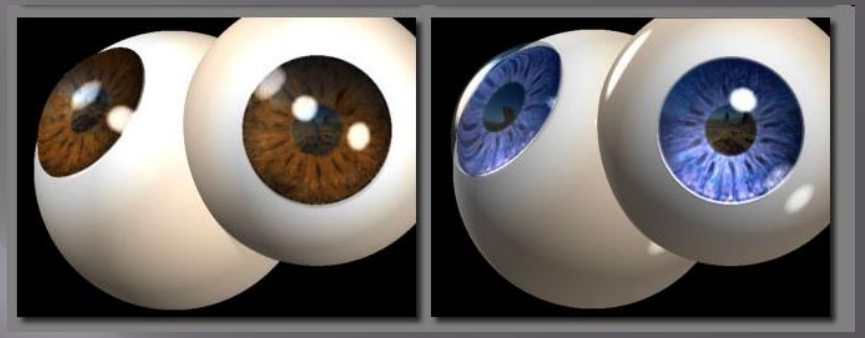


Genes

- **<u>Genes are short sequences of DNA which tell the cell to make certain proteins</u>**
- The proteins are what give us our individual characteristics
- Each persons genes are different (except??)

Identical Twins

Genetic Features



Genetic Features

Earlobes

Rolling Tongue

Human – Animal Gene Similarities

- - Genome-wide variation from one **human being** to another can be up to 0.5% (99.5% similarity)

  - **Chimpanzees** are 96% to 98% similar to humans

  - **Cats** are 90% similar to humans, 82% with dogs, 80% with cows, 79% with chimpanzees, 69% with rats and 67% with mice

  - **Cows** are 80% genetically similar to humans

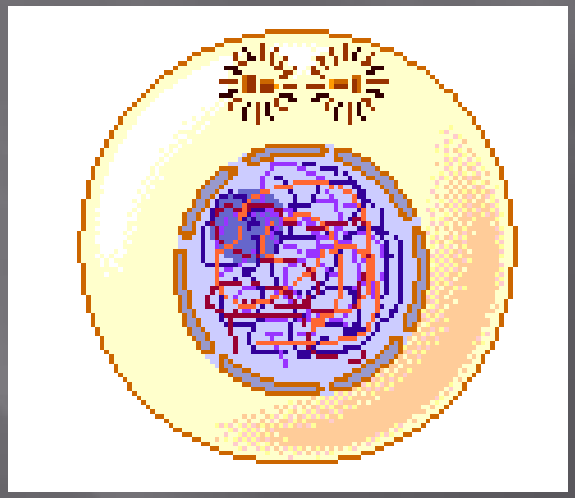
  - 75% of **mouse** genes have equivalents in humans

  - The **fruit fly** (*Drosophila*) shares about 60% of its DNA with humans

  - About 60% of **chicken** genes correspond to a similar human gene

Interphase

- **<u>The time between cell divisions</u>**
- Cells undergoes DNA replication and growth
- The cell spends most of its time in Interphase.



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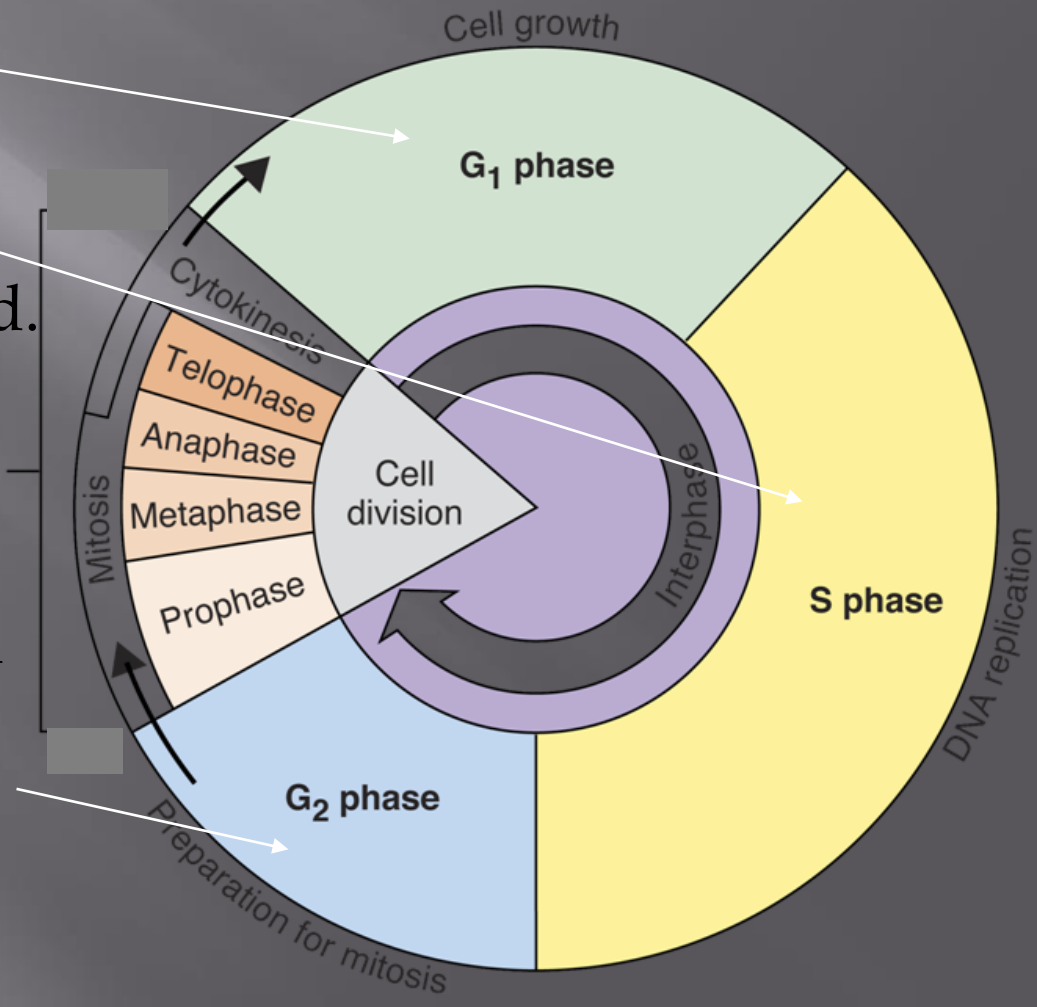
There are 3 Stages in Interphase:

G_1 Phase – cells carry out metabolic activities to prepare for the S Phase.

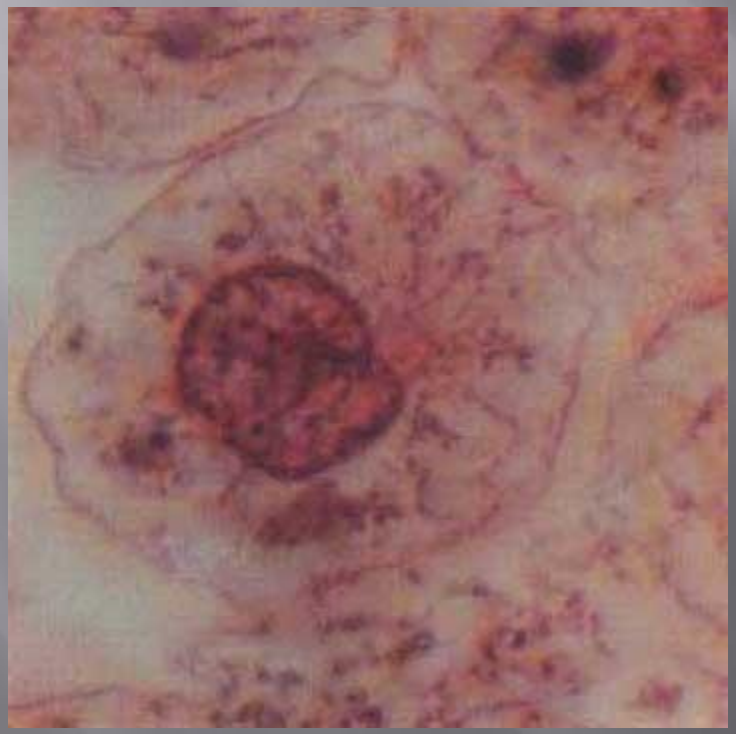
S Phase – "Synthesis Phase" – DNA is replicated.

G_2 Phase – organelles and molecules required for cell division are produced. Cell prepares for mitosis.



