

# Biology

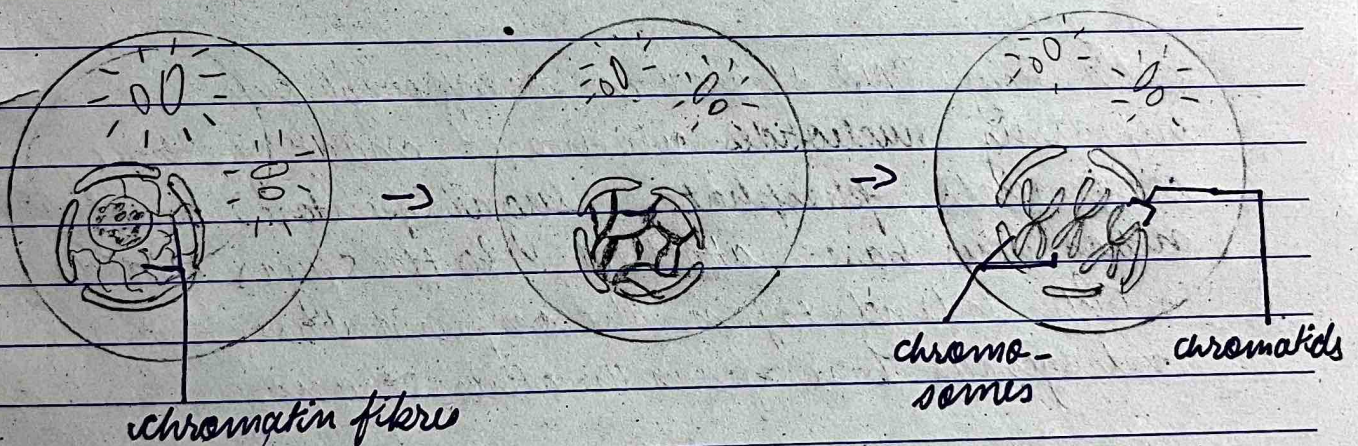
CH: Structure of Chromosomes, Cell Cycle and Cell Division

Chromosomes are highly coiled, ribbon-like structures formed by the condensation of chromatin fibres during cell division.

Chromosomes contain one long DNA molecule associated with many proteins. This complex of DNA and proteins is called the chromatin.

Literal meaning of Chromosome: chromosomes (chroma: coloured, soma: body)

Chromosomes in animals were first studied in 1882 by a German scientist Walter Flemming.



Condensation of chromatin fibres into chromosomes during cell division. (Mitotic prophase phase)

## Chromatin

made up of fibre which is formed of two substances:

1. DNA - 40%
2. Histones - 60%

### (i) Molecular structure of DNA

The shape of the DNA molecule was first studied by Rosalind Franklin.

The structure was finally worked out by Watson and Crick.

Single DNA molecule is very large hence described as macromolecule.

composed of two ~~are~~ complementary strands which are wound around each other in a double helix.

Each single DNA strand is composed of repeating nucleotides which are made of three components, phosphate, sugar (pentose) and nitrogenous base. Attached to the sugar inwards which intends to join the complementary nitrogenous base from the other strand.

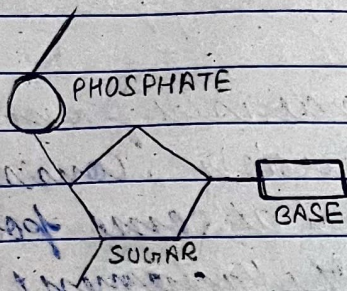
### Nitrogenous Base

Purines

Pyrimidines

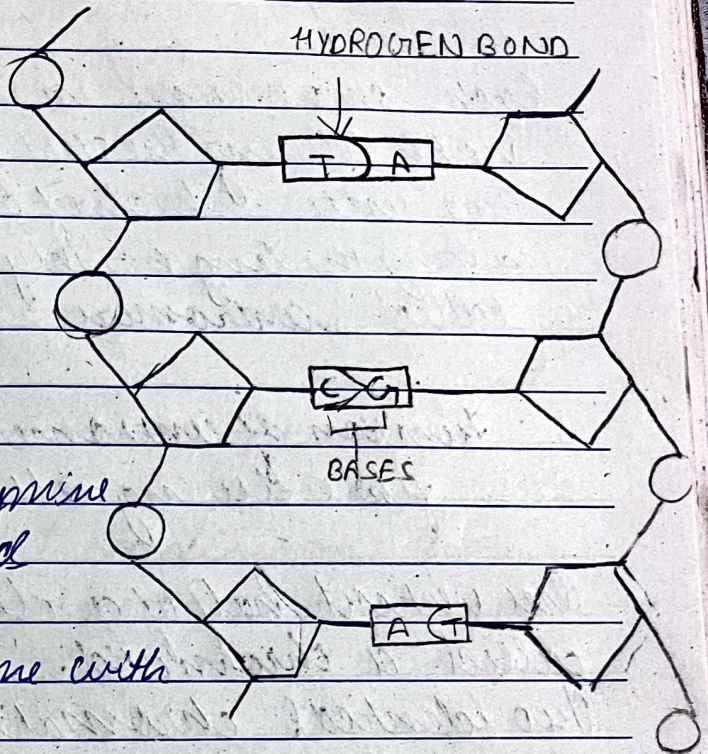
adenine (A) guanine (G)

Thymine (T) Cytosine (C) Uracil (U)



The basic structure of a nucleotide

- Adenine pairs with Thymine with 2 Hydrogen bonds
- Guanine pairs with Cytosine with 3 Hydrogen bonds



2 parallel strands of a part of DNA

## (ii) Histone proteins

Histones are the proteins that help in the coiling and packaging of DNA into structural units called nucleosomes

DNA strand winds around a core of eight histone proteins (histone octamer). Each such complex is called nucleosome

## Structure of chromosomes.

Each chromosome in its condensed form is visible during the start of cell division, consists of two sister chromatids joined at some point along the length. This point of attachment is called centromere.

~~Function of centromere: attach to the spindle fibre during cell division.~~

One vertical half of a duplicated chromosome is called a chromatid.

Two identical chromatids that are joined by a centromere are called sister chromosomes.

## Function of centromere:

- It serves to attach the centromeres with spindle fibres during cell division.
- It also helps to detach the sister chromatids of a chromosome during the anaphase stage.

## Genes -

Genes are specific sequences of nucleotides on a chromosome that encode particular proteins which are expressed in the form of some particular feature of the body.

- They are the units of heredity which are transferred from parents to offspring and are responsible for some specific characteristics of the offspring.

## Need for new cells

1. For growth:
2. For replacement
3. For repair
4. For reproduction.

## Cell Cycle

Cell cycle is a series of events that take place in a cell leading to the duplication of its DNA and subsequent division of the cell to produce two daughter cells.

A cell cycle has two phases

a non dividing phase  
- interphase

a dividing phase  
- M-phase or mitosis

## Interphase

Two daughter cells produced from a mother cell are relatively small with a full size nucleus but relatively little cytoplasm. These cells are said to be in interphase.

• In this phase they prepare for next cell division and grow to same size as their mother cell.