GENERAL EMBRYOLOGY

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Department
of
Anatomy and Histology
School of Medicine
The University of Jordan

By Dr. Amjad Shatarat

a.shatarat@ju.edu.jo

https://www.facebook.com/DrAmjad-Shatarat

According to the number of chromosomes in the nucleus of the human cells we Have **two** types :

1- Somatic cells

2- Reproductive cells **(also called sex cells)**

A **somatic cell (*soma body) is any cell of the***
body other than a germ cell

A **germ cell is a gamete (sperm or** oocyte)
or **any precursor cell destined to become a gamete**

Somatic cells : contain ***two sets of chromosomes***:
first set contains 23 chromosomes coming from the ***mother*** called ***maternal***
The second set contains 23 chromosomes coming from the ***father*** called ***paternal***

Therefore, **Somatic cells** called

diploid

cells (*dipl- double; -oid form), symbolized* ***2n***

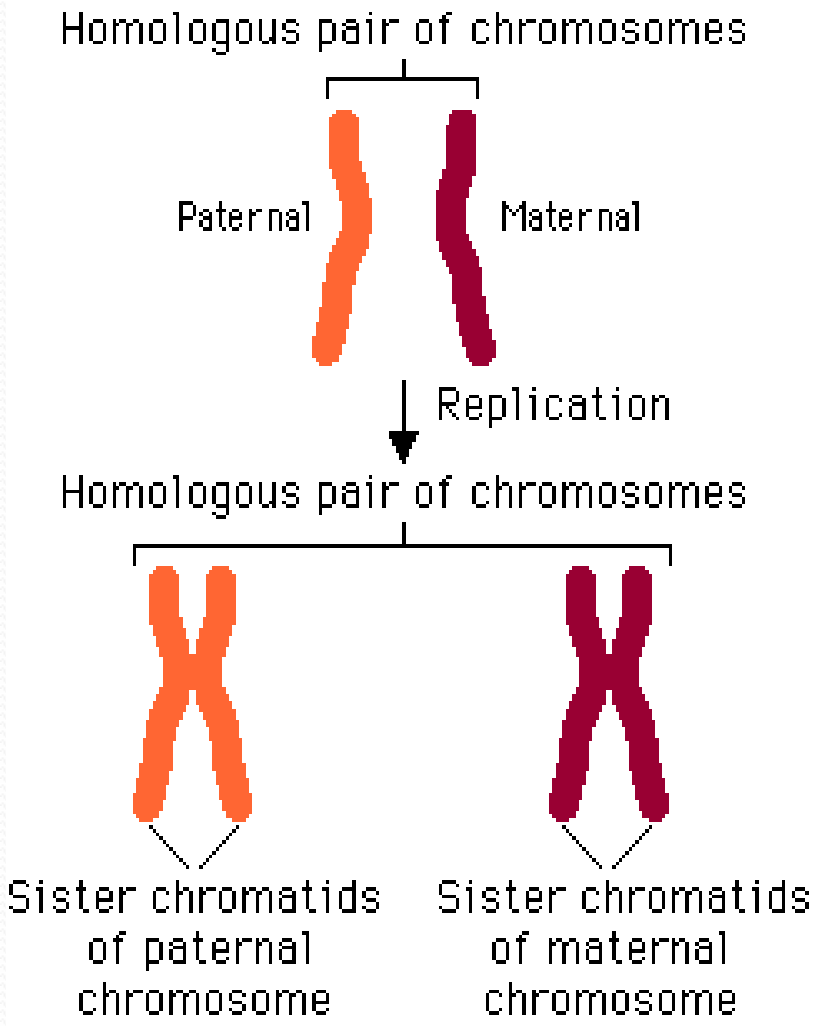
The two chromosomes that make up each pair are called homologous chromosomes
(*homo- same) they*
contain similar genes arranged in the same (or almost the same) order

What are

HOMOLOGOUS CHROMOSOMES

When examined under a light microscope generally they look very similar.
The exception to this rule is one pair of chromosomes called the **sex chromosomes, designated** X and Y.
In females the homologous pair of sex chromosomes consists of two large X chromosomes; in males the pair consists of an X and a much smaller Y chromosome