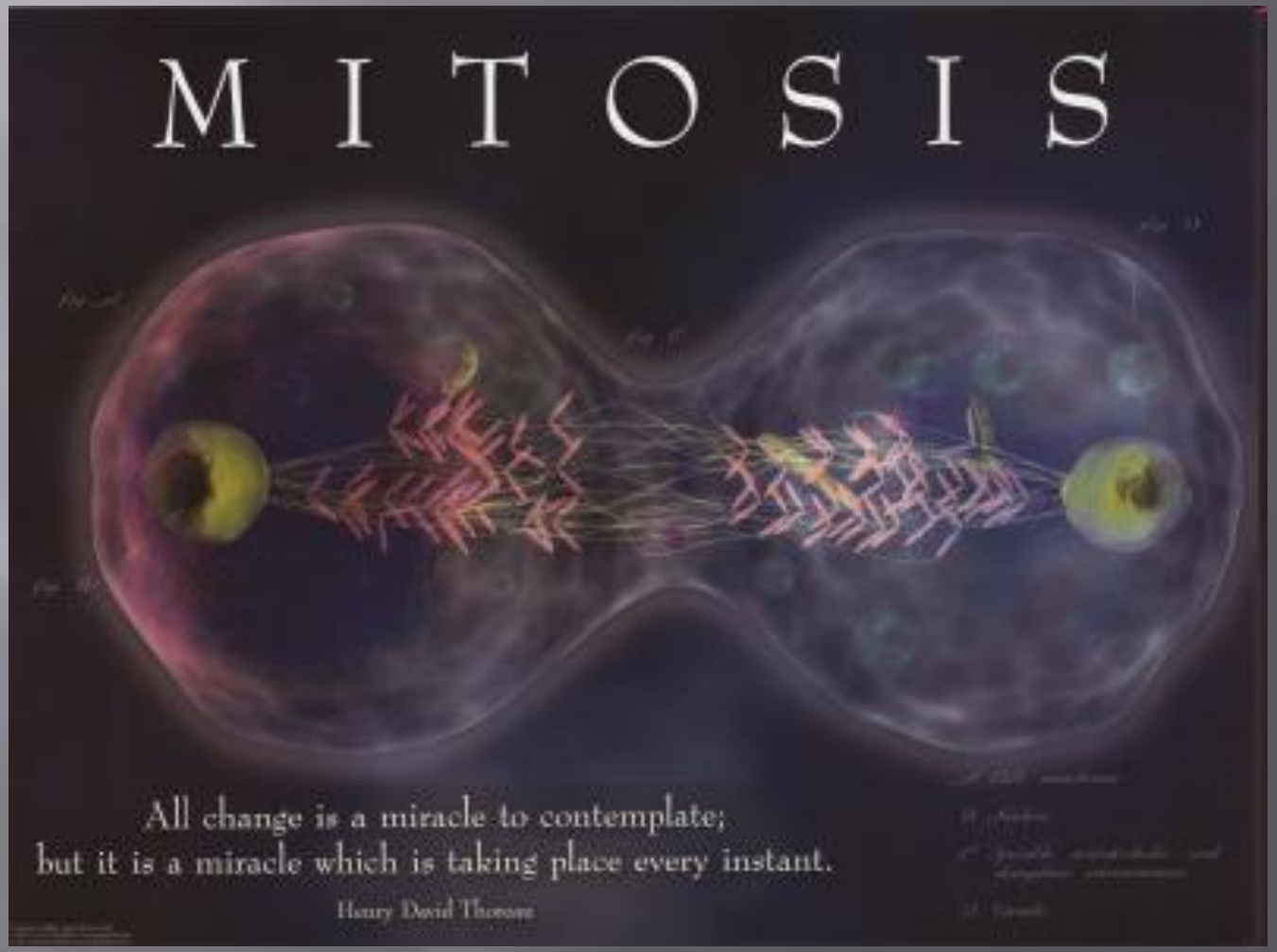
Interphase

Animal Cell



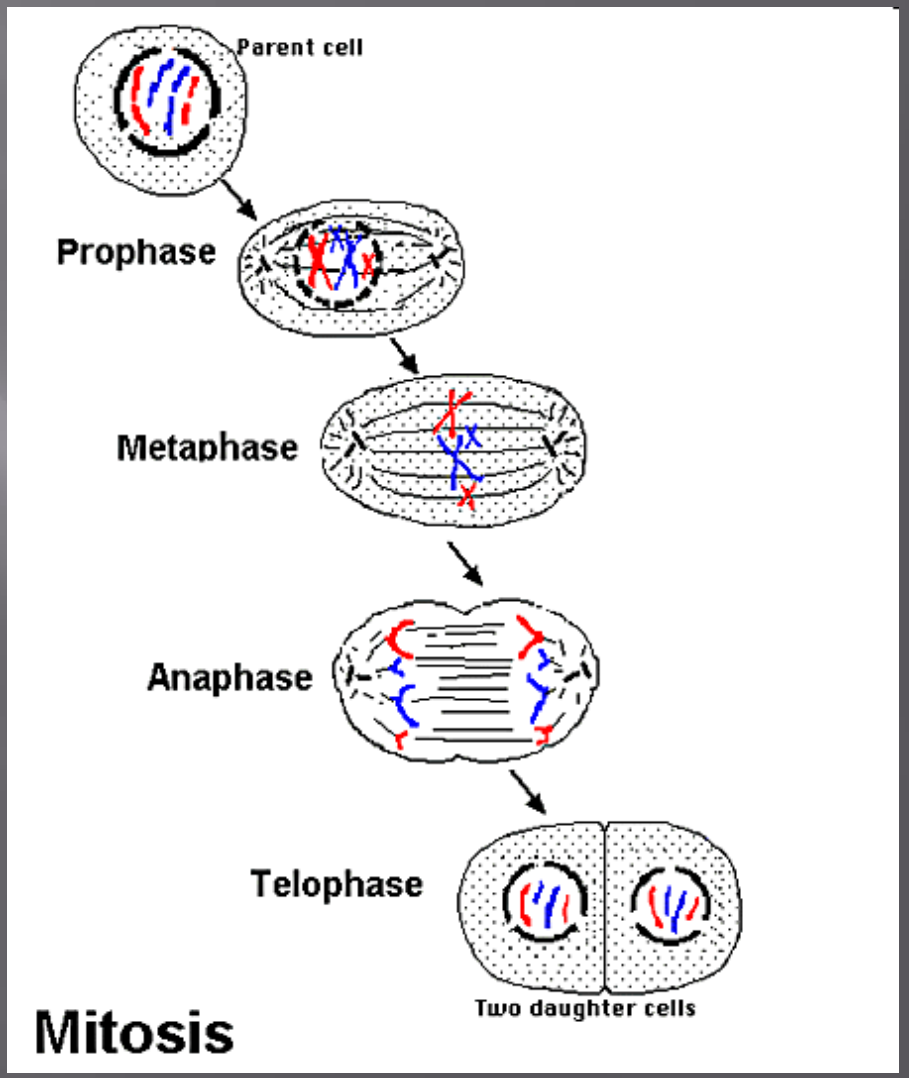
Plant Cell

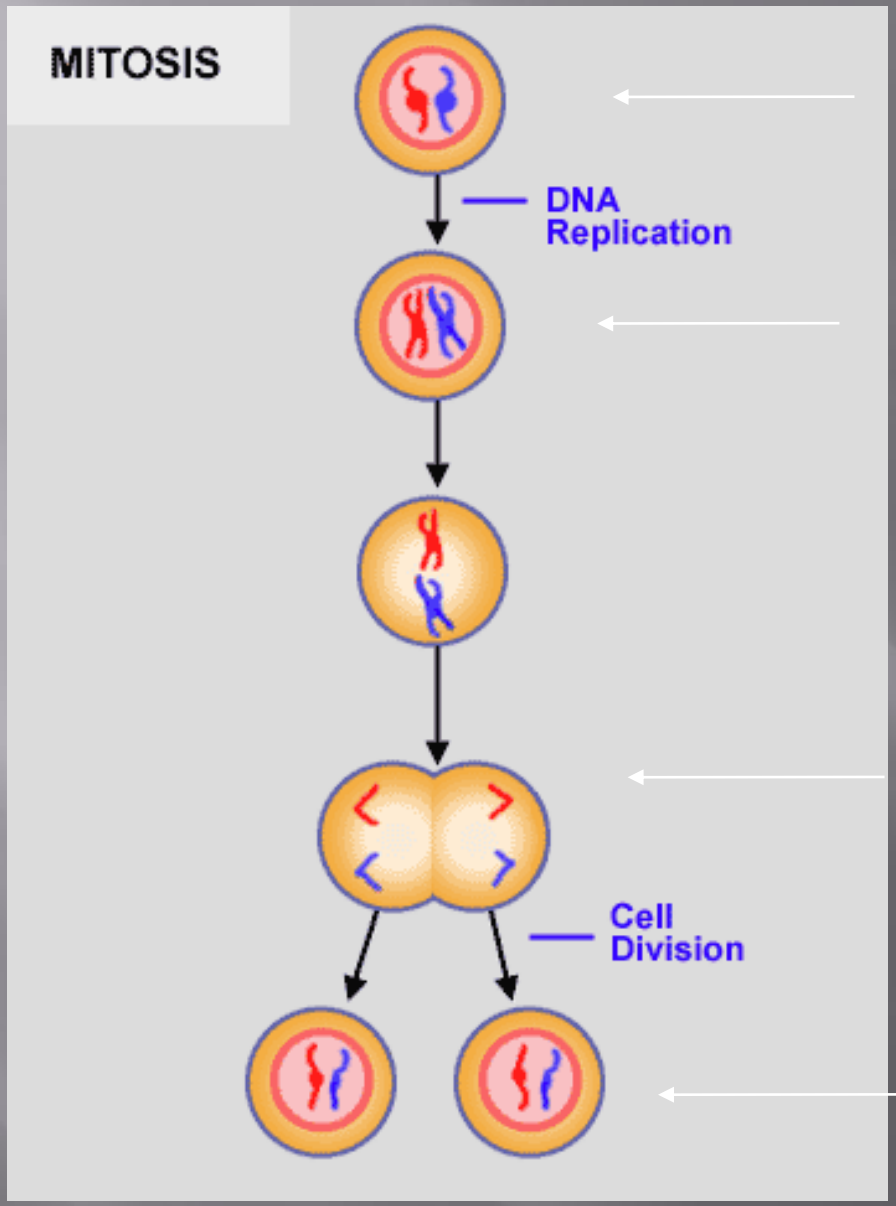
Cell Division Phase (Mitosis)



