

# CELL DIVISION

- Is the process by which a *parent cell* divides into two or more *daughter cells*.
- Cell division is usually a small segment of a larger cell cycle

# CHROMOSOMES

- **Are structures that transmit genetic information to next generation.**

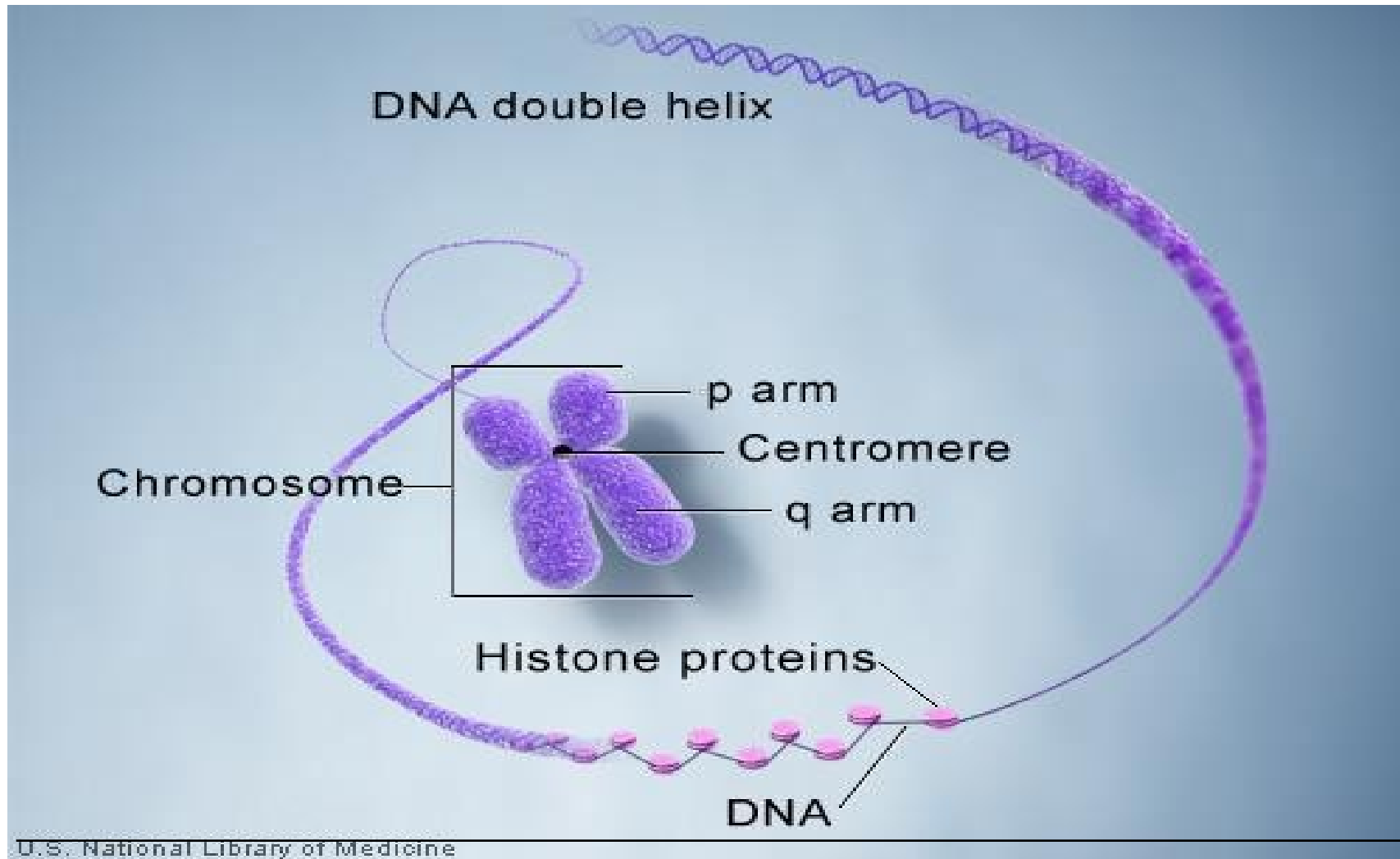
Chromosome



DNA



# CHROMOSOMES

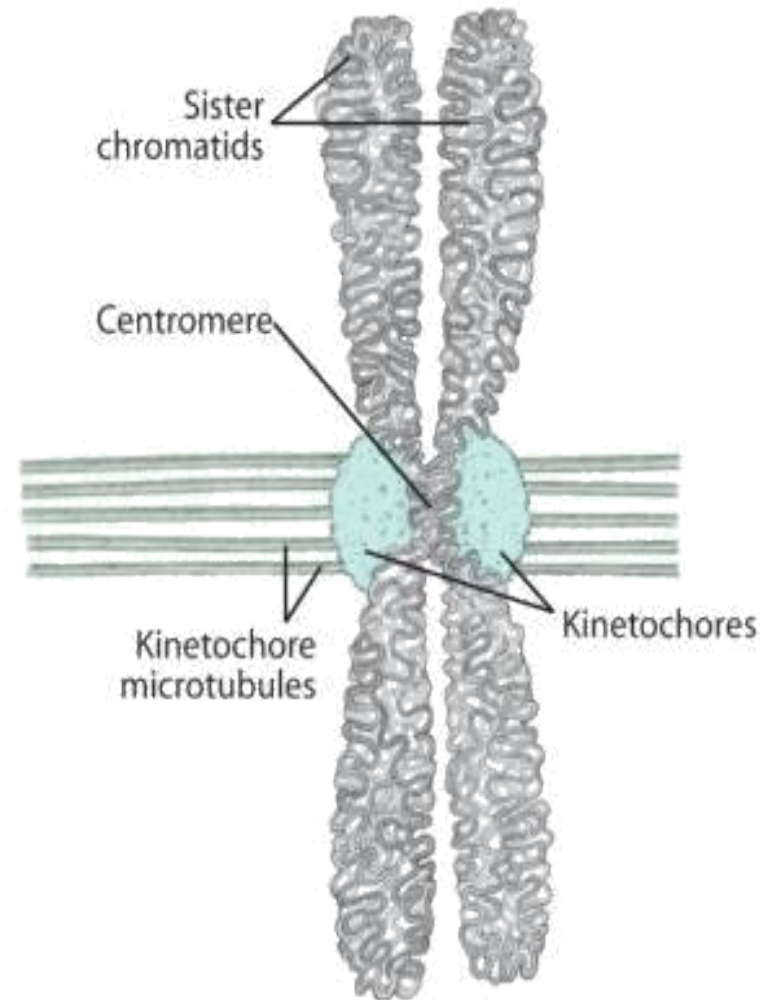