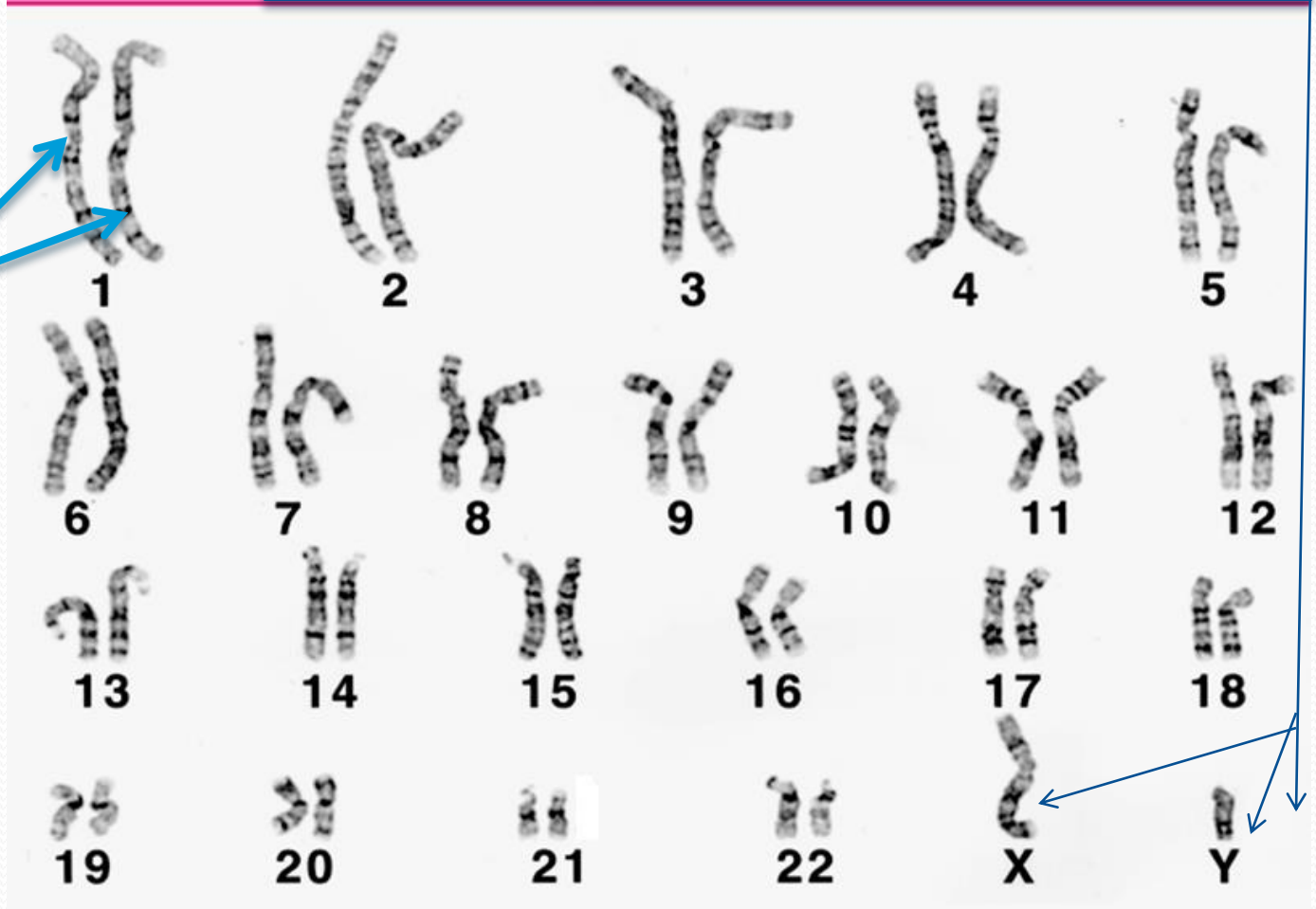
Note : If the sex pair is XX the individual is **genetically female** If the sex pair is XY the individual is genetically **male**



HOMOLOGOUS CHROMOSOMES

Notice that chromosomes number 23 are not homologous, what does this mean?

Notice that in this picture There are two chromosomes Numbered 1 and etc. These Chromosomes are called homologous chromosomes; one comes from the mother and the other comes from the father During fertilization



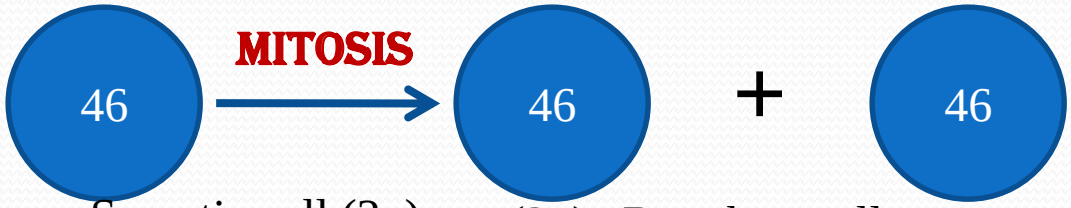
Picture of the 46 chromosomes (23 pairs of chromosomes)

Where can we find somatic cells?

All the cells in the human body are somatic except the ***sperm*** and the ***oocyte***

How they divide?

