Composition of The cell

The Chromosome

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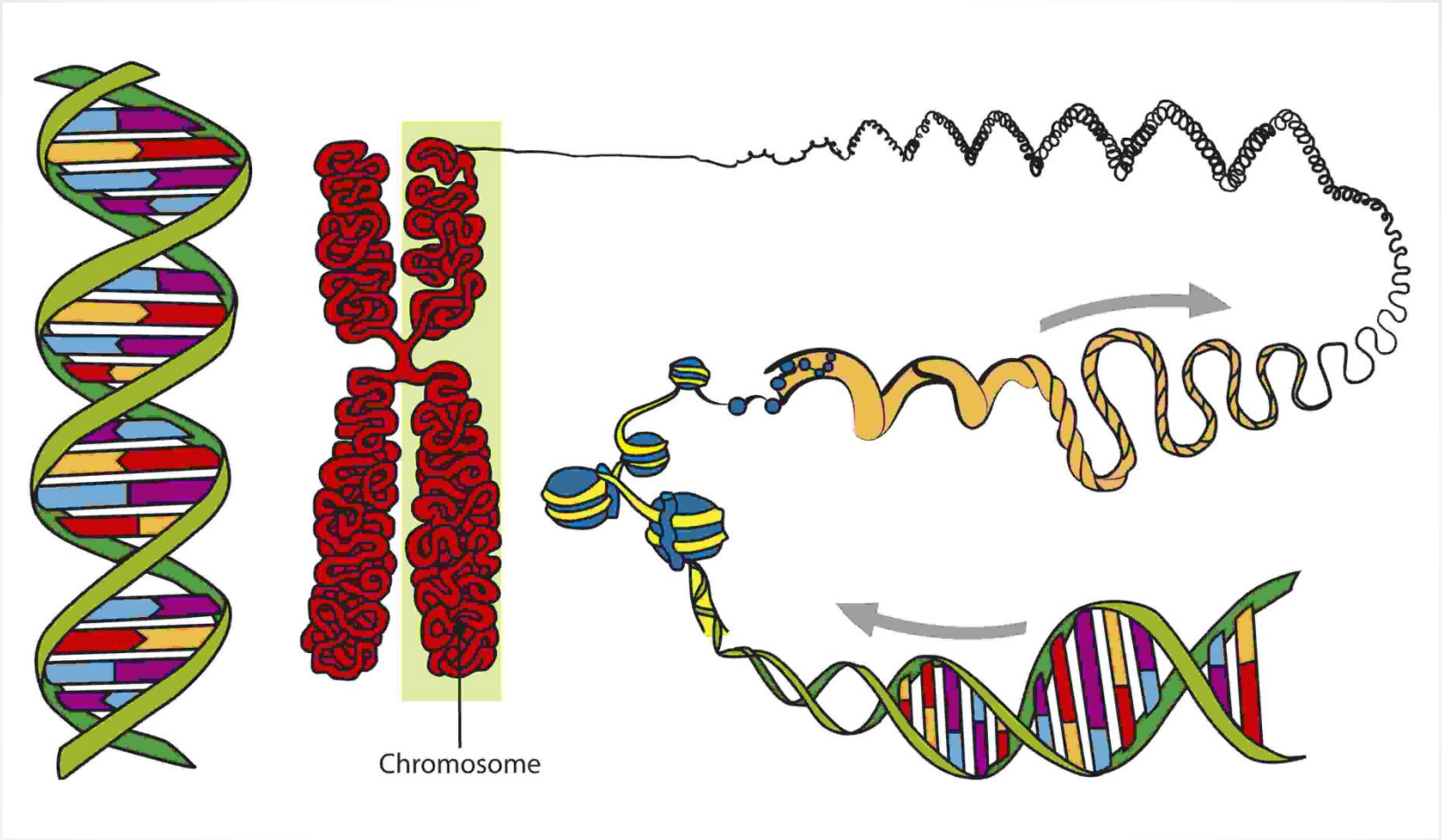
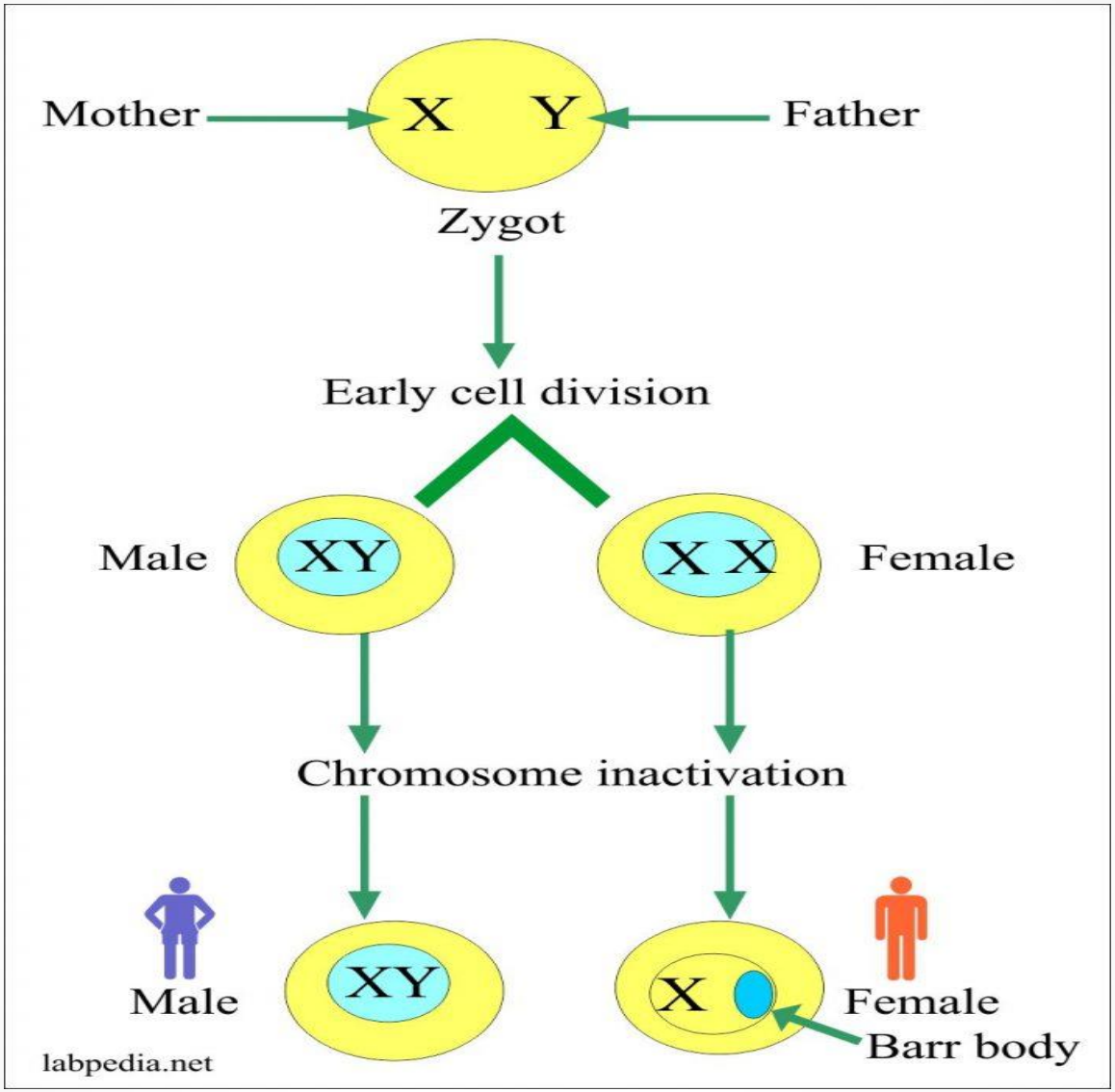
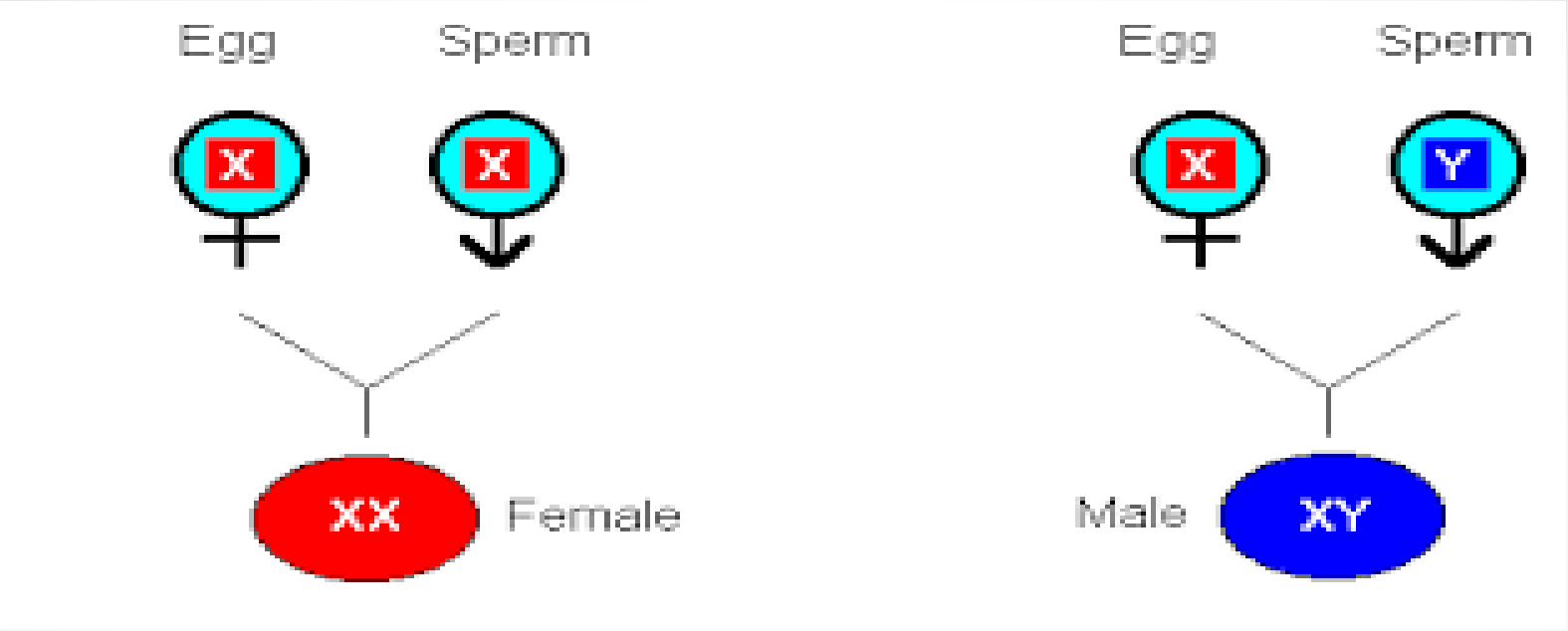
Chromosome