## Chromatid

Two copies of the same chromosome attached together

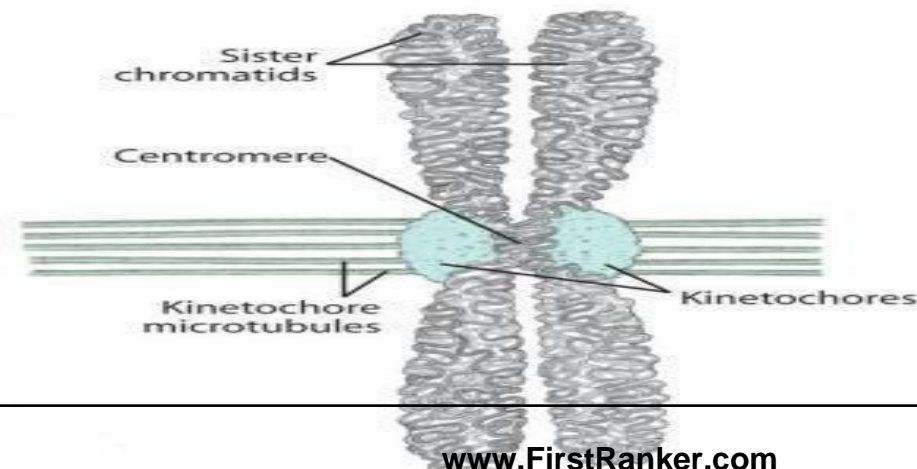
## Centromere

Is the primary constriction where the sister chromatids are attached



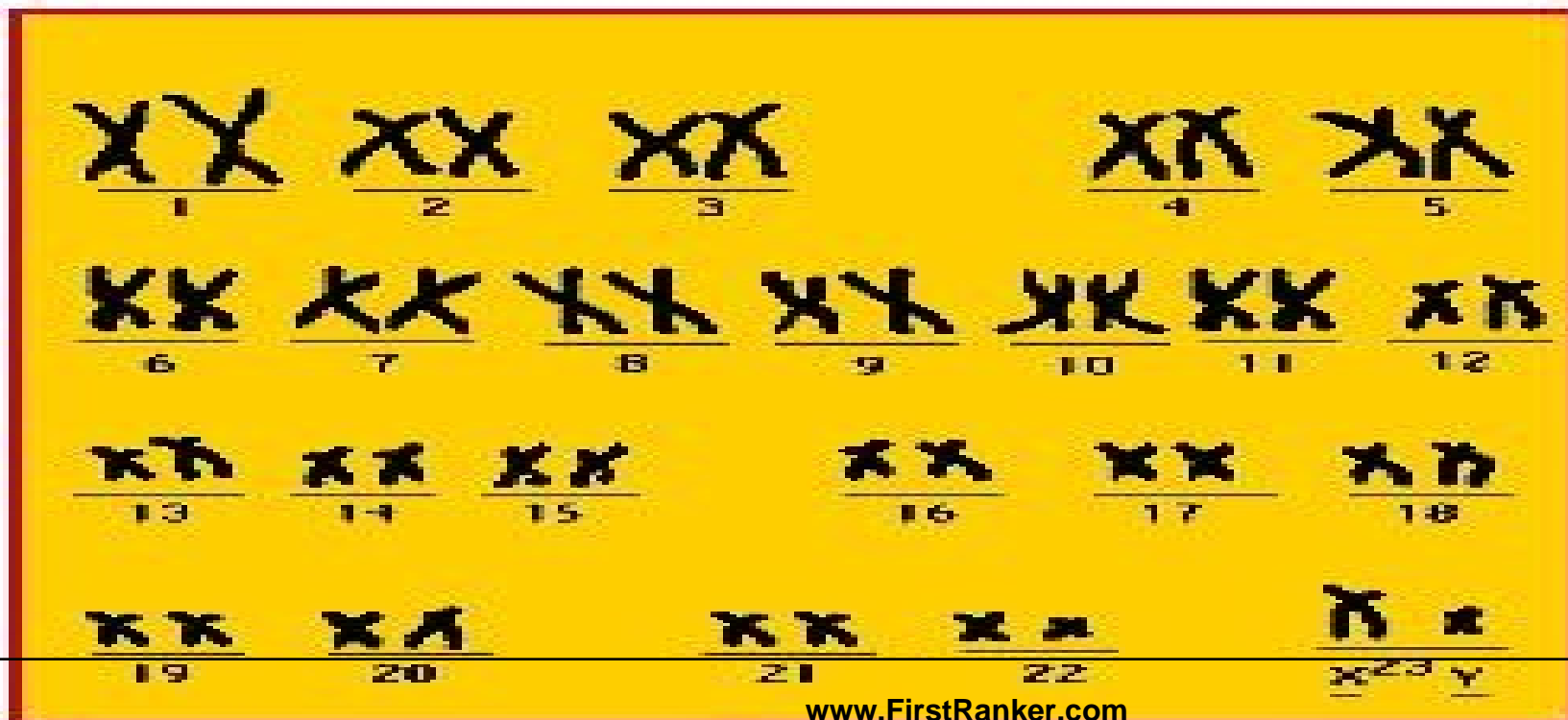
# KINETOCHORE

- Is the protein structure that assembles on the centromere and attach sister chromatids to mitotic spindle; that move chromosomes during mitosis & meiosis.