Somatic cells divide by **mitosis** for growth and to replace cells that die from tear and wear



important

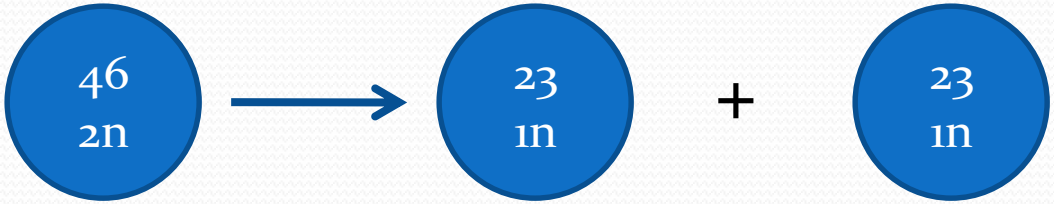
MITOSIS CONSERVES CHROMOSOMES NUMBER

2- Reproductive cells (also called sex cells)

Reproductive cells develop in gonads (ovaries in female and testes in male)

They contain only **23** chromosomes that is why they are called **haploid** cells (1n)

Reproductive cells divide by meiosis



Reproductive cell
Diploid 46 chromosomes

Gametes haploid cells 23 chromosomes

Meiosis does not conserve Chromosomes number instead It reduces it by half

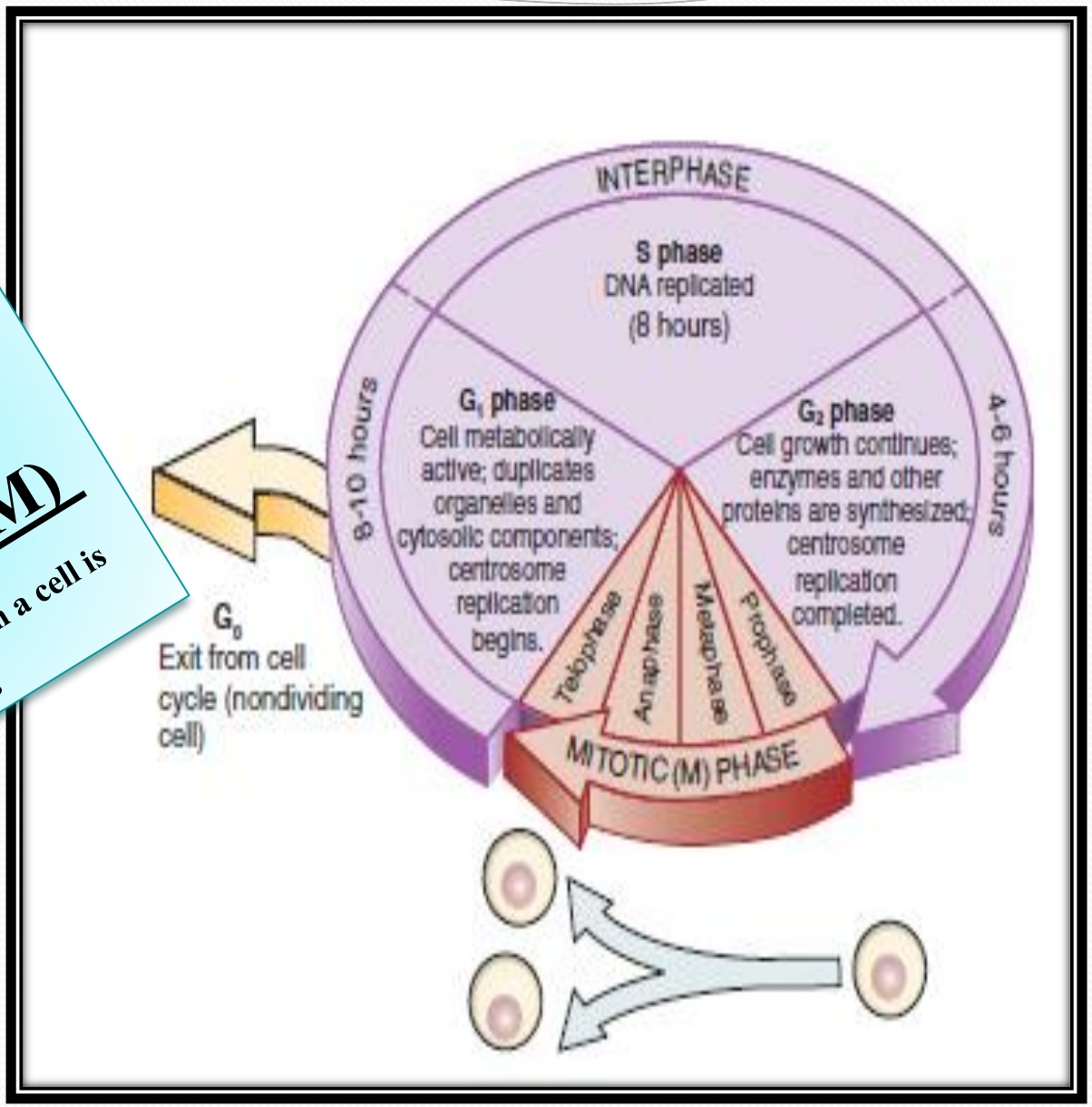
important

precursor cell destined to become a gamete

Cell Division

When a cell reproduces, it must replicate (duplicate) all its chromosomes to pass its genes to the next generation of cells