Mitosis

- Process whereby a cell will divide to produce two new identical cells
- Allows organisms to grow and replace old, damaged or dead cells
- **Occurs in all body cells**





Parent cell

Chromosomes are copied and double in number (Interphase)

Chromosomes now split

2 daughter cells identical to original

Every cell in your body contains the **same** genes, but only some act to make the cells specialised – e.g. nerve or muscle tissue.

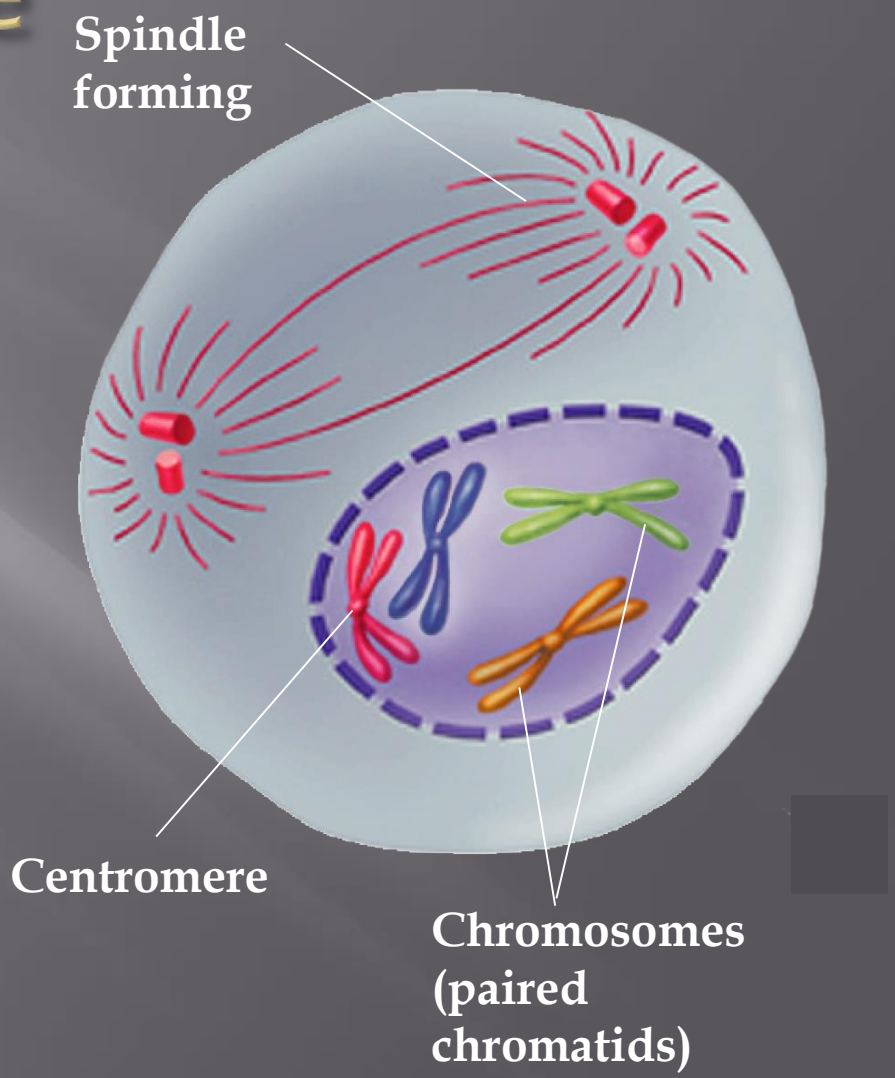
Prophase

- **Prophase is the first and longest phase of mitosis.**

- Strands of DNA condense and thicken to form visible duplicated chromosomes (sister chromotids).

- Sister chromatids are held together by centromeres

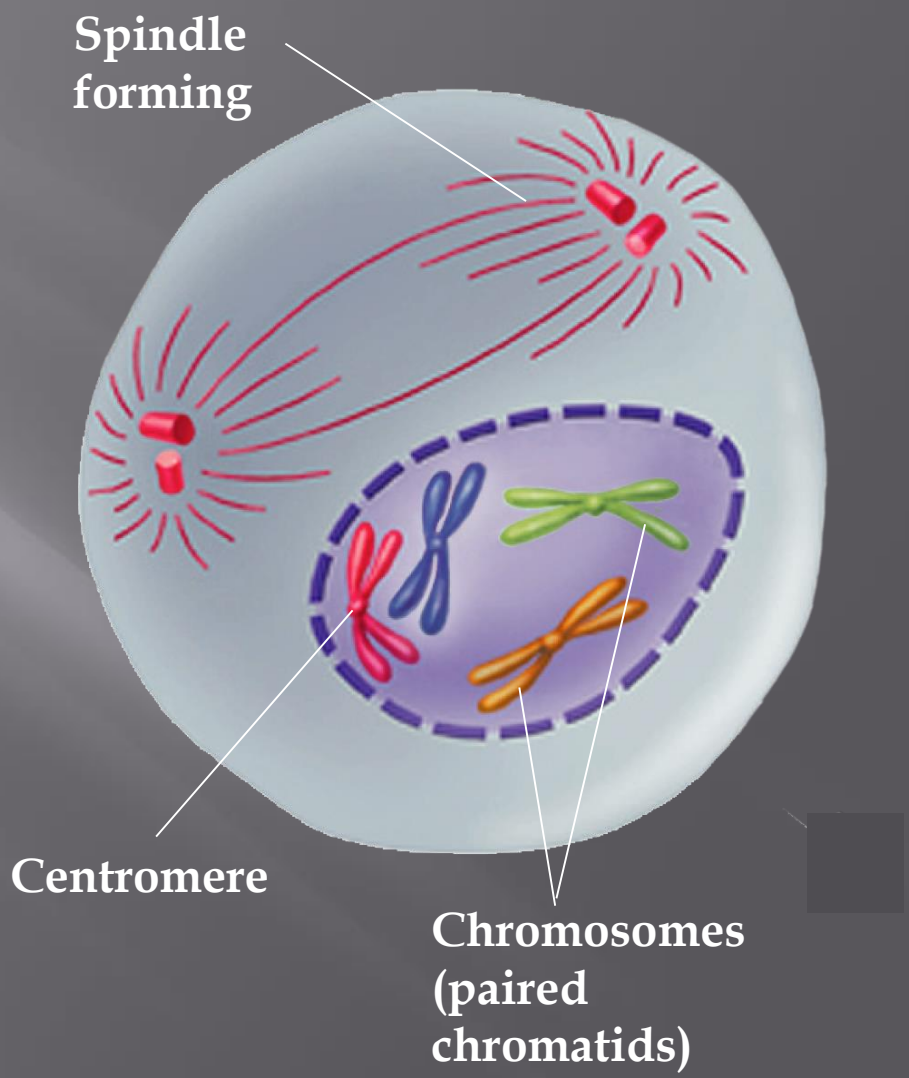
- The nuclear membrane breaks down.