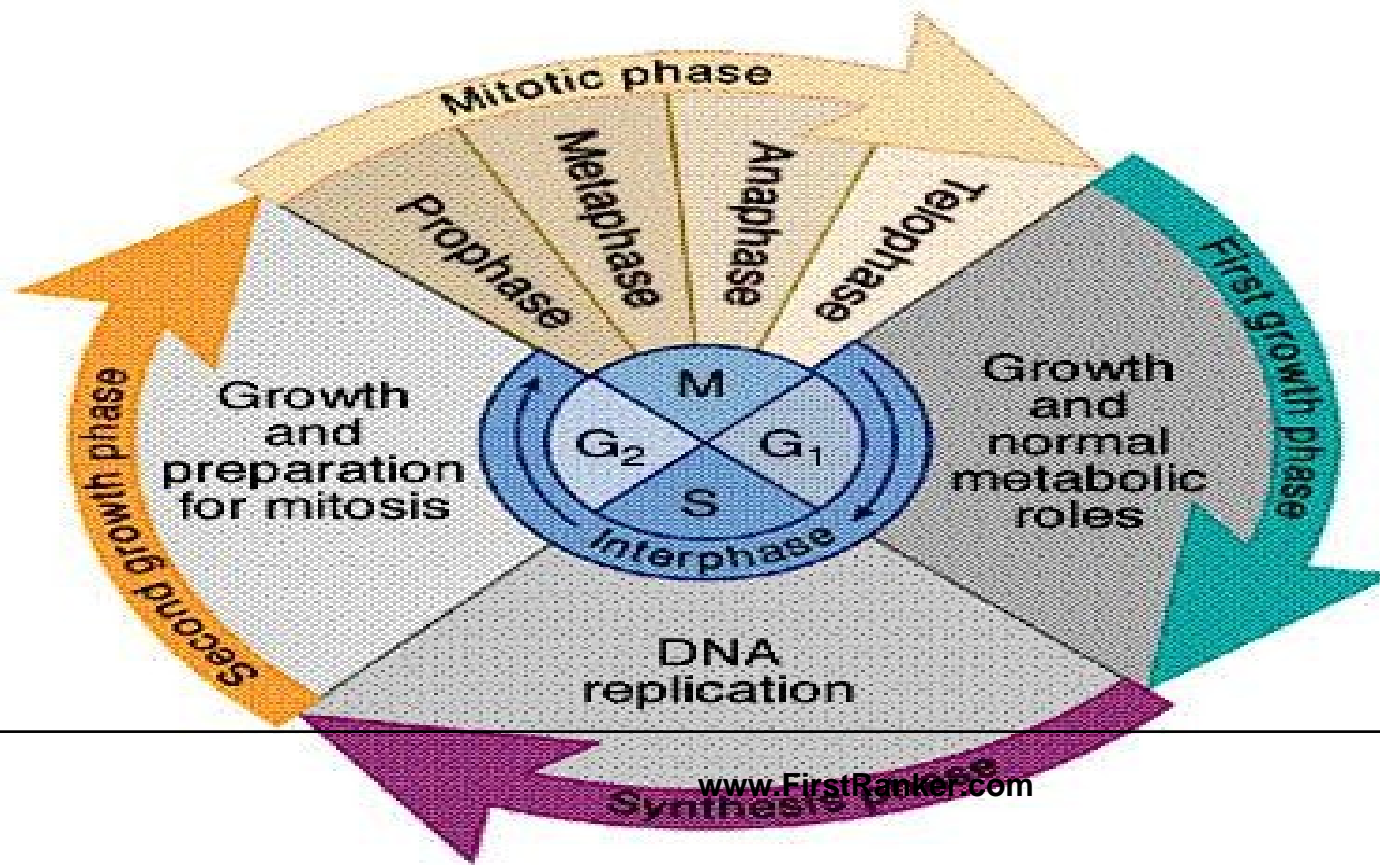
# KARYOTYPE

A karyotype is the complete set of chromosomes in a specie. It describes the number of chromosomes, and what they look like under a light microscope.



# CELL CYCLE

- The cell cycle is an ordered set of events, culminating in cell growth and division into two daughter cells. Non-dividing cells not considered to be in the cell cycle.

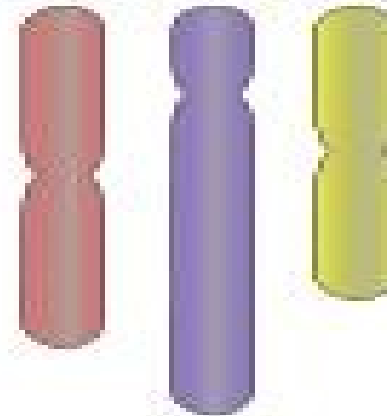




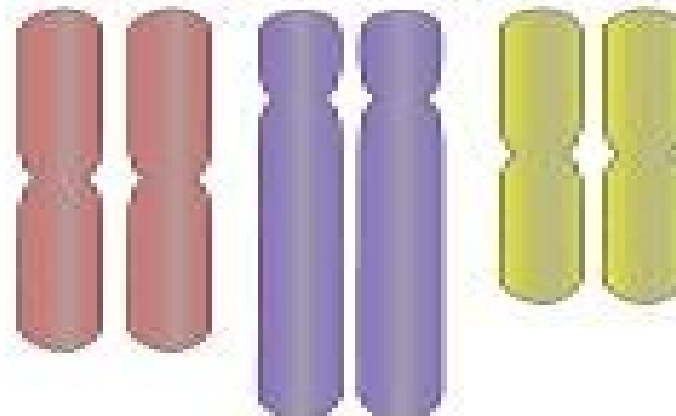
# MITOSIS

- Is **nuclear division plus cytokinesis**, and produces two identical daughter cells
- **Mitosis** occurs in all somatic cells ---diploid (2n) cells

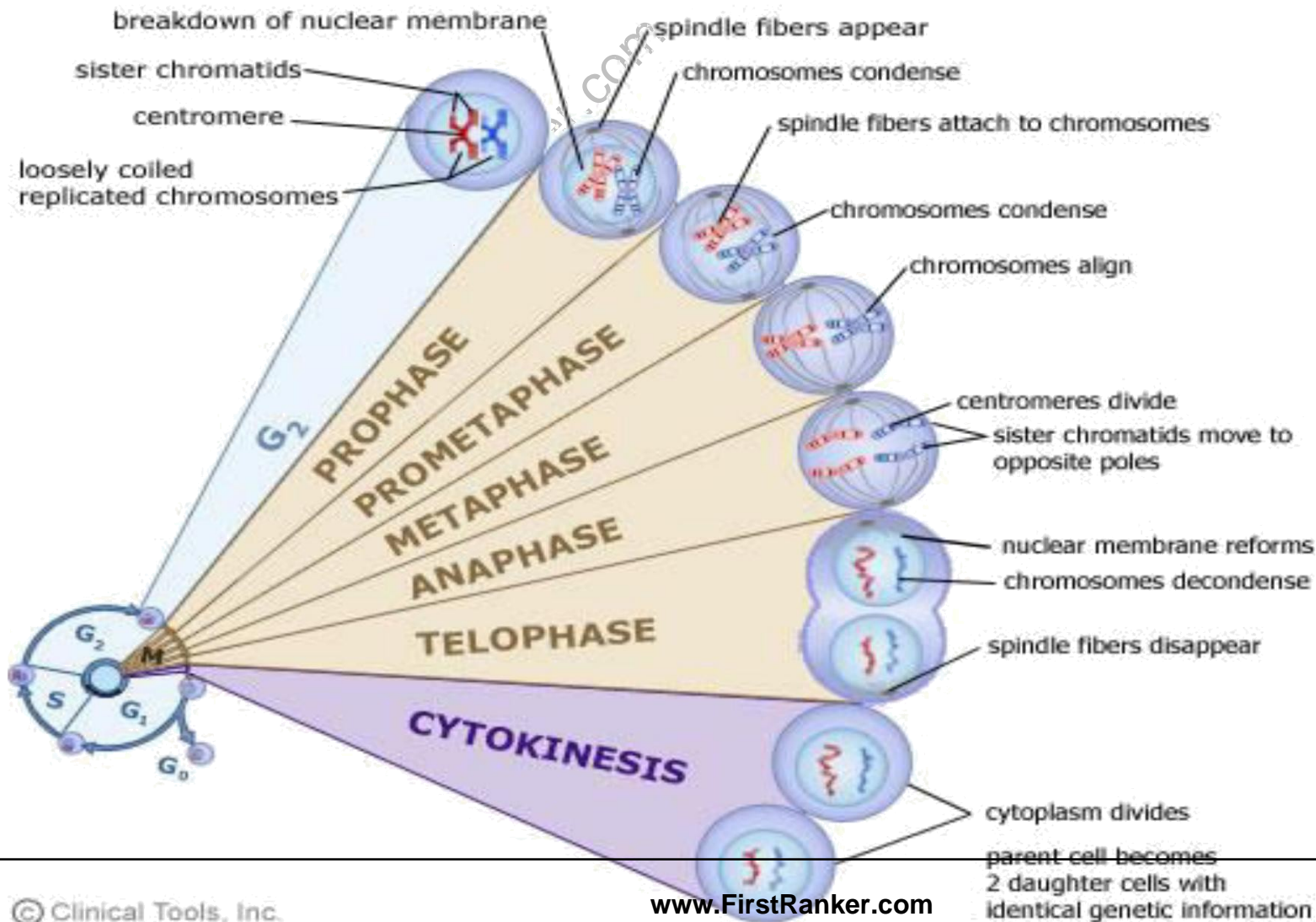
Haploid (N)