The cell cycle consists of two ***major periods:*** **INTERPHASE,** when a cell is not dividing, and the **MITOTIC (M) PHASE,** when a cell is dividing



INTERPHASE

The Interphase

Interphase is a state of high metabolic activity; it is
during this time that the cell does most of its growing.

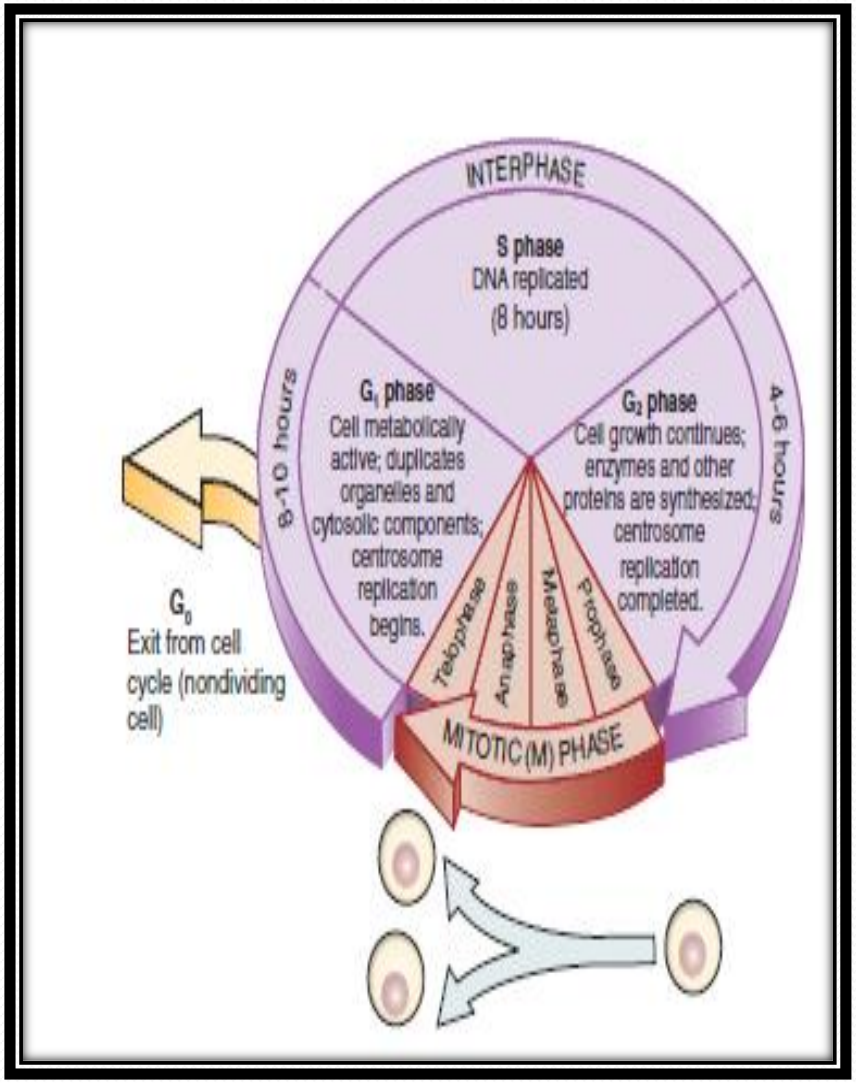
During **interphase**
1- The cell replicates its DNA
2-Produces additional organelles and cytosolic components

Interphase consists of three phases:

1-G1 phase

2-S phase

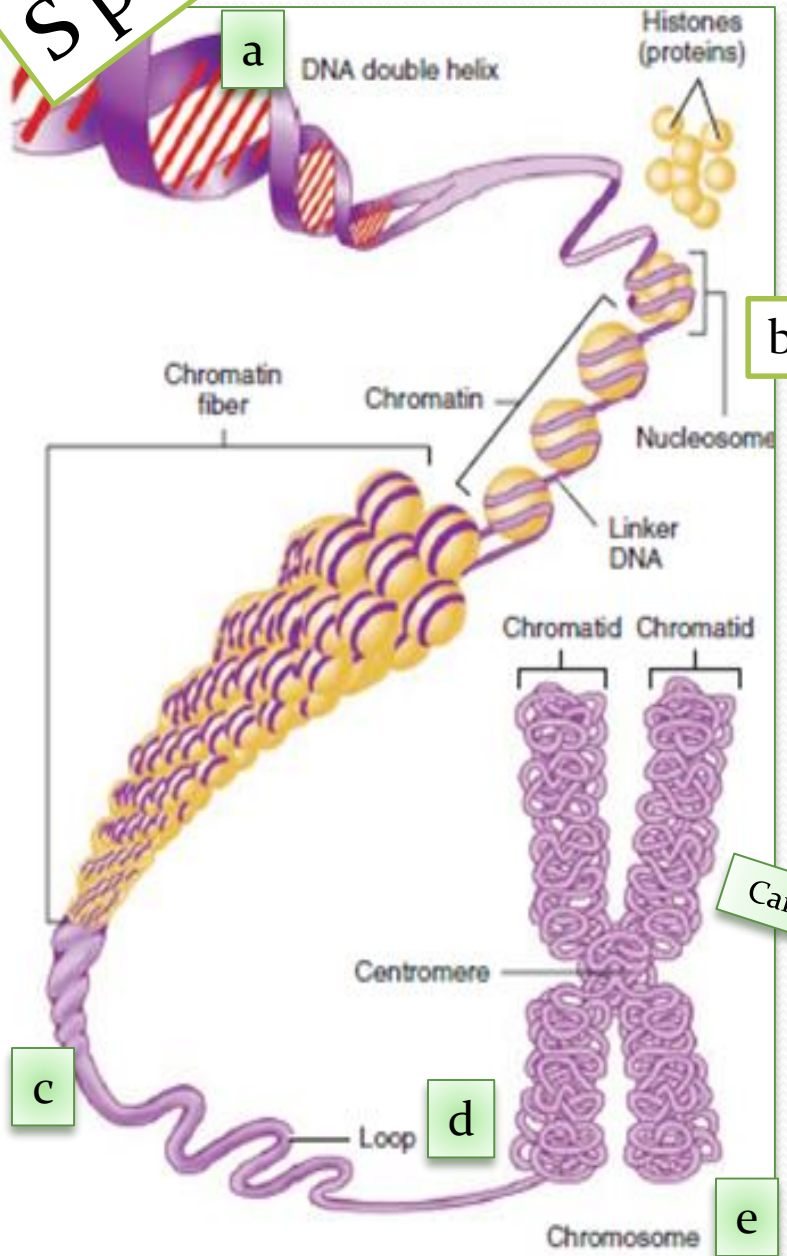
3-G2 phase



S phase

all cells before division undergo DNA synthesis during the Interphase

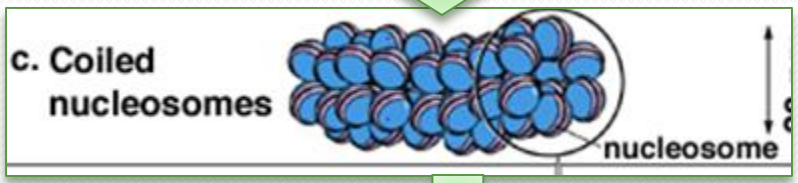
Chromosome's structure



a. DNA helix

\+

proteins called **histones**