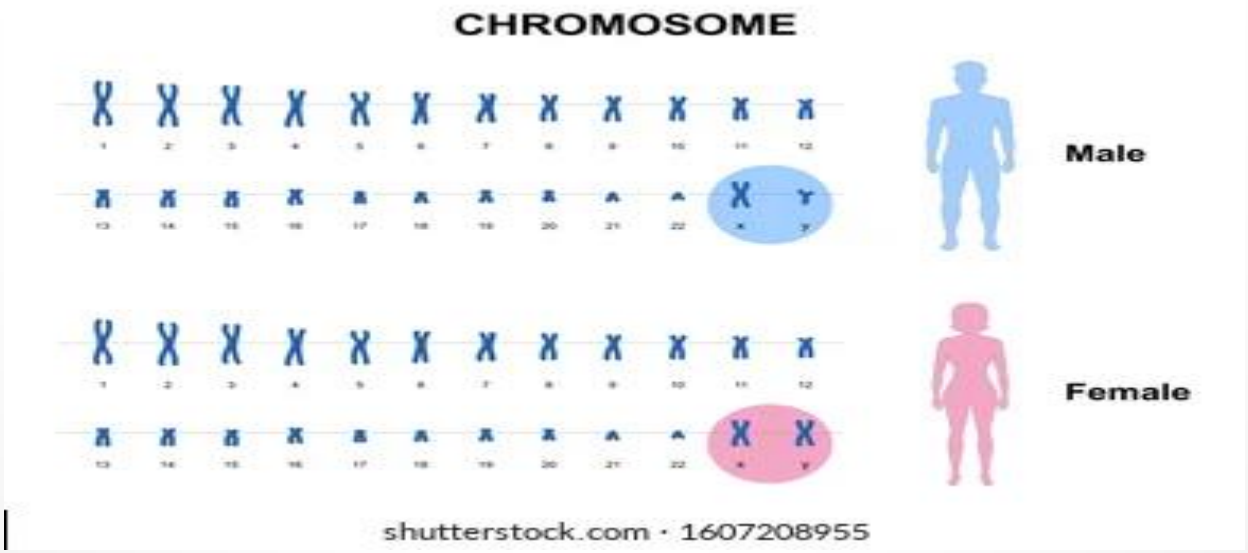
- A **chromosome** is a long DNA molecule with part or all of the genetic material of an organism. Most eukaryotic chromosomes include packaging proteins called histones which, aided by chaperone proteins, bind to and condense the DNA molecule to maintain its integrity These chromosomes display a complex three-dimensional structure, which plays a significant role in transcriptional regulation.