Prophase

- The centrioles move to opposite poles of the cell

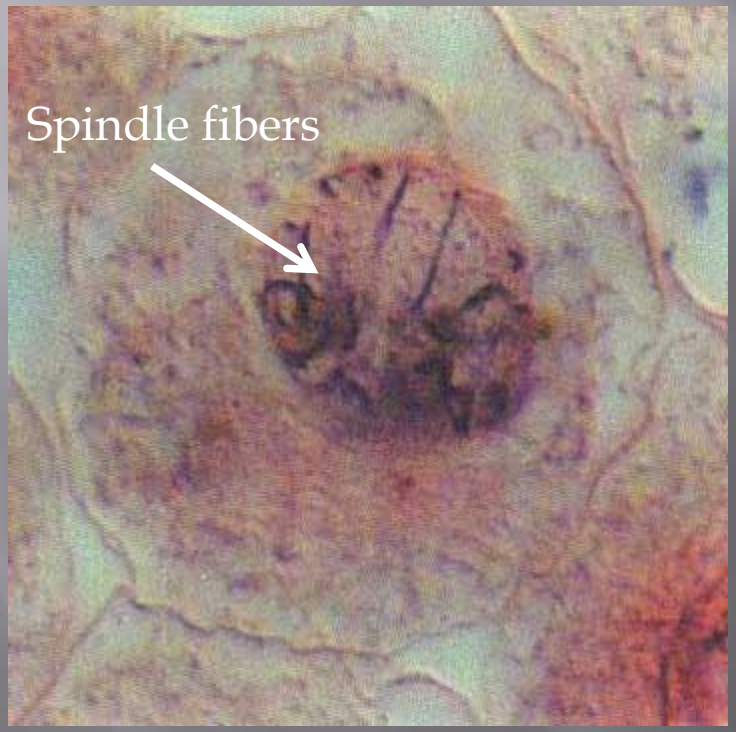
- **Spindle fibres begin to form from the centrioles.**



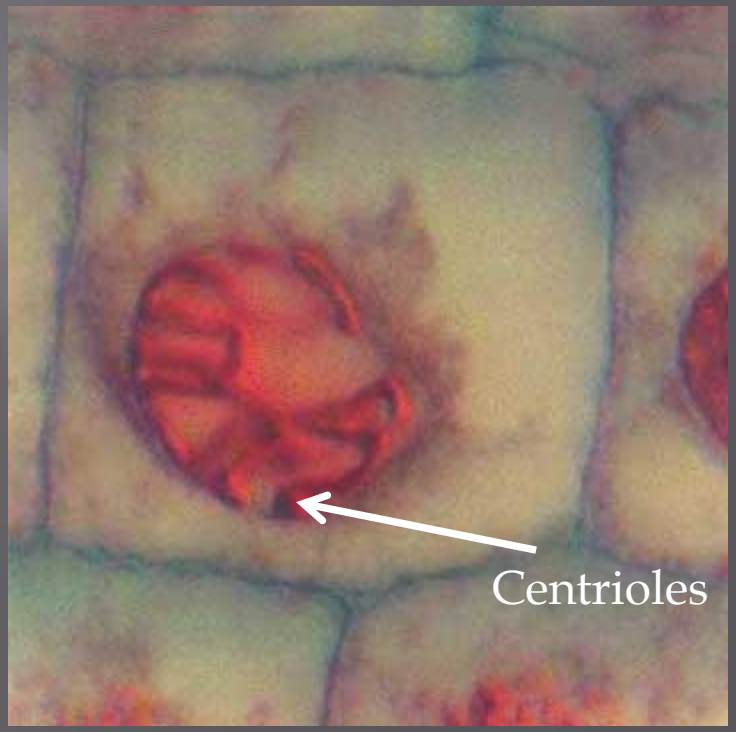
Chromatids become visible under the light microscope

Prophase

Animal Cell



Plant Cell

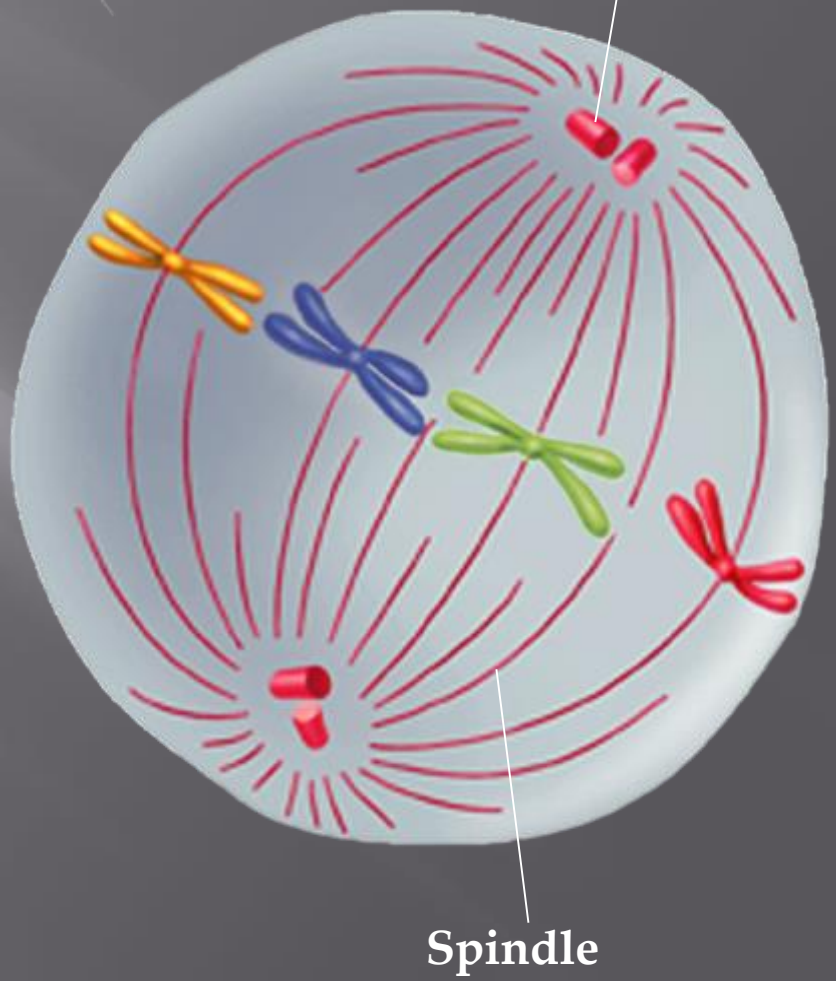


Metaphase

- **The second phase of mitosis.**

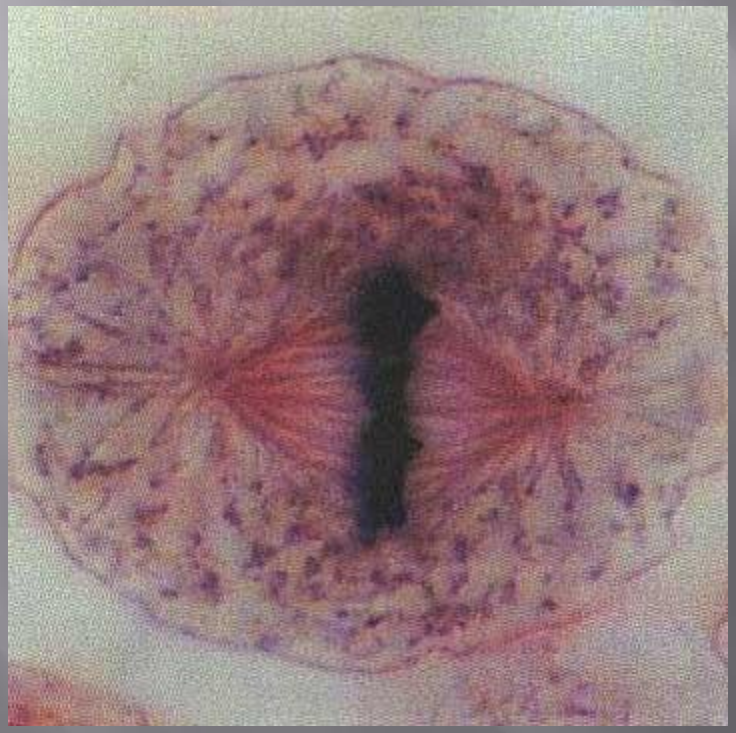
- Spindle fibres connect the centromere of each chromosome to the poles of the spindle.

- Spindle fibres help chromosomes line up across the equator (center) of the cell.