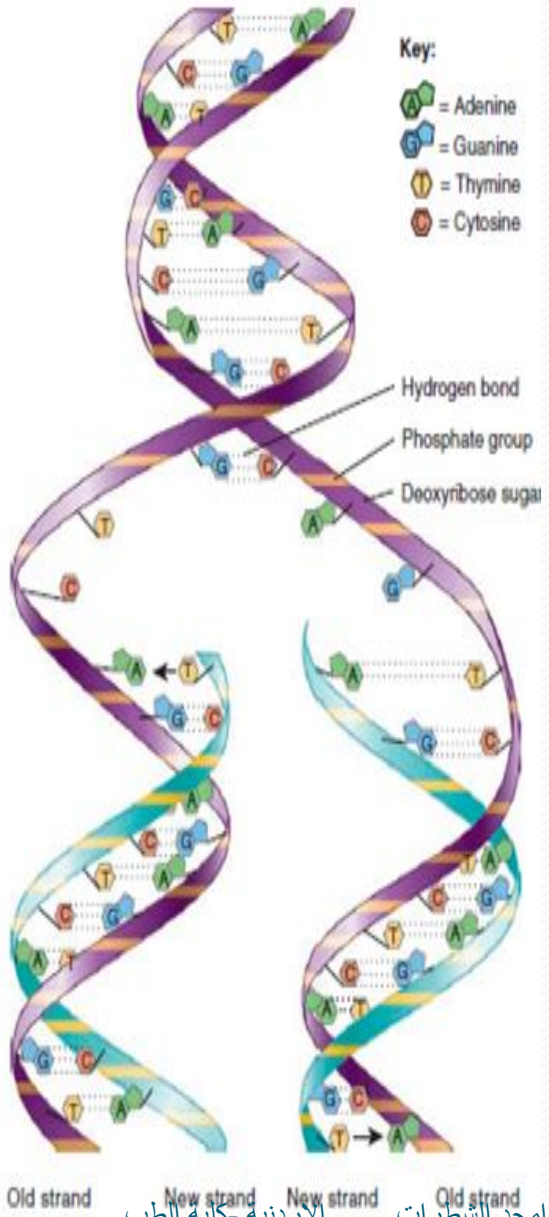


Can condensed to form chromosome

e

Interphase

DNA replicates (duplicates)



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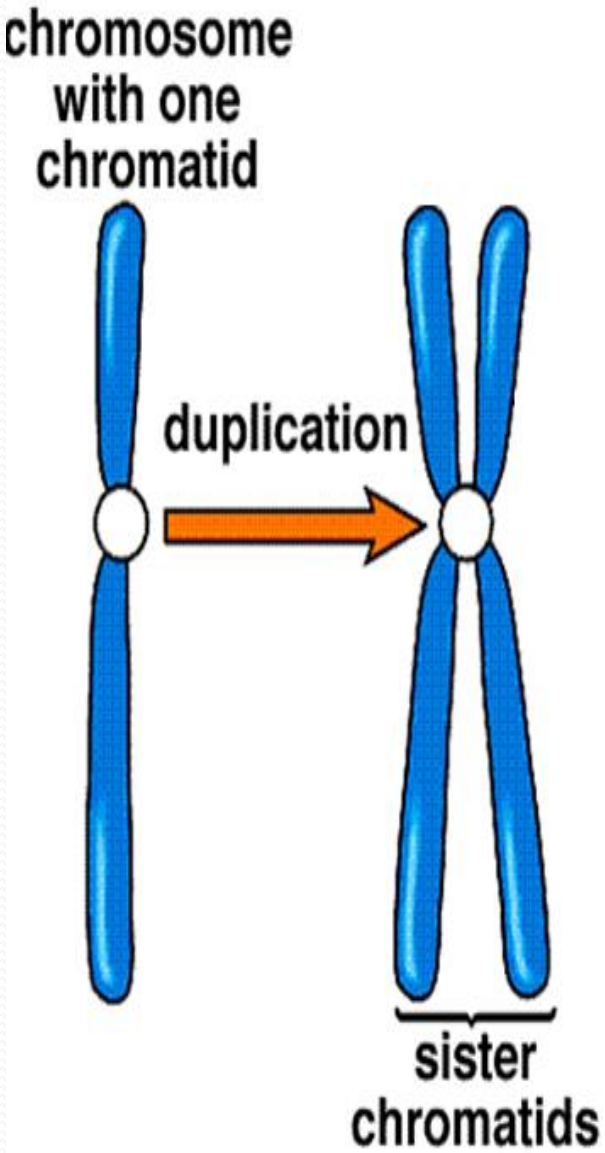
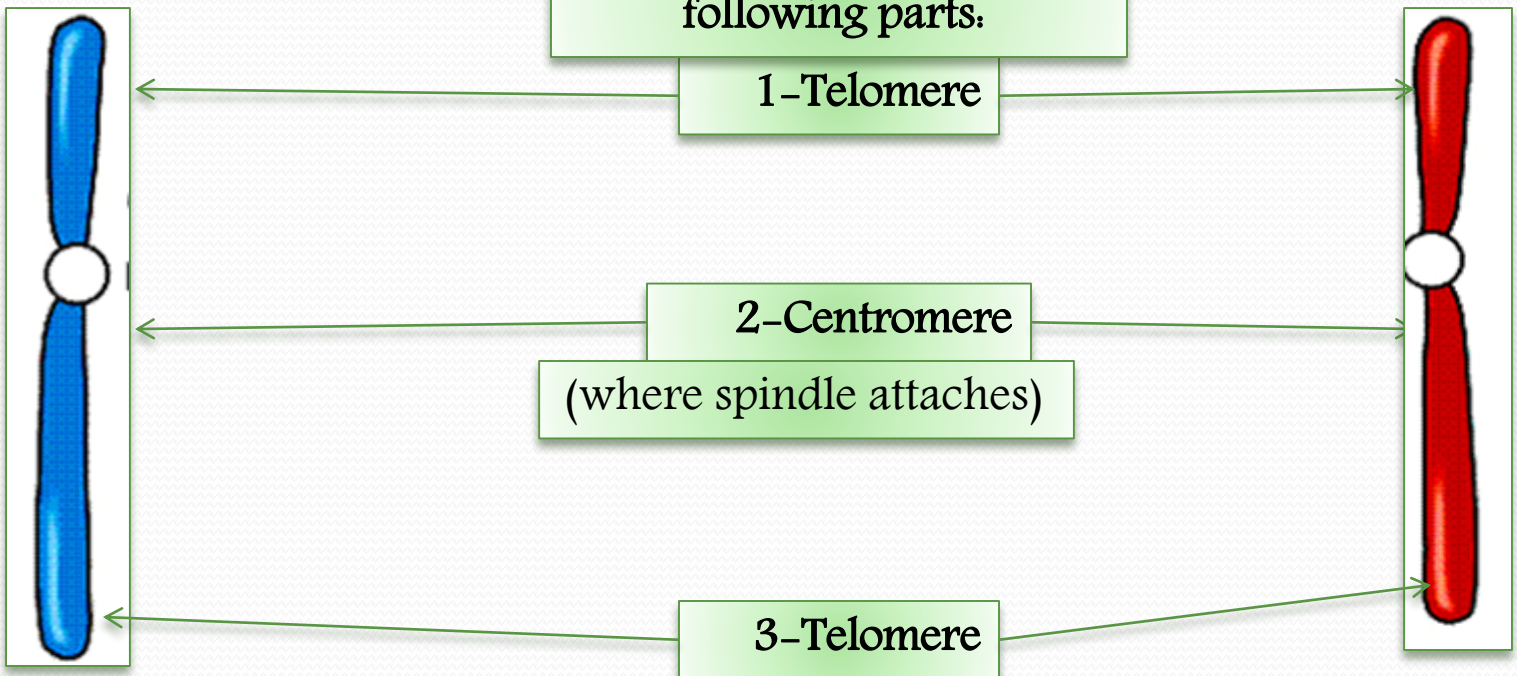