Chromosome

- **Chromosomes,** the most highly condensed form of chromatin, are visible during mitosis. To form chromosomes
- The human cells contain 46 chromosomes , 44 (the somatic chromosomes), the other pair (sex chromosomes) consists of dissimilar chromosomes (XY) in males and similar ones (XX) in females.
- In females, only one X chromosome is active the inactive X chromosome is often visible as a clump of heterochromatin termed sex chromatin , or the Barr body.


Mother
X
Y
Father
Zygot
Early cell division
Male
XY
X X
Female
Chromosome inactivation
Male
XY
X
Female
Barr body
labpedia.net


Egg
Sperm
X
X
XX
Female
Egg
Sperm
X
Y
Male
XY


CHROMOSOME
Male
Female
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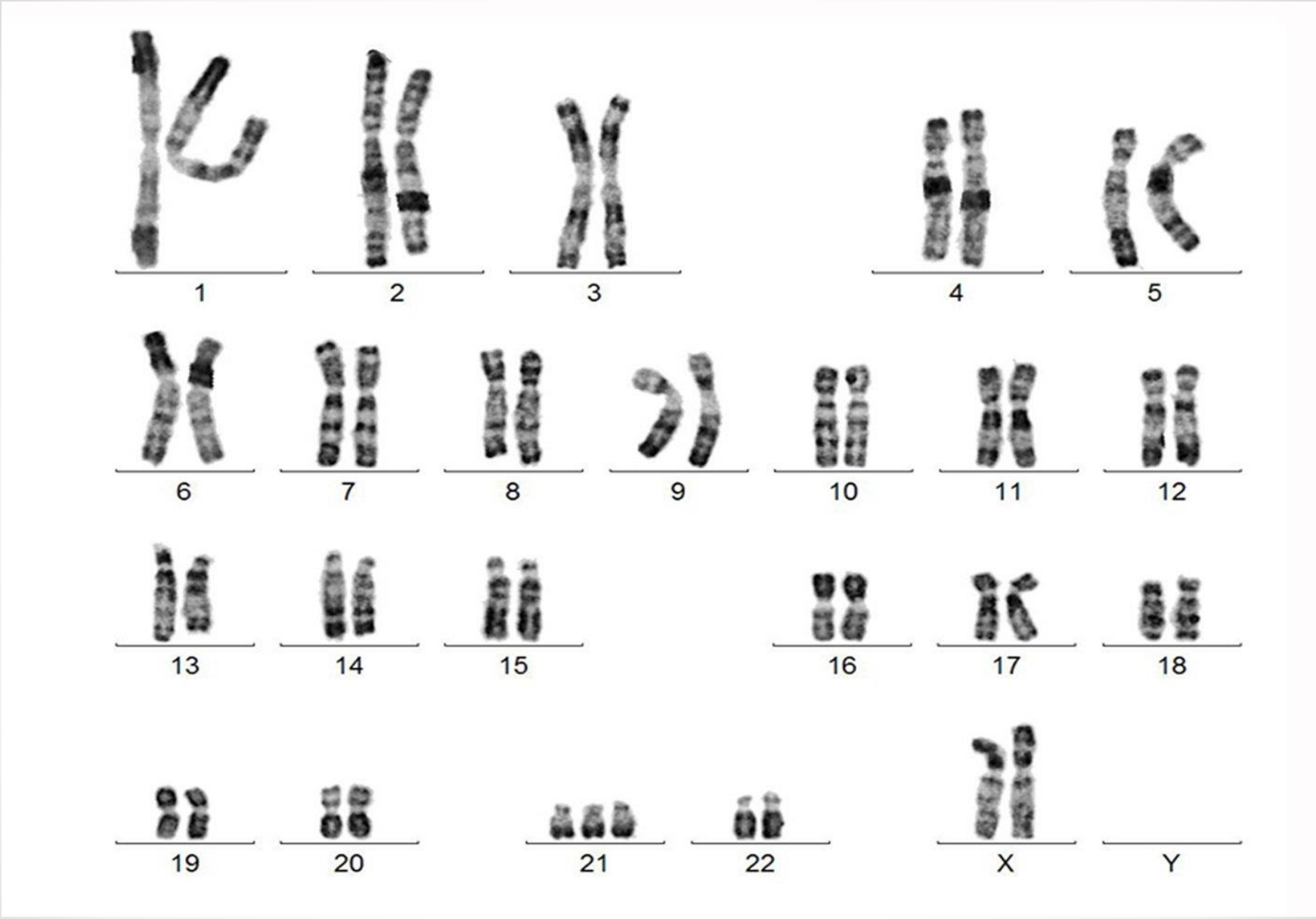
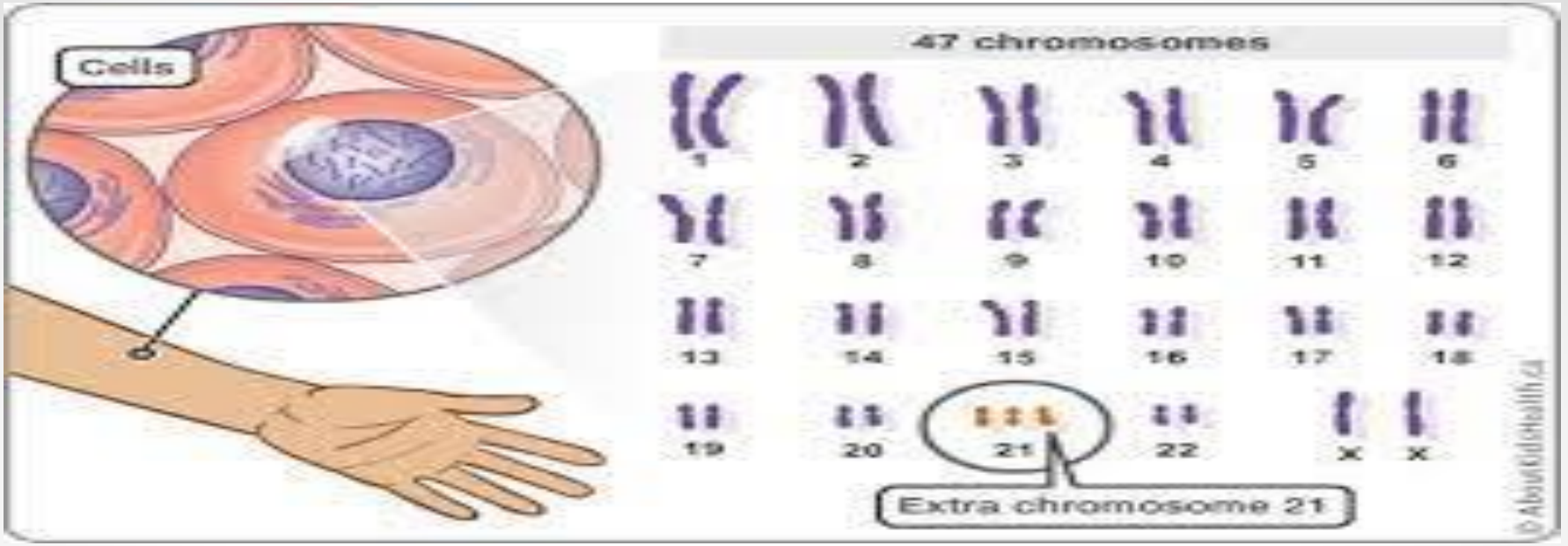
Karyotyping :