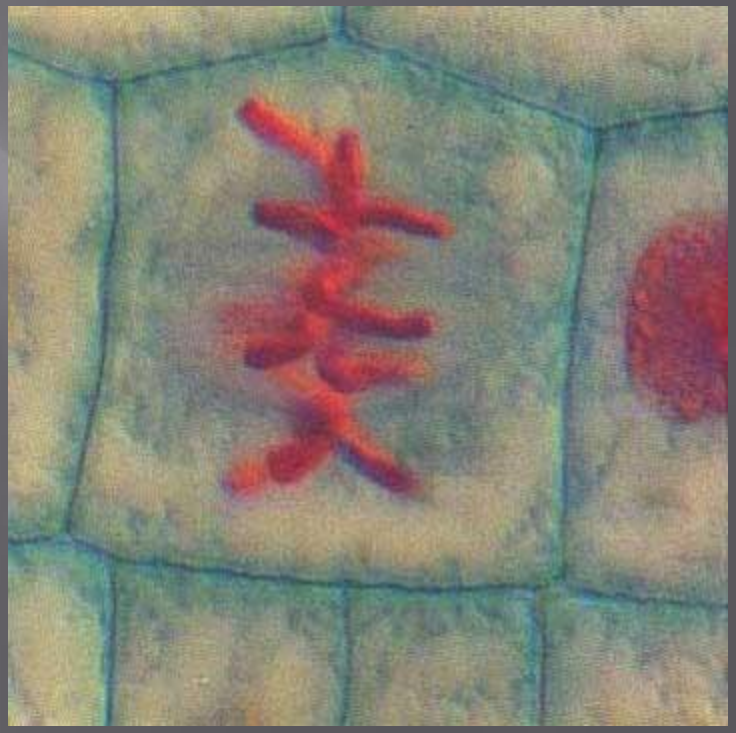


Metaphase

Animal Cell

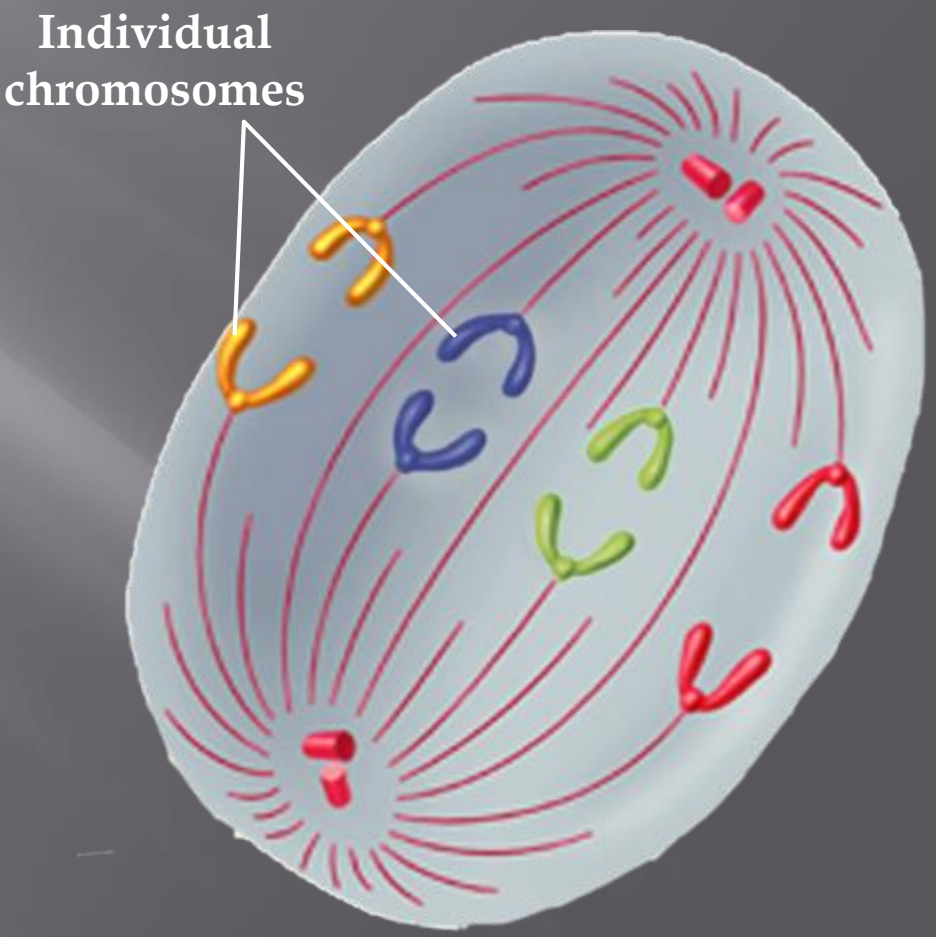


Plant Cell



Anaphase

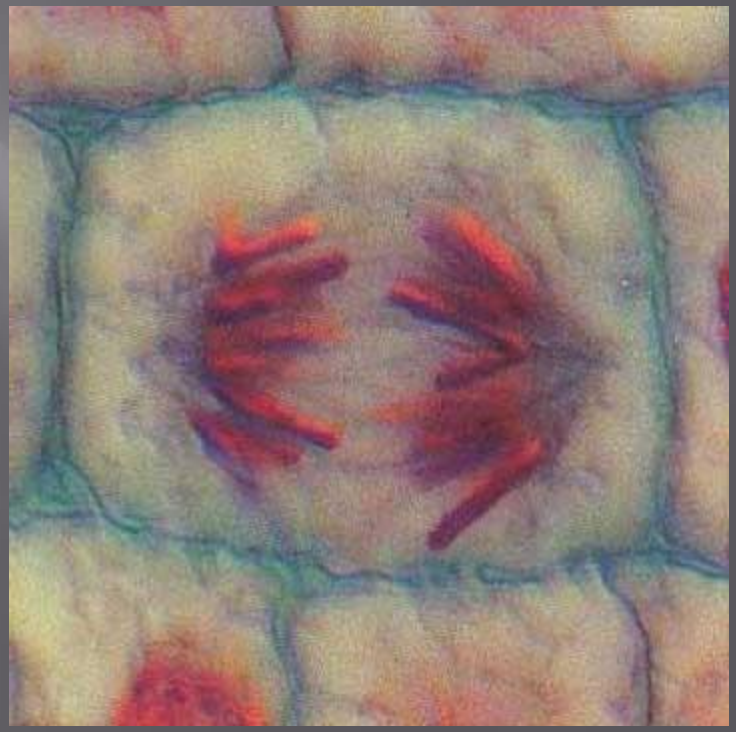
- The third phase of mitosis.
- **Centromeres are split apart**
- Each chromatid pair splits (each are now called daughter chromosomes).
- Spindle fibres shorten and thicken, pulling one chromatid (**chromosome)** from each spilt pair to opposite poles.