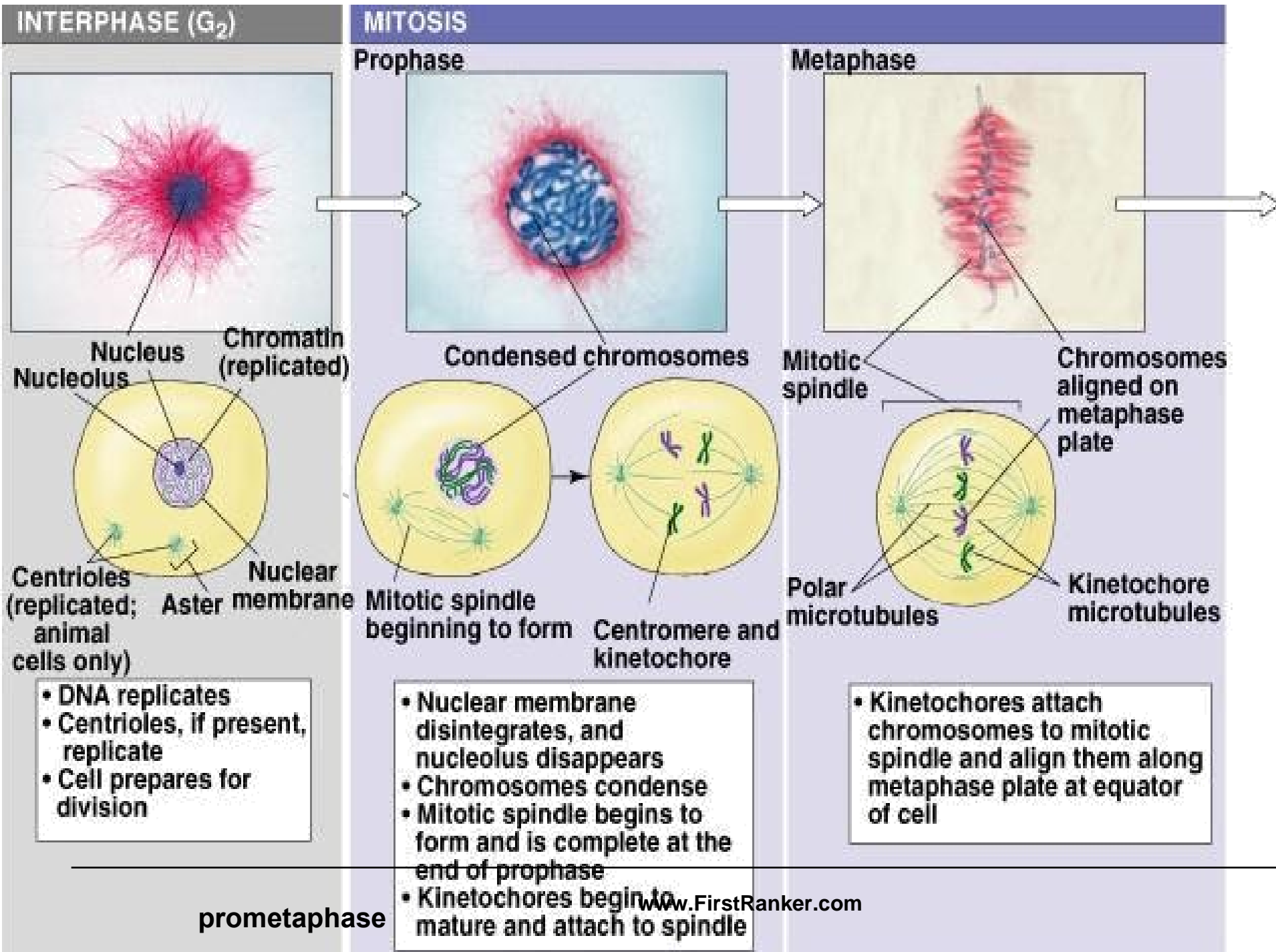


Diploid (2N)



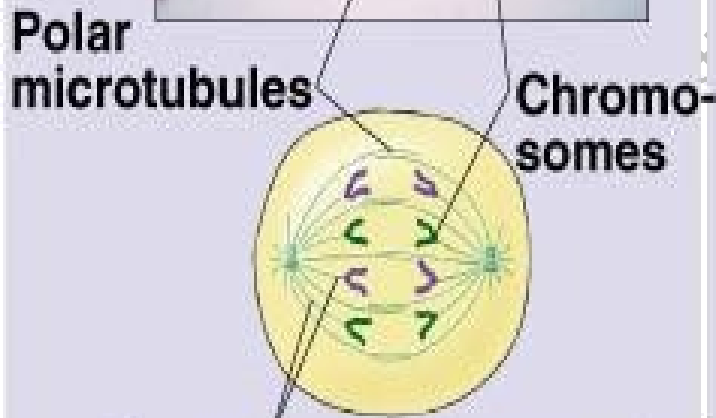
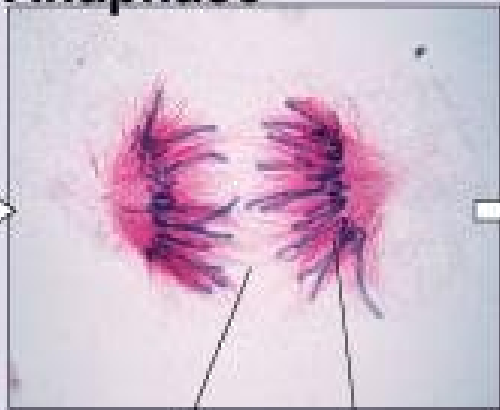
# PHASES OF MITOSIS