- A cell's karyotype is a picture of its chromosomes arranged by chromosome type . Preparing such a picture is called karyotyping. Cells in culture are stimulated to enter mitosis with phytohemagglutinin (a mitogen) .
- The dividing cells are treated with colchicine to arrest them in metaphase , when the chromosomes are highly coiled and visible. Lysis of the cells with a hypotonic solution causes the chromosomes to spread out on the slide with little or no overlapping .


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
X
Y

- The chromosome spread is photographed, and pictures of the chromosomes are cut out, paired, and assembled into a specific sequence. Karyotyping allows cataloging of chromosomes for detection of structural abnormalities and deleted or excess chromosomes.
- **Down syndrome** : is a condition in which a child is born with an extra copy of their 21st chromosome — hence its other name trisomy 21 . This causes physical and mental developmental delays and disabilities.



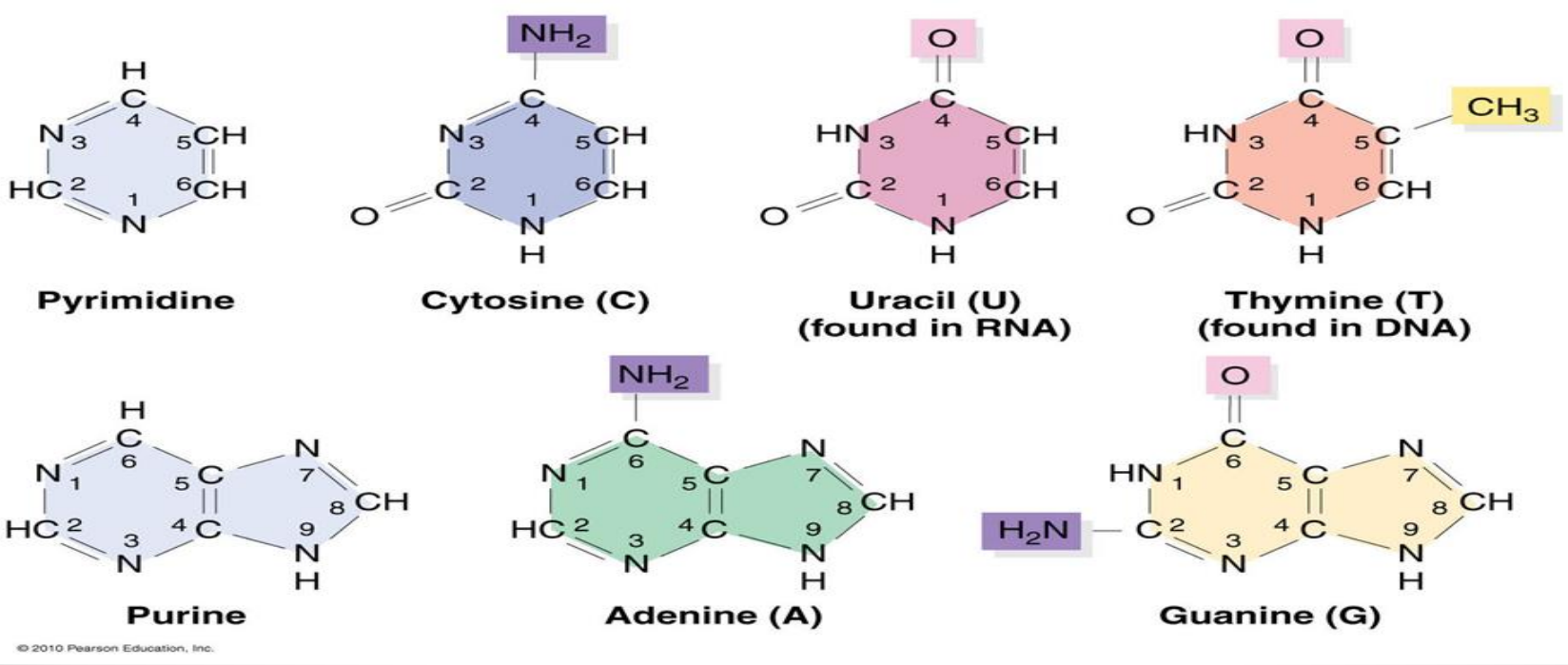
Down syndrome

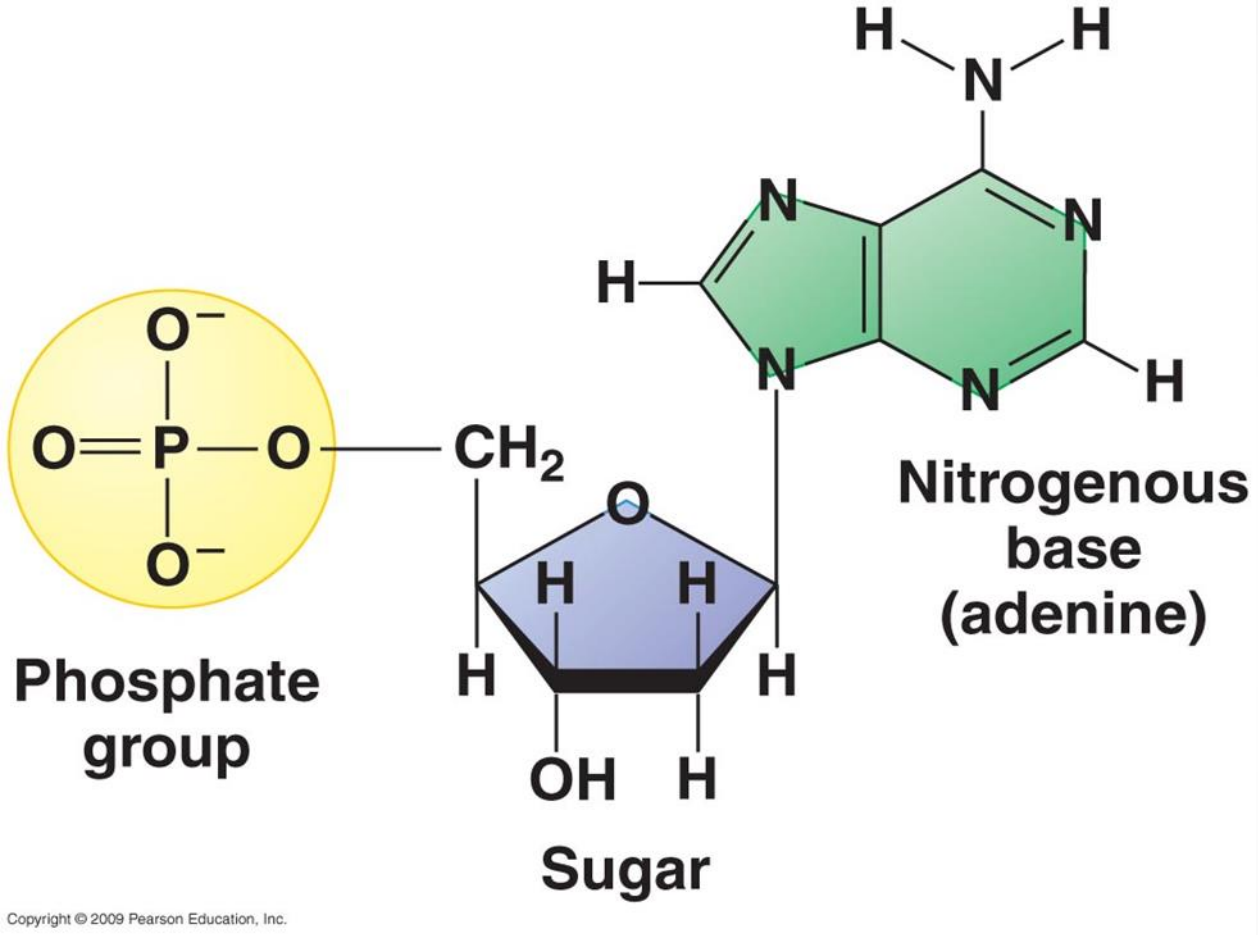
Nucleic acids structure

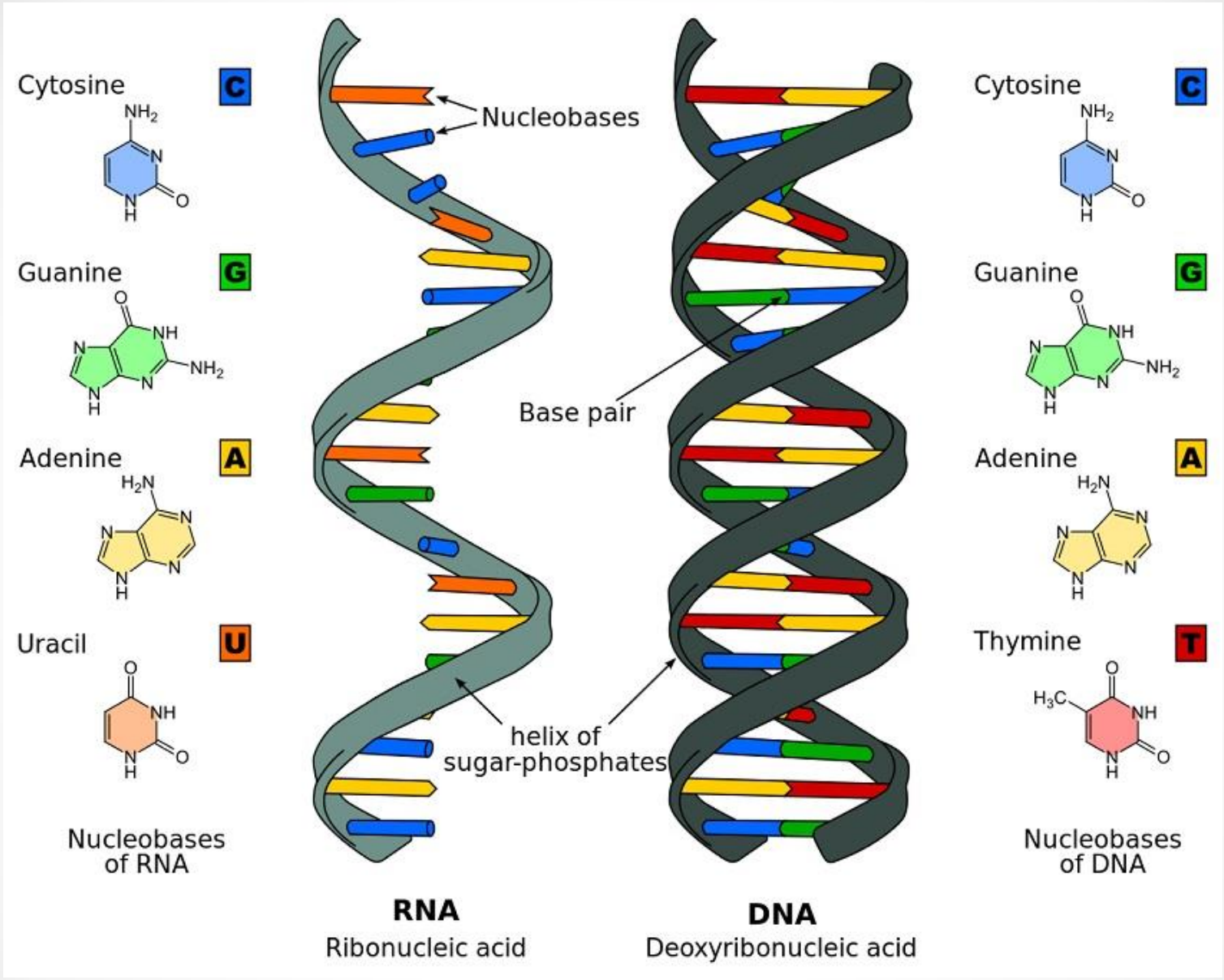
- Nucleic acids are large polymers consisting of repeating nucleotide units.
- Each nucleotide contains one phosphate group, one pentose or deoxy-pentose sugar , and one purine or pyrimidine base.
- In DNA the sugar is D-2-deoxyribose; in RNA the sugar is D-ribose.
- In DNA the purine bases are adenine (A) and guanine (G), and the pyrimidine bases are thymine (T) and cytosine (C).