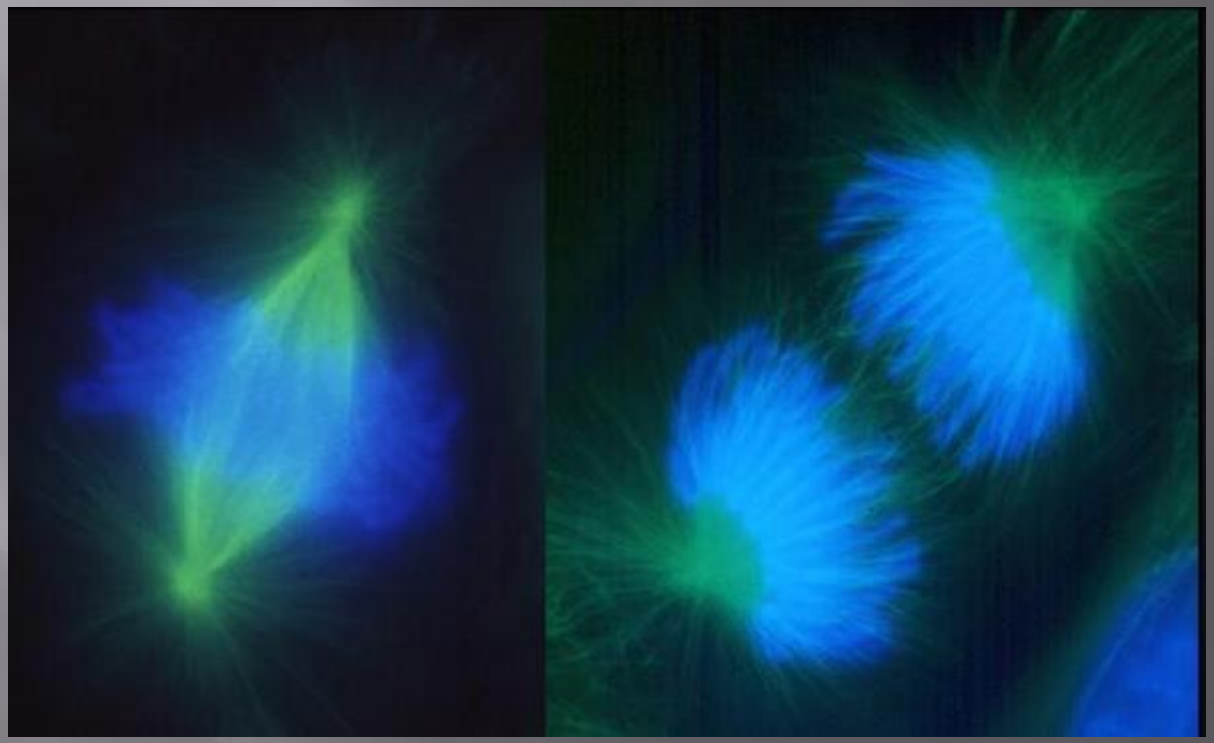
Anaphase

Animal Cell

Plant Cell



Anaphase



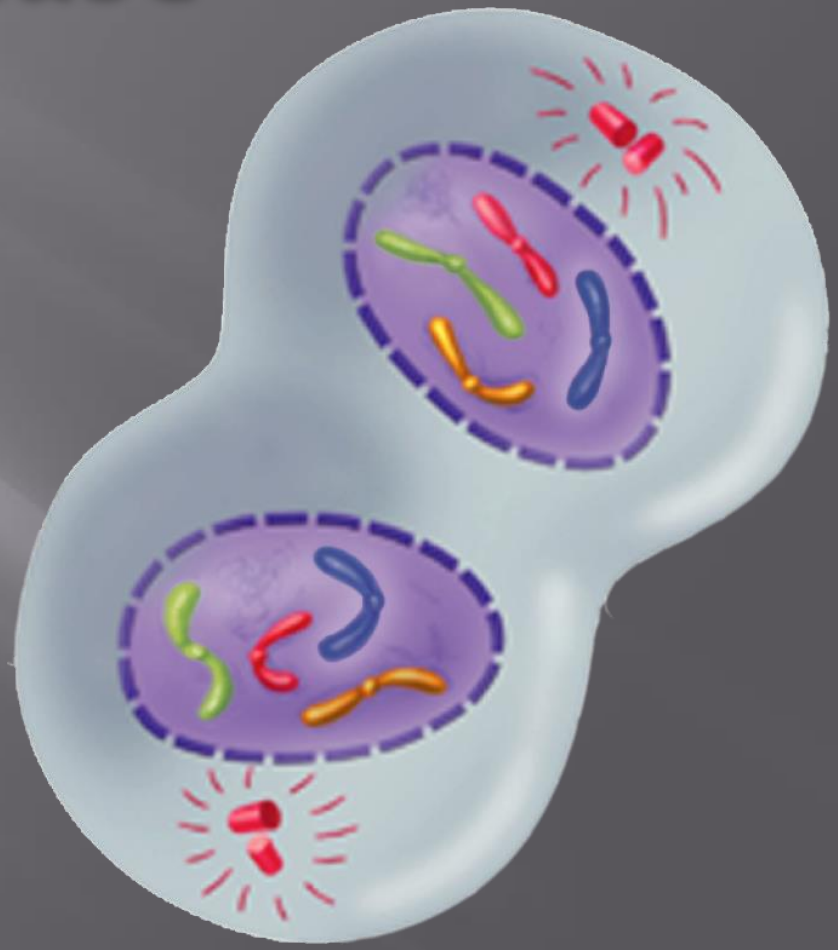
Telophase

- The fourth and final phase of mitosis.

- Chromosomes gather at opposite ends of the cell. They begin to unwind and are less visible.

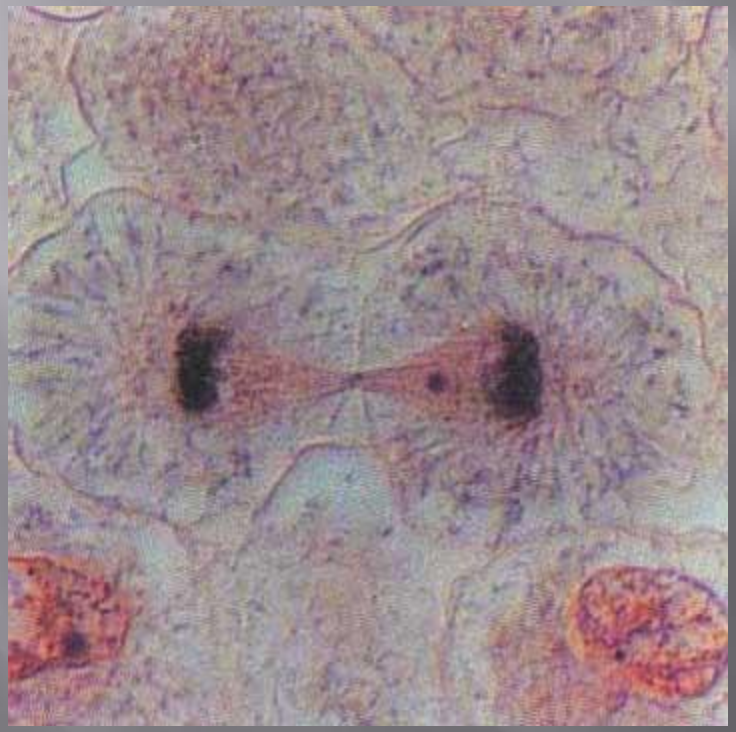
- **<u>Nuclear membrane begins to reform</u>**