The **S** stands for ***synthesis*** *of DNA.*

The chromatin of nucleus condense into a chromosome

Each chromosome has the following parts:



1-Telomere

2-Centromere

(where spindle attaches)

3-Telomere

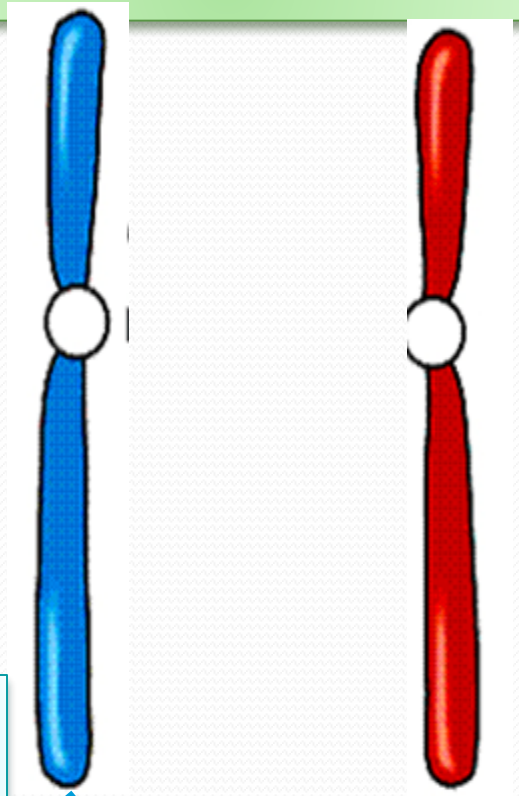
(special structures at the ends)

depending on the stage of the cell cycle chromosomes come in 2 forms:

1- The monad form consists of a single chromatid, a single piece of DNA containing a centromere and telomeres at the ends.

2- The dyad form consists of 2 identical chromatids (sister chromatids) attached together at the centromere