- in RNA the purine bases are adenine (A) and guanine (G), and the pyrimidine bases are Uracil (U) and cytosine (C).
- The repeating structure of polynucleotides involves alternating sugar and phosphate residues, with phosphodiester bonds linking the 3'-hydroxyl group of one nucleotide sugar to the 5'-hydroxyl group of the next nucleotide sugar.
- A purine or pyrimidine base is linked at the 1'-carbon atom of each sugar group and projects from the repeating **sugar-phosphate backbone.**

- dsDNA is helical , and the two strands in the helix are antiparallel. The double helix is stabilized by hydrogen bonds between purine and pyrimidine bases on the opposite strands.






Cytosine
C
Guanine
G
Adenine
A
Uracil
U
Nucleobases of RNA
Nucleobases
Base pair
helix of sugar-phosphates
RNA
Ribonucleic acid
DNA
Deoxyribonucleic acid
Cytosine
C
Guanine
G
Adenine
A
Thymine
T
Nucleobases of DNA

Peroxisomes

- Peroxisomes (microbodies) are self replicating organelles (can divide or undergo fission) that contain more than 40 oxidative enzymes (urate oxidase ; catalase ; D-amino acid oxidase).

- They are small (0.2 – 1.0 μ) spherical or ovoid membranous organelles that present in almost all animal cells and function in catabolism long chain fatty acids (Beta oxidation) forming acyle coenzyme A (CoA) and H2O2.


Peroxisome
Lipid bilayer
Enzymes
Crystalline core
Transport protein
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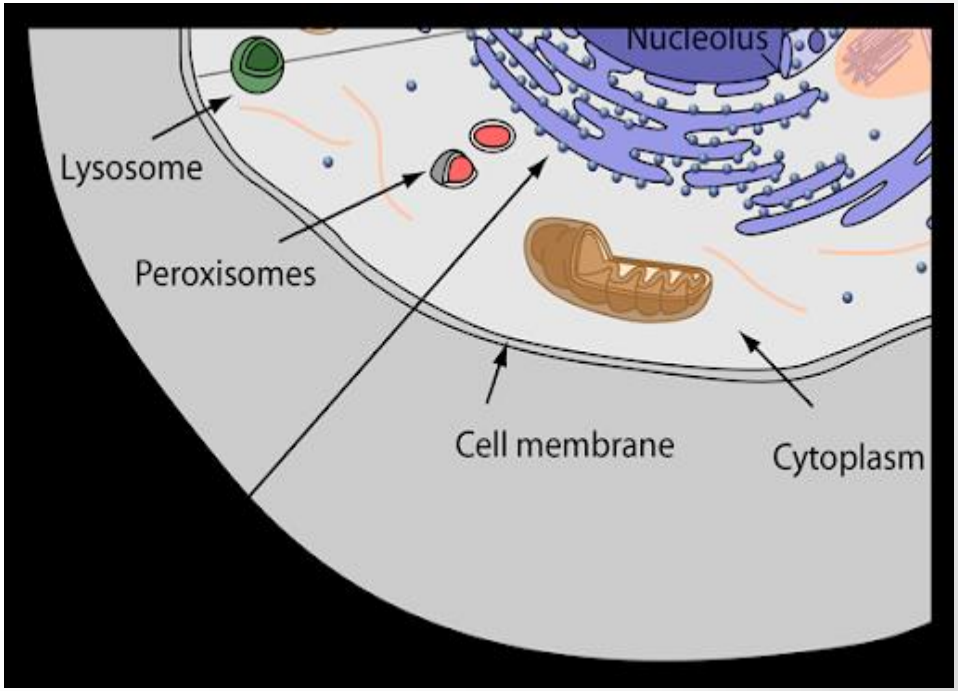
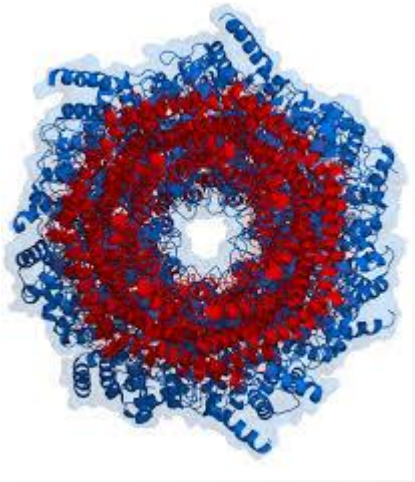

Nucleolus
Lysosome
Peroxisomes
Cell membrane
Cytoplasm

Proteasomes

- Proteasomes are small organelles composed of protein complex that are responsible for proteolysis of mal-formed

- The process of cytosolic proteolysis is controlled by the cell, and it requires that the protein be recognized as a potential candidate for degradation.



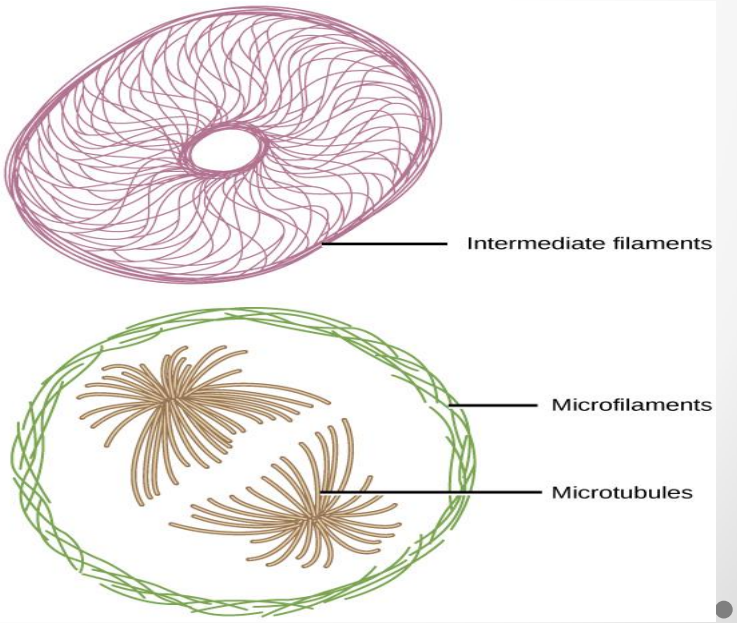
Cytoskeleton

- They are meshwork of protein filaments responsible for maintenance of cellular morphology, and participate in cellular motion .
- The cytoskeleton has three major components;