- **<u>Spindle fibres begin to break down.</u>**

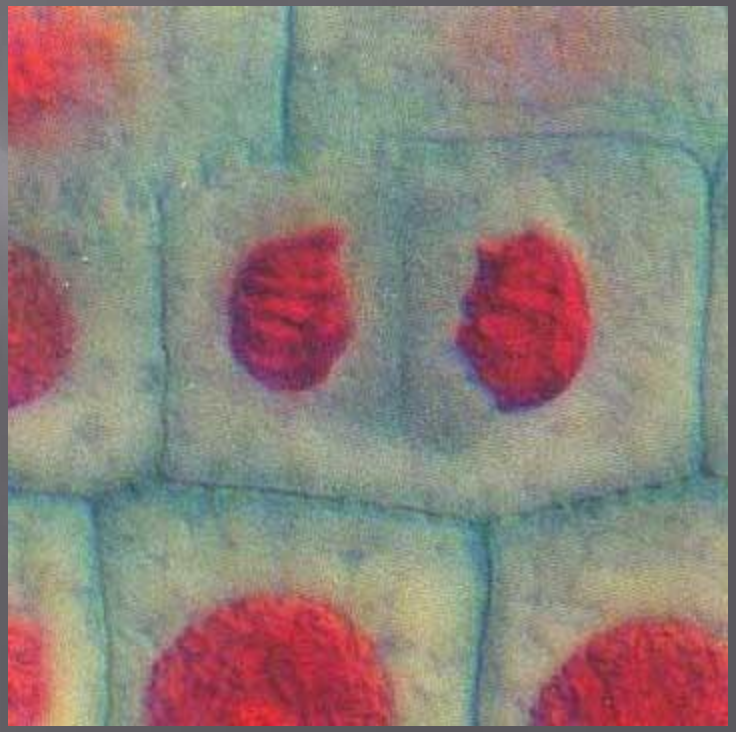


Telophase

Animal Cell

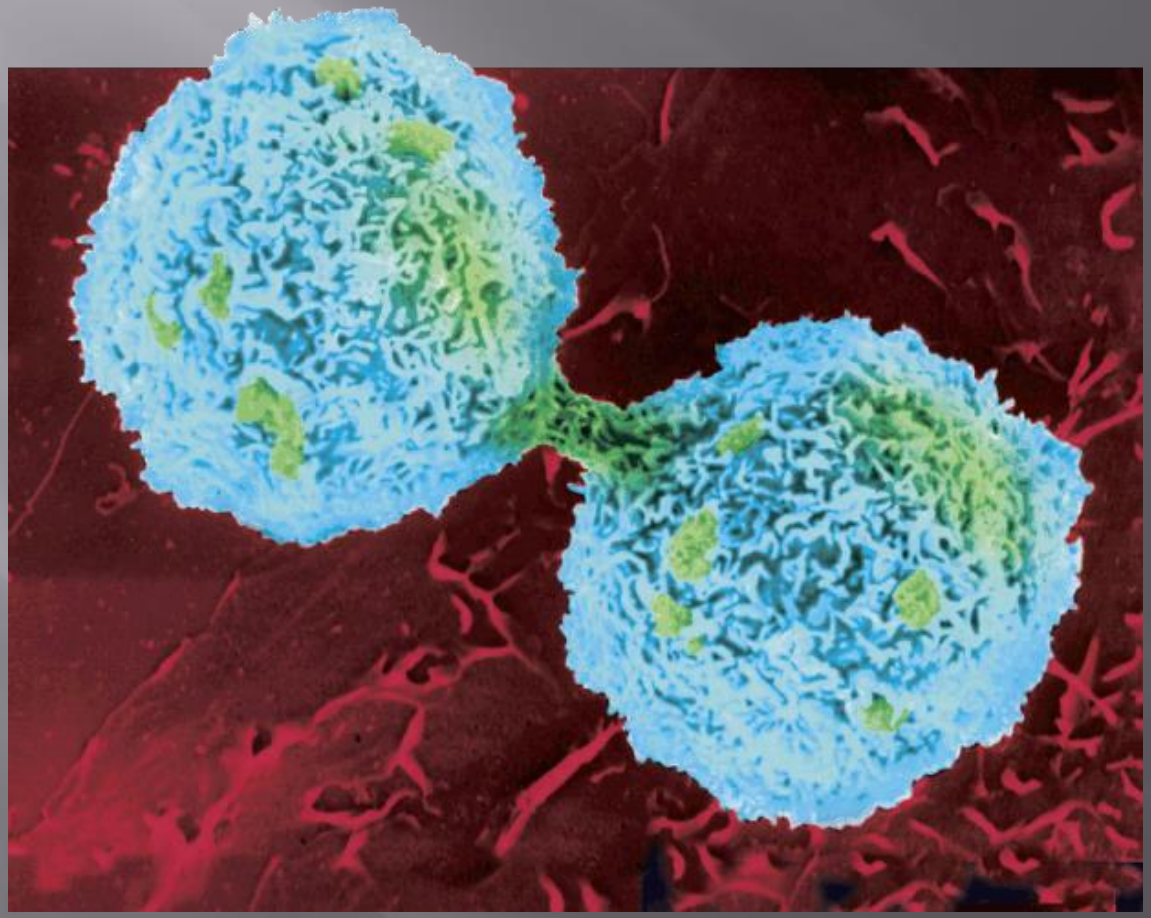


Plant Cell



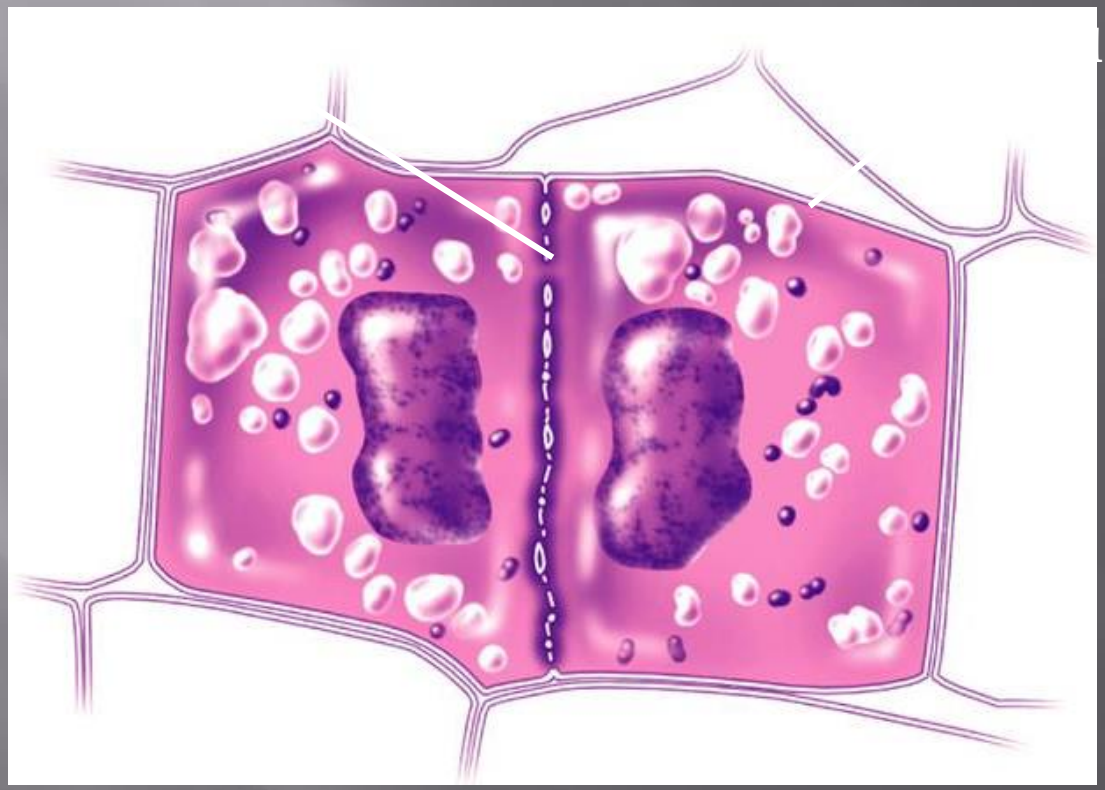
Cytokinesis in Animals

After mitosis the cytoplasm separates and two identical daughter cells form.



Cytokinesis in Plants

- In plants, a structure known as the cell plate forms midway between the divided nuclei.

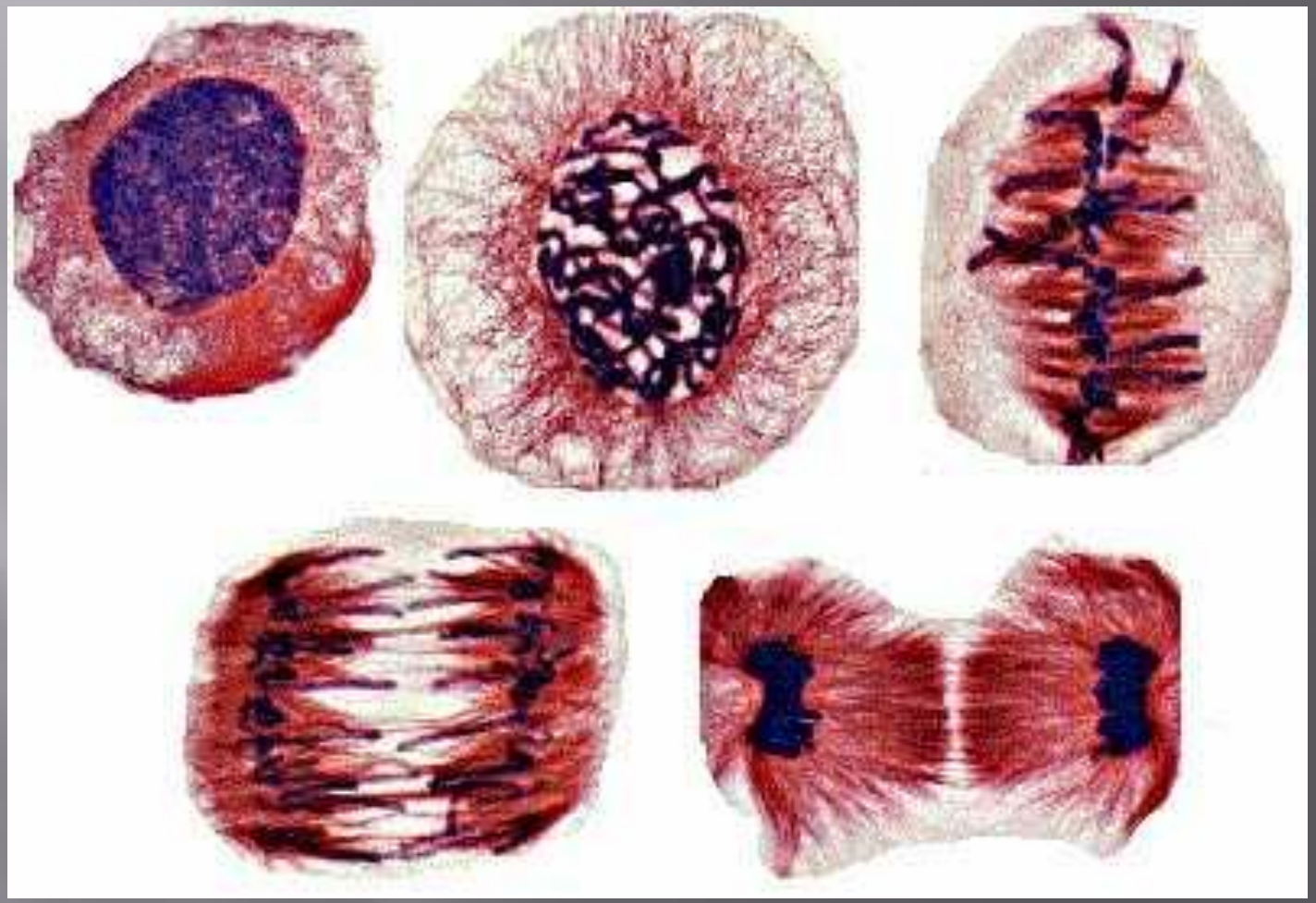


The cell plate gradually develops into a separating membrane and a cell wall begins to appear.