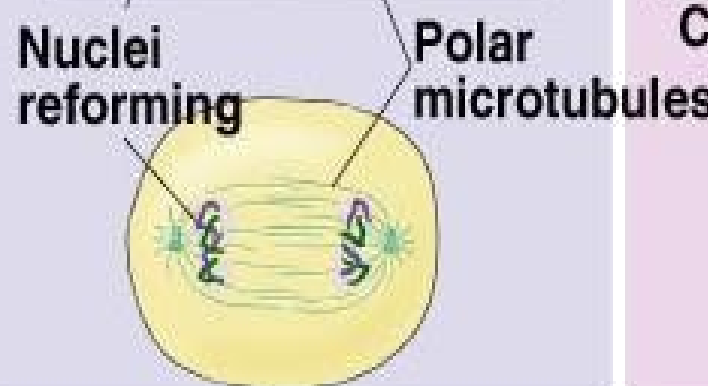
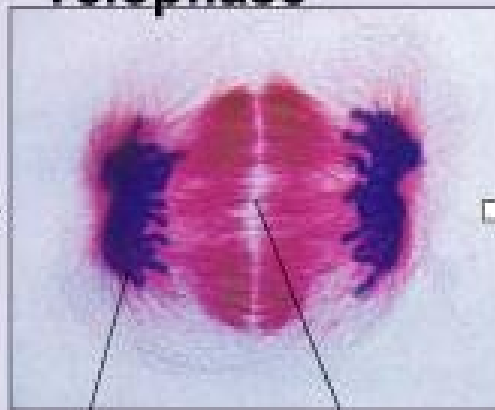
### MITOSIS

#### Anaphase



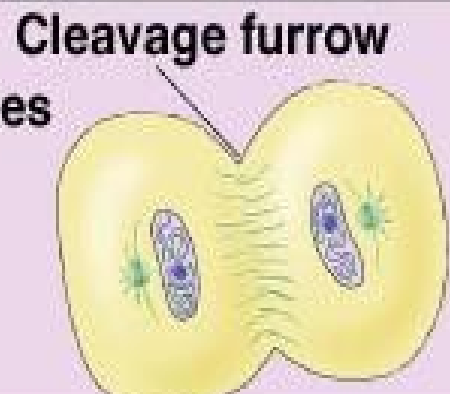
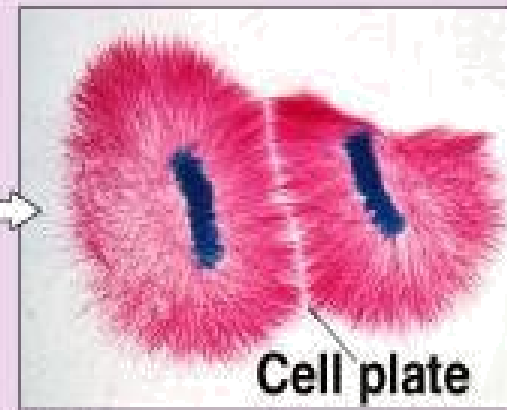
- Kinetochore microtubules shorten, separating chromosomes to opposite poles
- Polar microtubules elongate, preparing cell for cytokinesis

#### Telophase



- Chromosomes reach poles of cell
- Kinetochores disappear
- Polar microtubules continue to elongate, preparing cell for cytokinesis
- Nuclear membrane re-forms
- Nucleolus reappears
- Chromosomes decondense

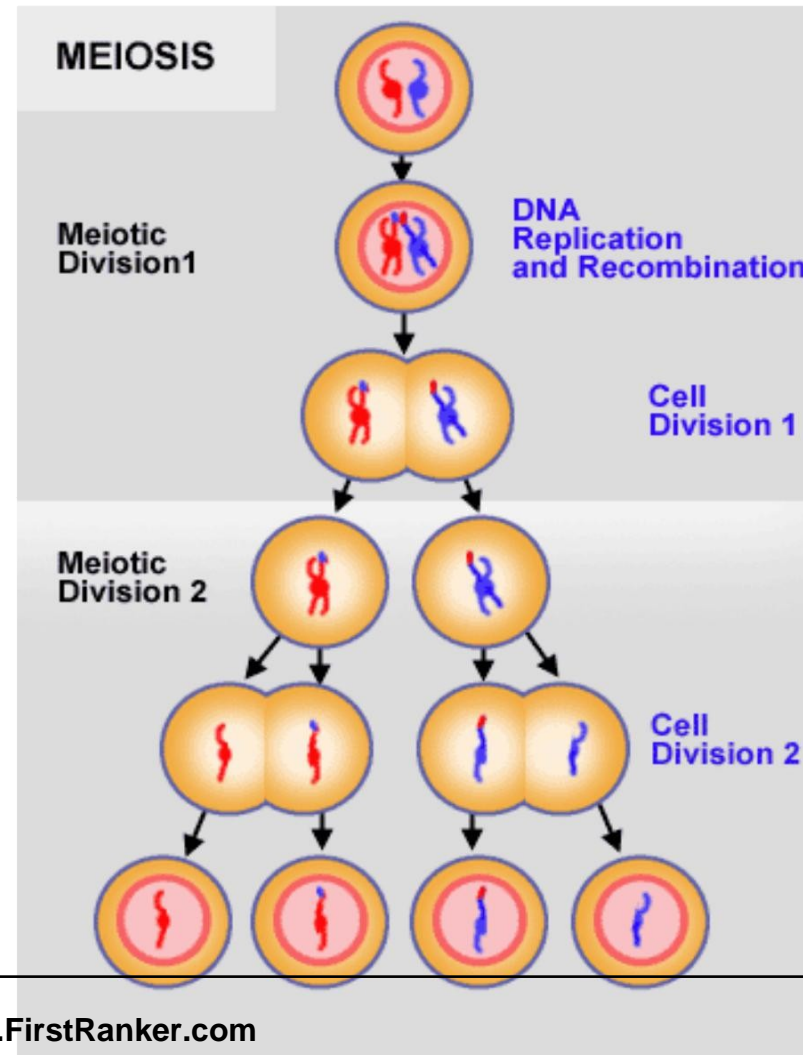
### CYTOKINESIS



- Plant cells: cell plate forms, dividing daughter cells
- Animal cells: cleavage furrow forms at equator of cell and pinches inward until cell divides in two

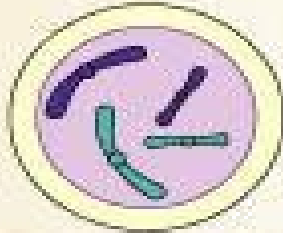
# MEIOSIS

- Meiosis is the cell division that takes place in **germ cells** only.
- Requires two cell divisions
- Diploid germ cells give rise to **haploid (n)** gametes.



Primary oocyte or primary spermatocyte

Parent cell (2n)



**MEIOSIS I**

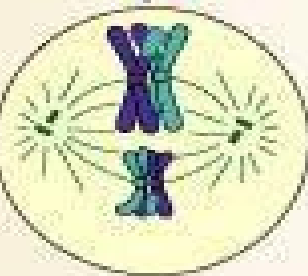
Chromosome replication

Prophase I



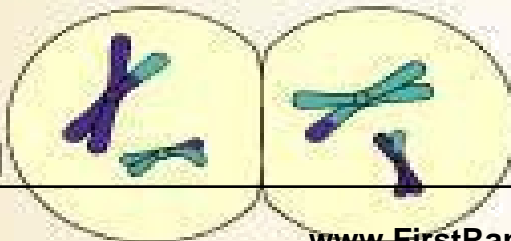
Homologous chromosomes pair; synapsis and crossing over occur.