1- Thin filaments

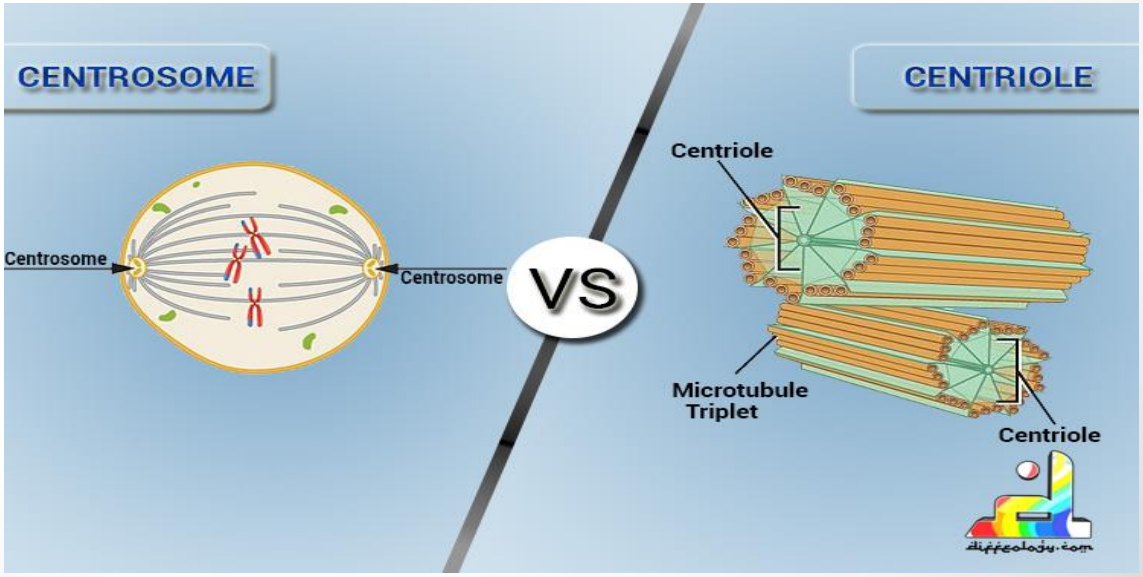
2- Intermediate filaments

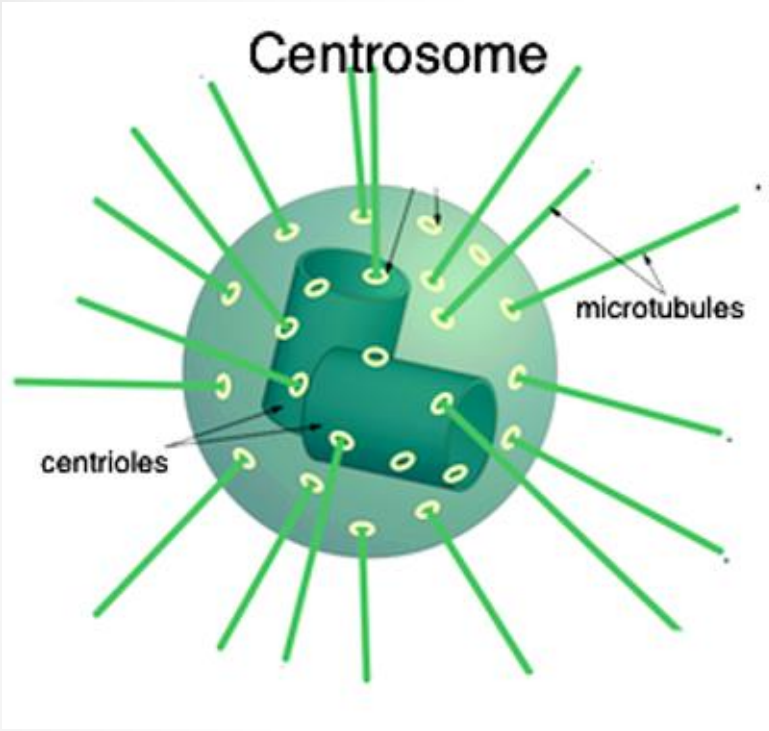
3- Microtubules

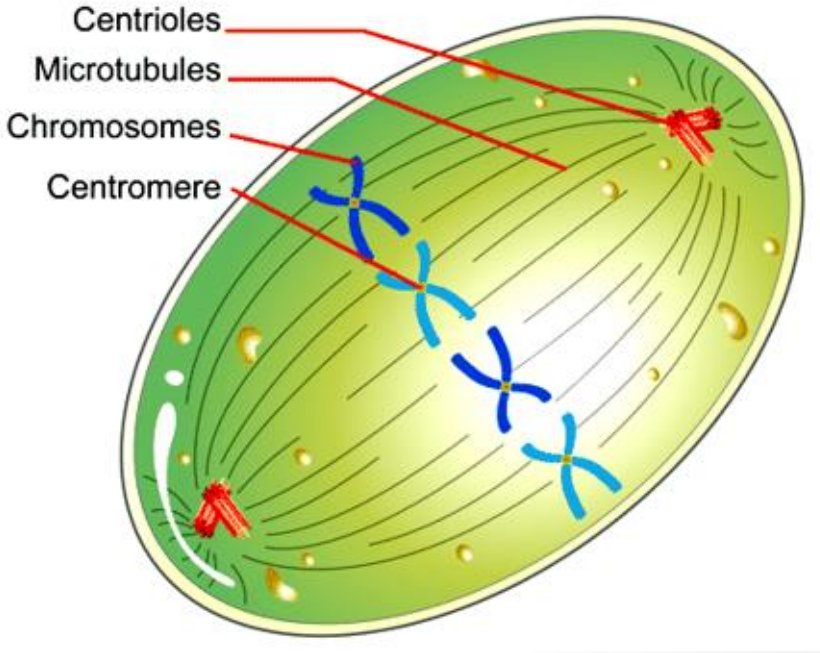


Centromere and Centrioles

- **Centromere** occurs in all eukaryotic cells. The number of **centromeres** in the cell equals the number of chromosomes.
- **Centrioles** are tube like structures that aid in cell division. ... The **centrioles** help in the formation of the spindle fibres that separate the chromosomes during cell division (mitosis).