Rat – epithelial cells

Prophase

Metaphase

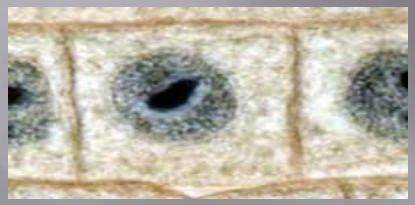


Anaphase

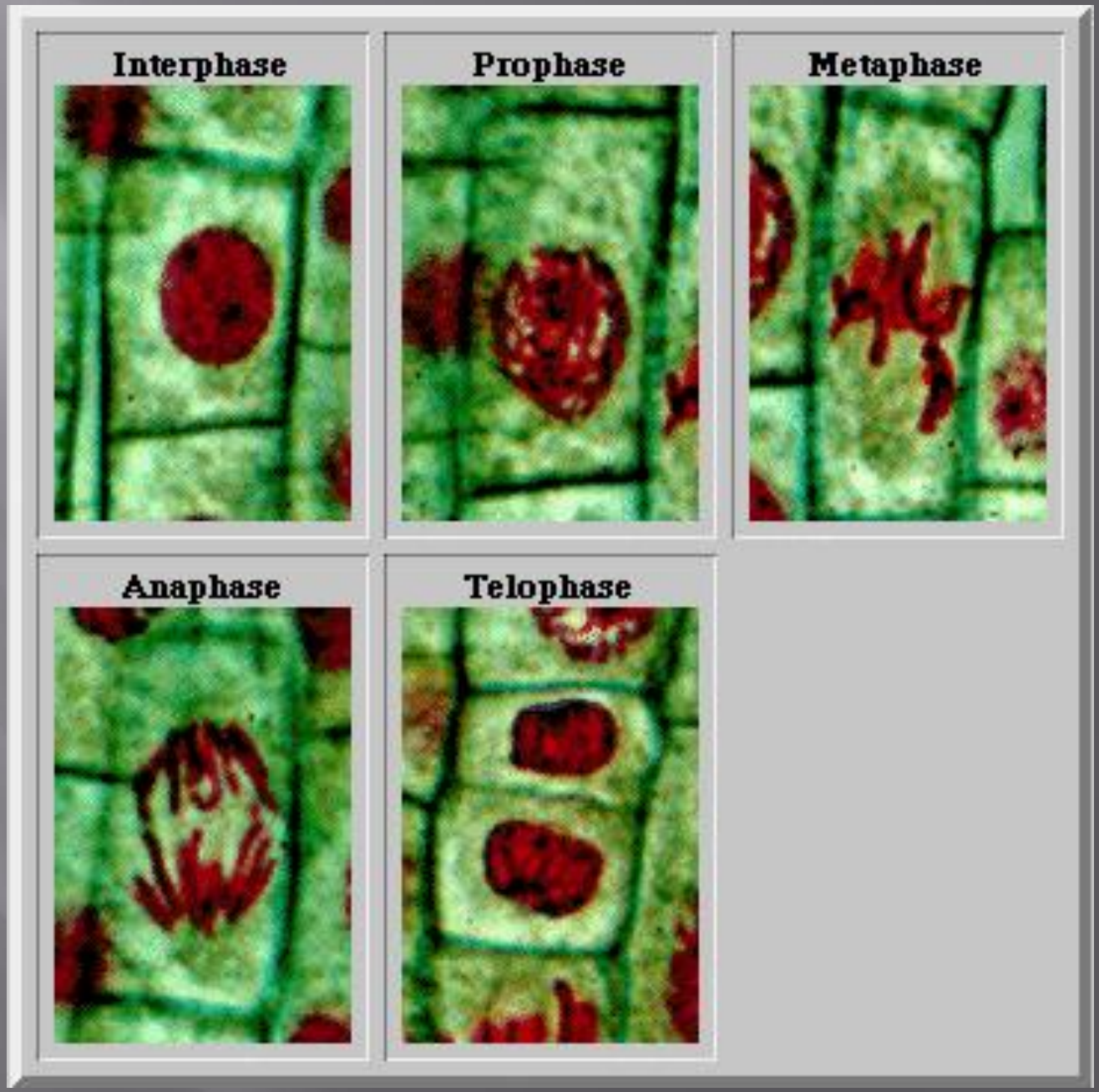
Telophase

Play Video

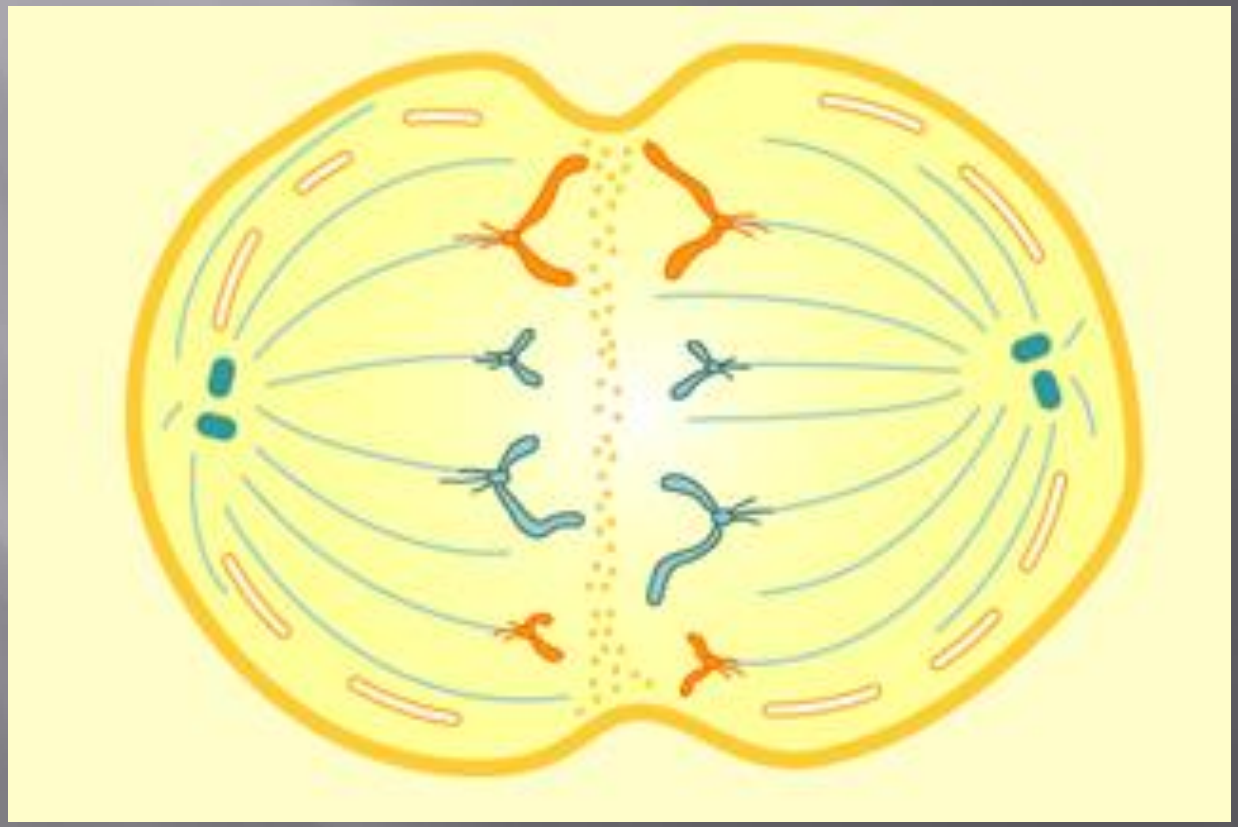
Plant Cell Cycle -- Review

Interphase 	**Prophase** 
Metaphase 	**Anaphase** 
Telophase 	**Interphase** 

Plants



Interactive Cell Division

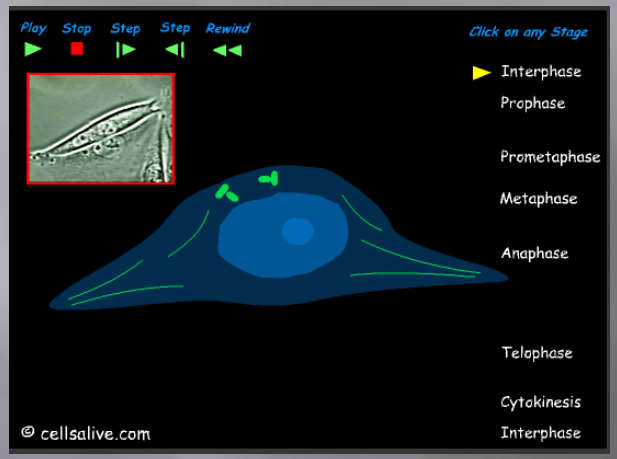


Checkpoints in the Cell Cycle

- A cell will not divide if:
  - **Signals from surrounding cells tell the cell not to divide**
  - There are not enough nutrients to provide for cell growth
  - The DNA within the nucleus has not been replicated
  - The DNA is damaged

Mitosis Animations -

Click the images to view



Interactive Cell Division

Timing Cell Division

Errors in Mitosis

- Substances such as toxic chemicals, radiation and viruses and cause MUTATIONS

- **<u>Mutations alter the structure of DNA</u>**

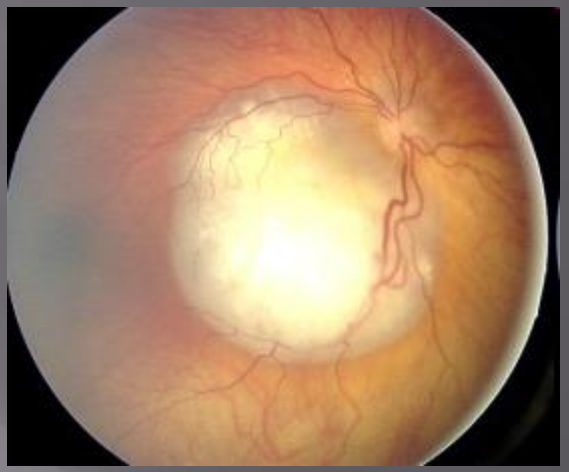
- When these cells divide the mutation is passed **<u>ONLY to the daughter cells</u>**

Errors in Mitosis

- One result of a mutation can cause cells to divide uncontrollably leading to CANCER
- Eg. Cigarette smoke can alter the chromosomes in the lungs causing these cells to undergo mitosis much faster than normal
  - **<u>This can lead to Lung Cancer</u>**

Healthy Lung Cancerous Lung

Retinoblastoma – Cancer of the Retina (back of the eye)



Retinoblastoma is caused by a mutation to certain genes in the eye which are carried on by mitosis.