Metaphase I



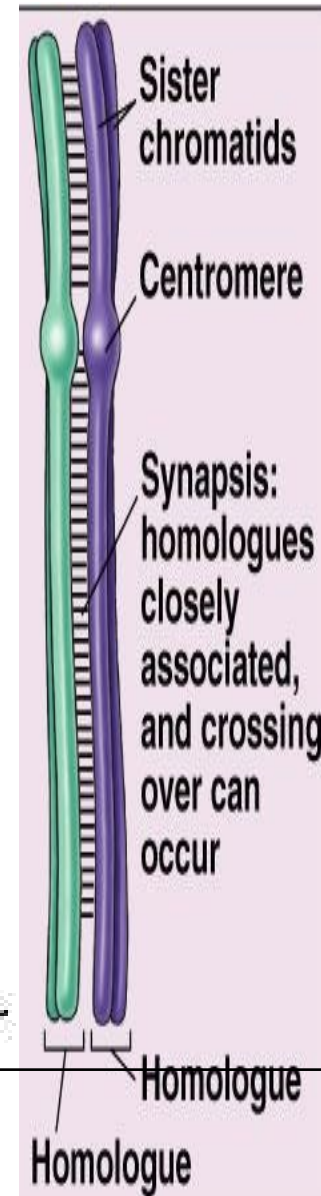
Paired homologous chromosomes align on metaphase plate.

Anaphase I  
Telophase I



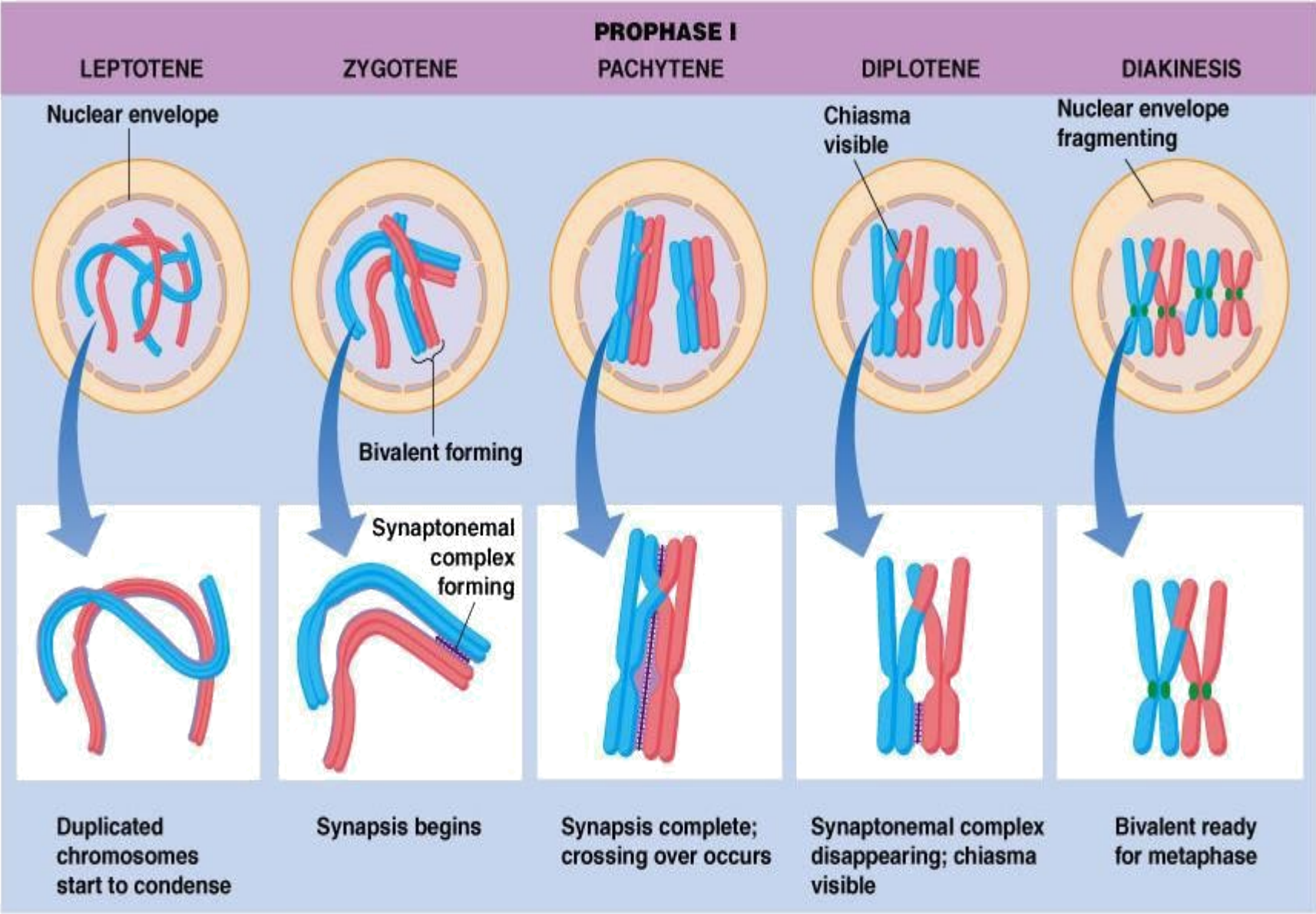
Homologous chromosomes separate; sister chromatids remain together.

Pair of homologous dyad (tetrad)



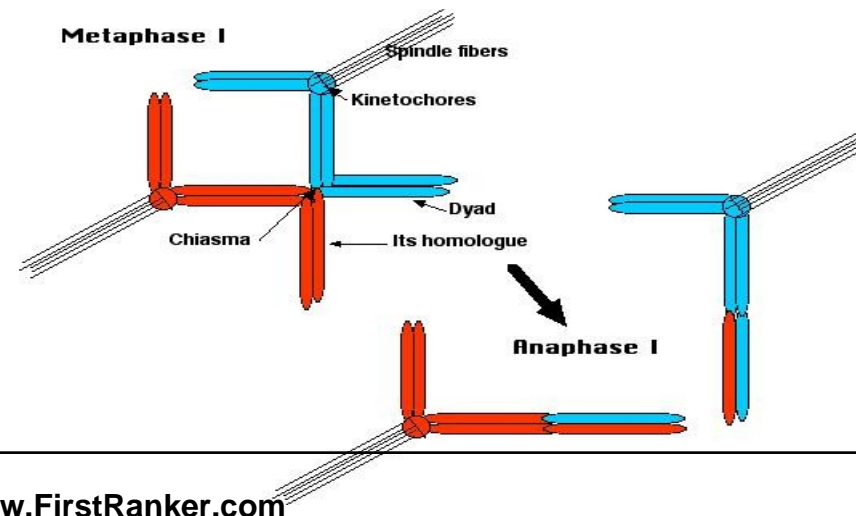
23 double structured chromosomes





# SPECIAL EVENTS IN MEIOSIS

- **Pairing of homologous chromosomes** length wise is called **synapsis**.
- **Pairing is exact and point to point** except for X & Y chromosome
- **Cross overs** or interchange of chromatid segments between paired homologous chromosomes
- As homologous chromosomes separate points of interchange are temporarily united and form an X like structure called **chiasma**.