Centrosome
microtubules
centrioles


Centrioles
Microtubules
Chromosomes
Centromere

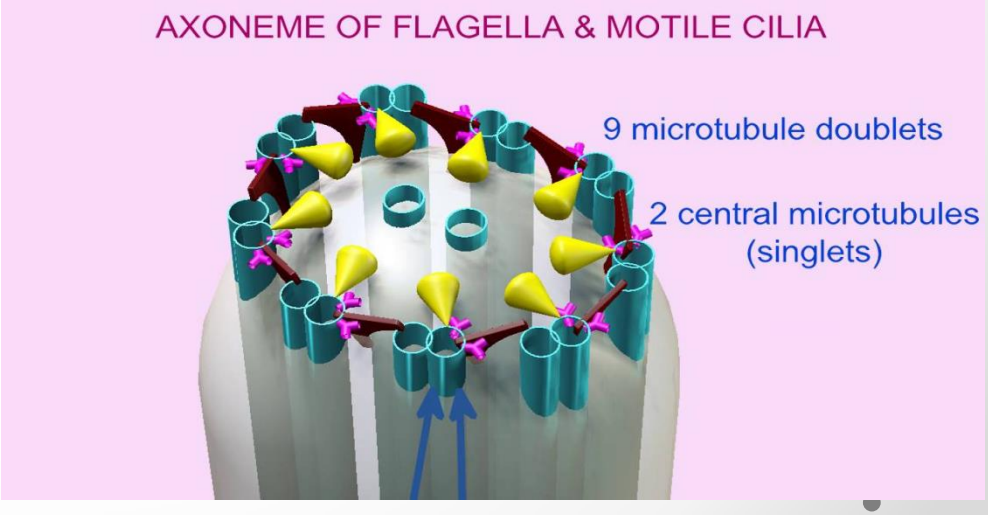
Cilia and Flagella

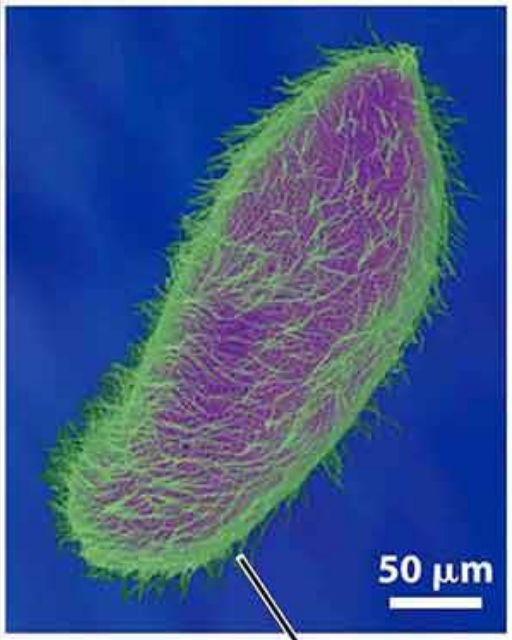
- are complex filamentous cytoplasmic structures protruding through a cell wall. They are minute, especially differentiated appendices of the cell.
- Flagella (singular = flagellum) are long, hair-like structures that extend from the plasma membrane and are used to move an entire cell.
- Cilia (singular = cilium) are short, hair-like structures that are used to move entire cells (such as paramecia) or substances along the outer surface of the cell

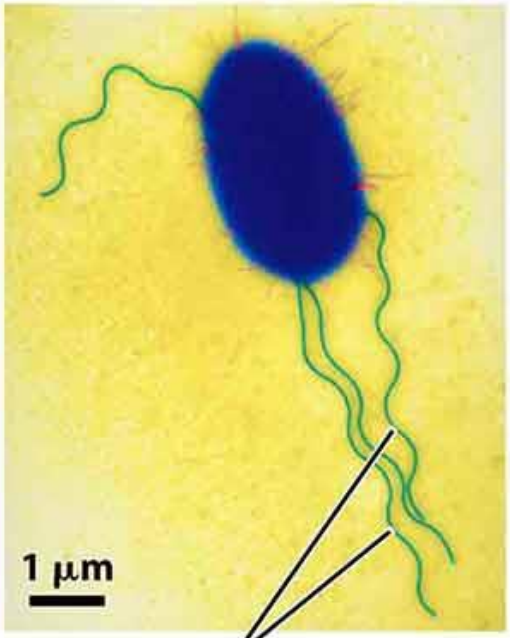
for example

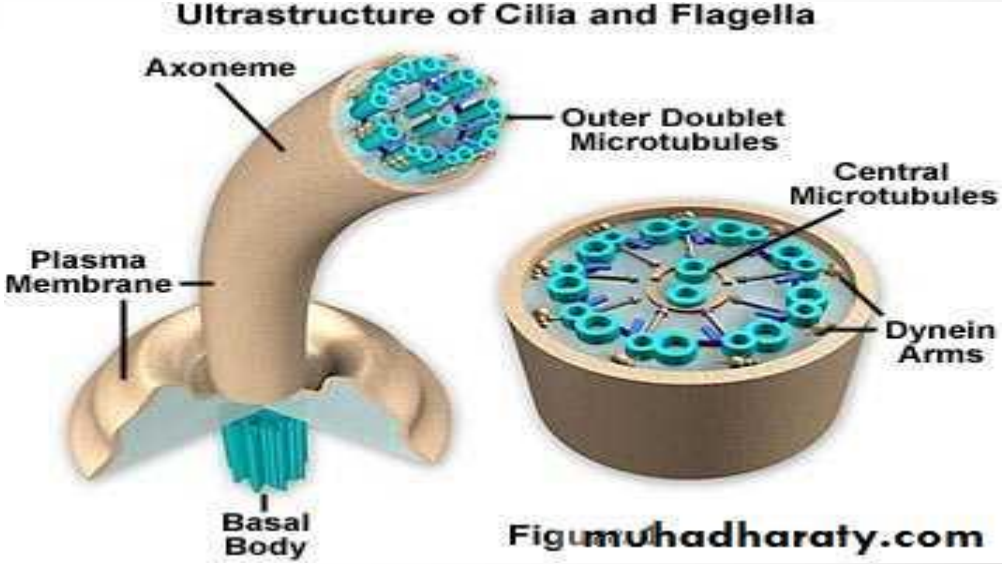
- the cilia of cells lining the Fallopian tubes that move the ovum toward the uterus , or cilia lining the cells of the respiratory tract that trap particulate matter and move it toward the nostrils).
- Generally, cilia are shorter than flagella (<10 μm compared to >40μm).
- Cilia are present on the surface of the cell in much greater numbers (ciliated cells often have hundreds of cilia but flagellated cells usually have a single flagellum).

- Both cilium and flagellum composed of the same core organization **(axoneme)**.
- The axoneme is formed of 9 pairs (doublets) and 2 central (singlet) microtubules.
- At the base of cilia or flagella there is a basal body, which is similar to centriol in structure.




50 µm
Cilia


1 µm
Flagella


Ultrastructure of Cilia and Flagella
Axoneme
Outer Doublet Microtubules
Central Microtubules
Plasma Membrane
Dynein Arms
Basal Body
muhadharaty.com


Thank You