The chromatin of nucleus condense into a chromosome



One chromosome coming from the father called paternal

One chromosome coming from the mother called maternal

HOMOLOGOUS CHROMOSOMES

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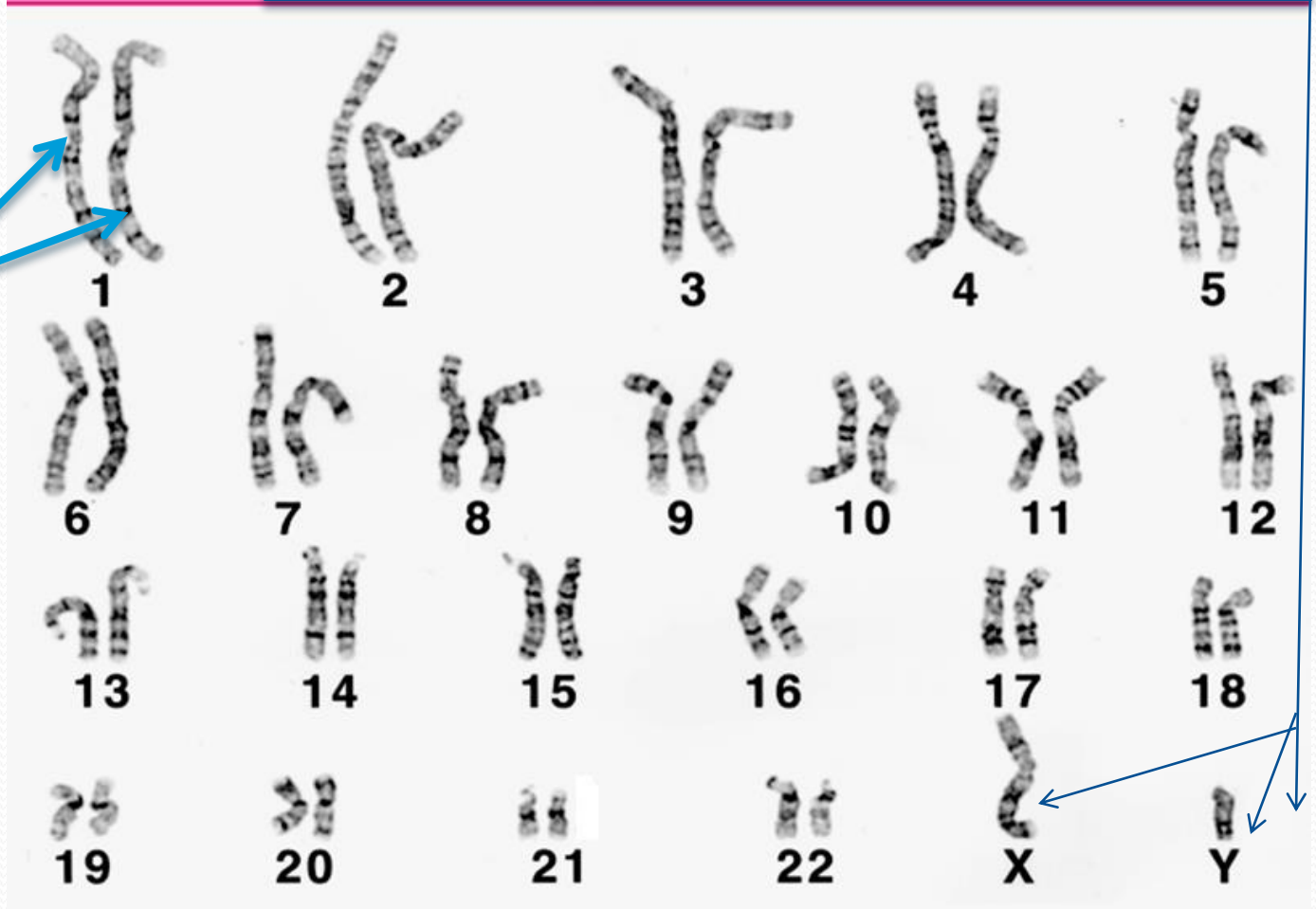

Picture of the 46 chromosomes (23 pairs of chromosomes)

G phases

Because the G phases are periods when there is no activity related to DNA duplication, they are thought of as ***gaps or interruptions in DNA duplication.***

The **G1 phase is the interval between** the mitotic phase and the S phase.

During G1,

the cell replicates most of its

organelles and cytosolic components but

not its DNA.

- **Replication of centrosomes also begins in the G1 phase.**

For a cell with a total cell cycle time of 24 hours, G1 lasts 8 to 10 hours. However, the duration of this phase is quite variable. It is very short in many embryonic cells or cancer cells. Cells that remain in G1 for a very long time, perhaps destined never to divide again, are said to be in the G0 phase.

Most nerve cells **are in the G0 phase. Once a cell enters the S phase, however, it is committed to go through the rest of the cell cycle.**

The G2 phase is the interval between the S phase and the mitotic phase. It lasts 4 to 6 hours.

During G2, cell growth continues, enzymes and other proteins are synthesized in preparation for cell division, and replication of centrosomes is completed.

MITOTIC (M) PHASE

Cell Division

Somatic cells

by

Mitosis

Reproductive cells

by

Meiosis

To be discussed later

Cell Cycle

Interphase
(Cell is not dividing)

Consist of three phases:

1- The G1 phase
2- The S phase
3- The G2 phase

Mitotic phase
(Cell is dividing)

Consists of four stages:

1-Prophase
2-Metophase
3-Anaphase
4-Telophase

Thank you