# MEIOSIS II

No DNA synthesis or replication

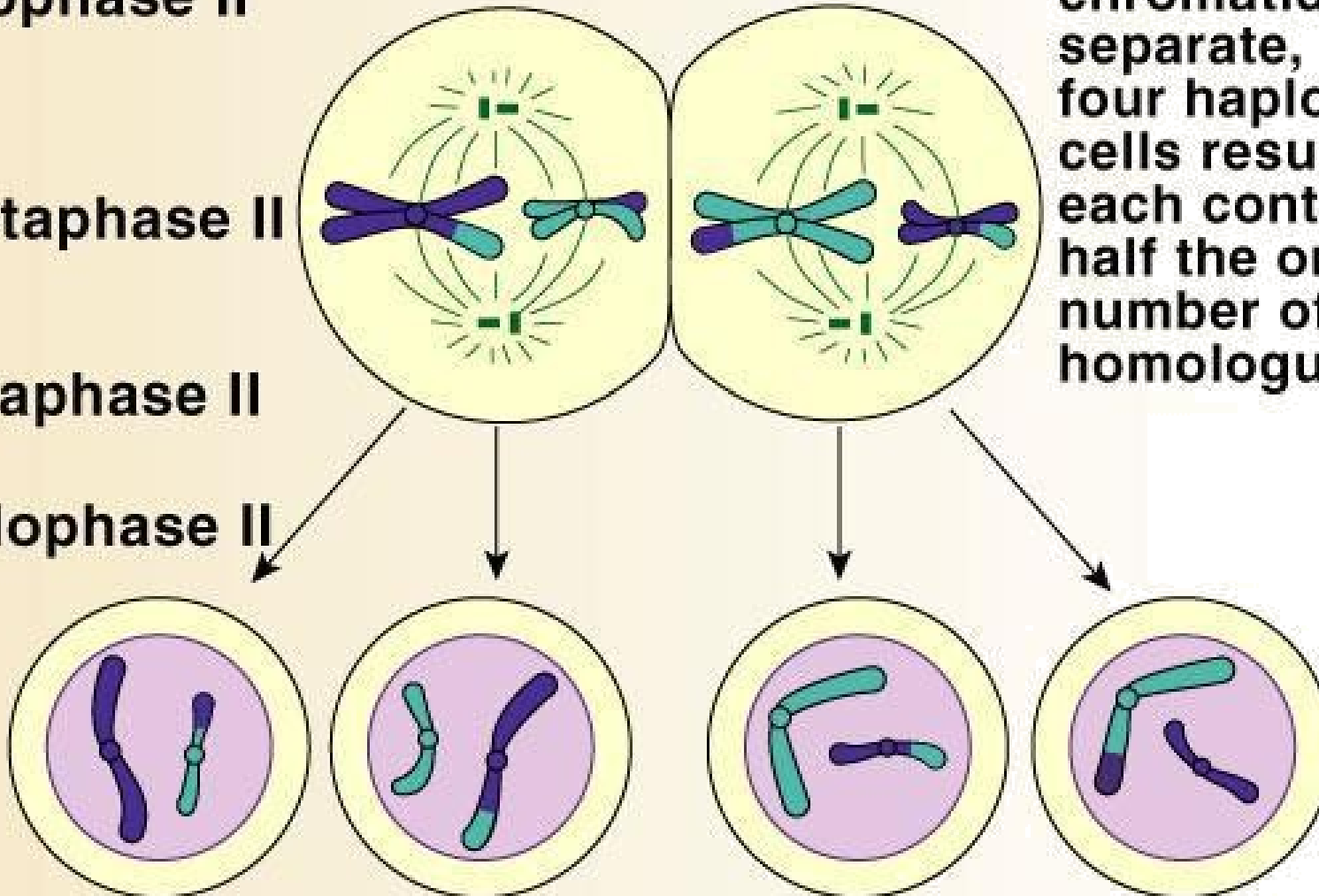
**Prophase II**

**Metaphase II**

**Anaphase II**

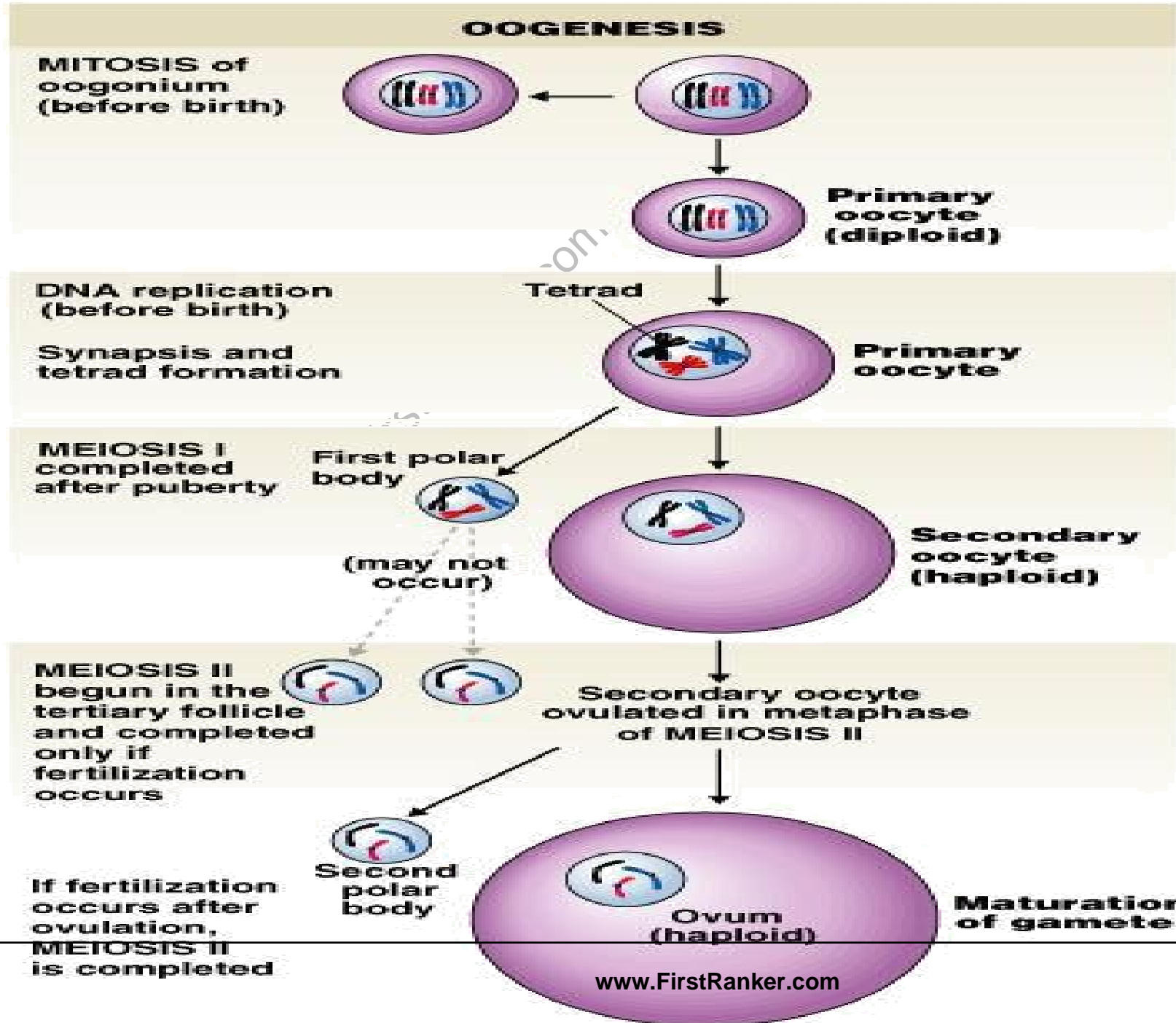
**Telophase II**

Chromosomes align, sister chromatids separate, and four haploid cells result, each containing half the original number of homologues.

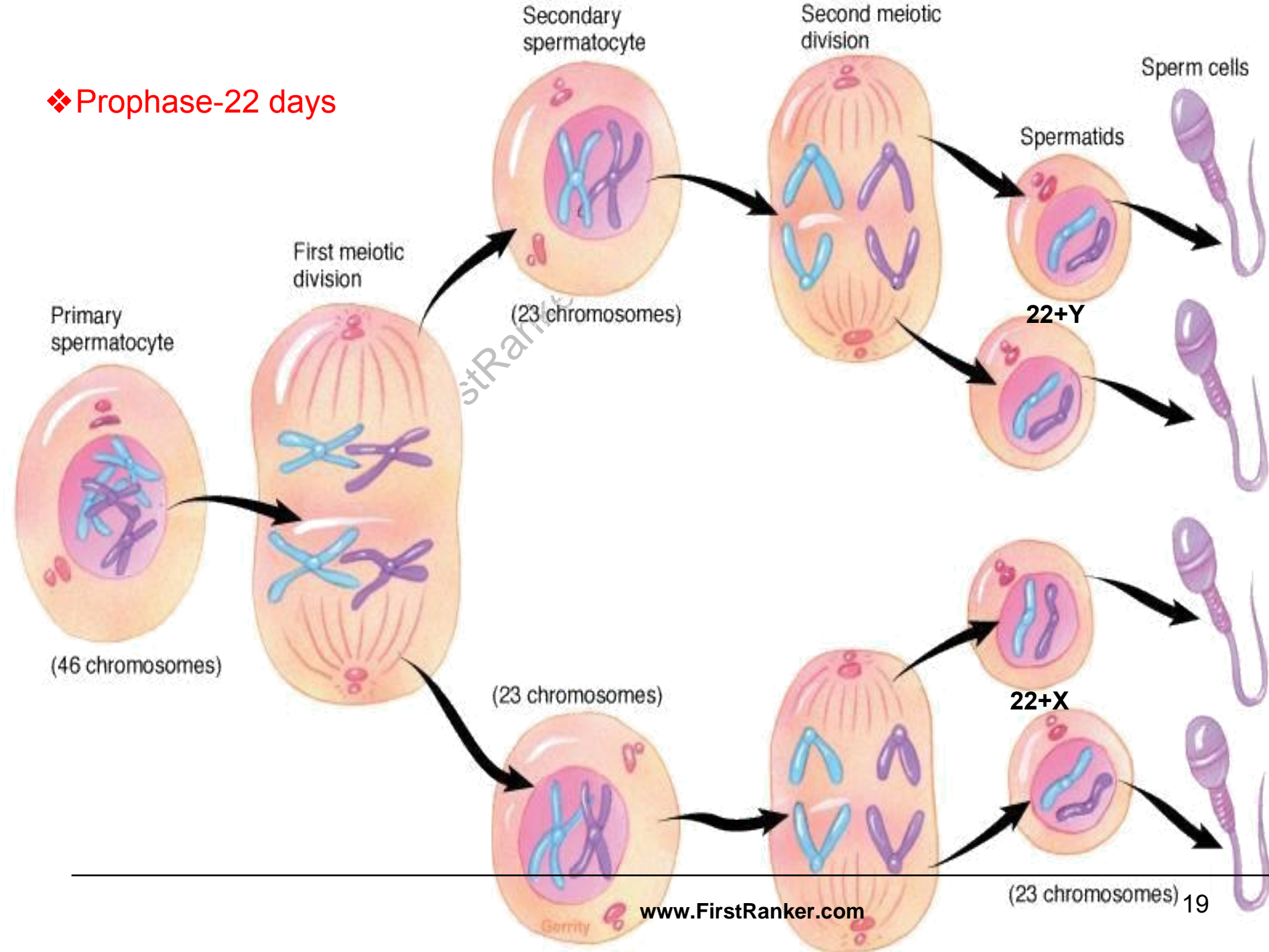


**Four daughter cells (each  $n$ )**

**23 single structured chromosomes**



❖ Prophase-22 days



# SIGNIFICANCE OF MEIOSIS:

- Provides constancy of the chromosome number from generation to generation by reducing the chromosome number from diploid to haploid, thereby producing haploid gametes.
- Allows random assortment of maternal and paternal chromosomes between the gametes.
- Relocates segments of maternal and paternal chromosomes by crossing over of chromosome segments, which "shuffles" the genes and produces

a ***recombination of genetic material.***

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- The stage of the cell cycle where each chromosome is composed of two chromatids in preparation for mitosis.
- **A.** G1
- **B.** S
- **C.** M
- **D.** G2

- Which of the following statements is NOT true of mitosis?
- **A.** A single nucleus gives rise to two identical daughter nuclei
- **B.** The daughter nuclei are genetically identical to the parent nucleus.
- **C.** The centromeres divide at the onset of anaphase.
- **D.** Homologous chromosomes synapse in prophase.

- Which sequence of the cell cycle is common to eukaryotes?
  - **A.** G1 to G2 to S to M to cytokinesis
  - **B.** G1 to M to G2 to S to cytokinesis
  - **C.** G1 to S to M to G2 to cytokinesis
  - **D.** G1 to S to G2 to M to cytokinesis



- The stage of the cell cycle where the cell is preparing to begin DNA replication is called:
  - **A.** G1
  - **B.** G2
  - **C.** S

- D. M

Thank you