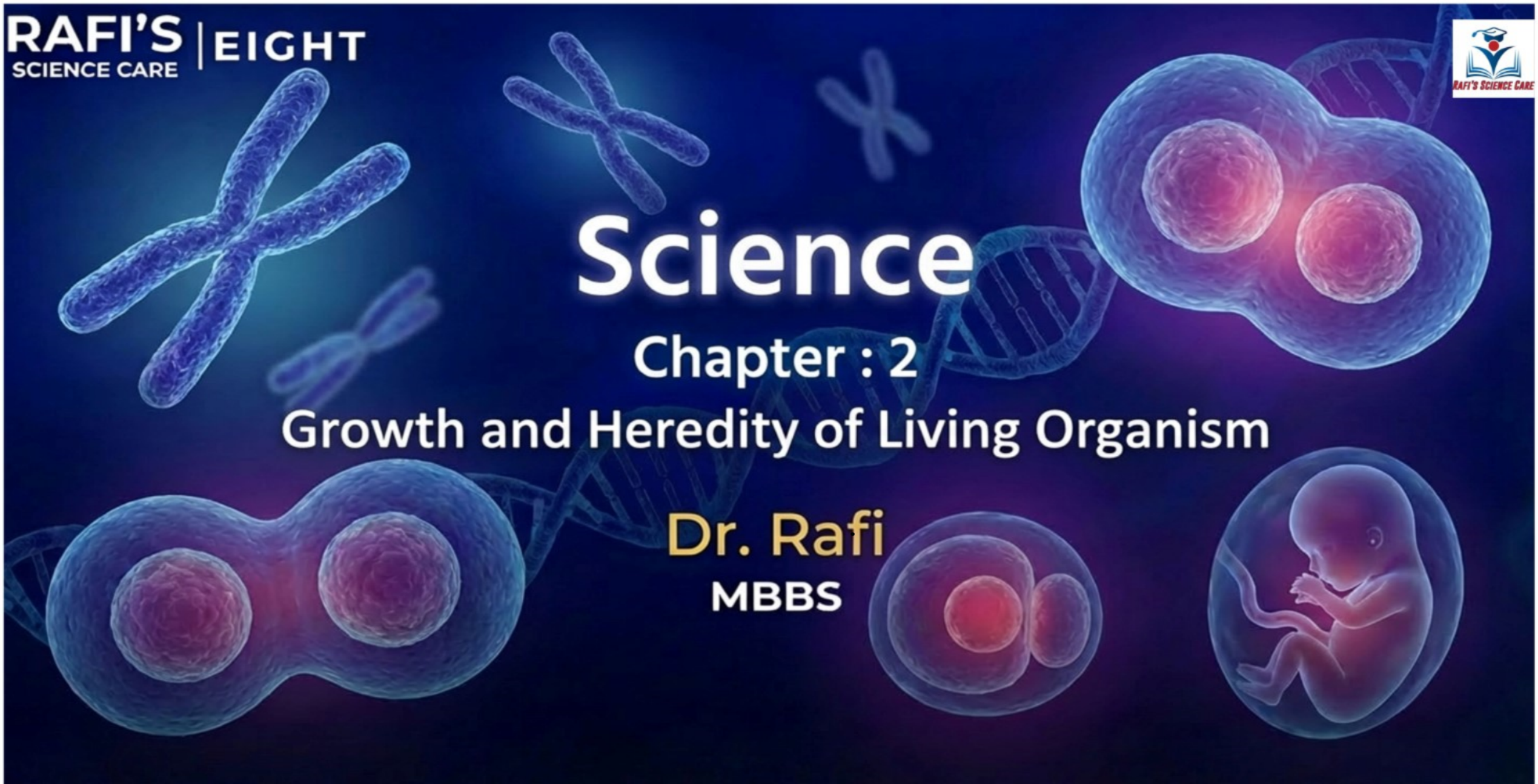
RAFI'S SCIENCE CARE | EIGHT



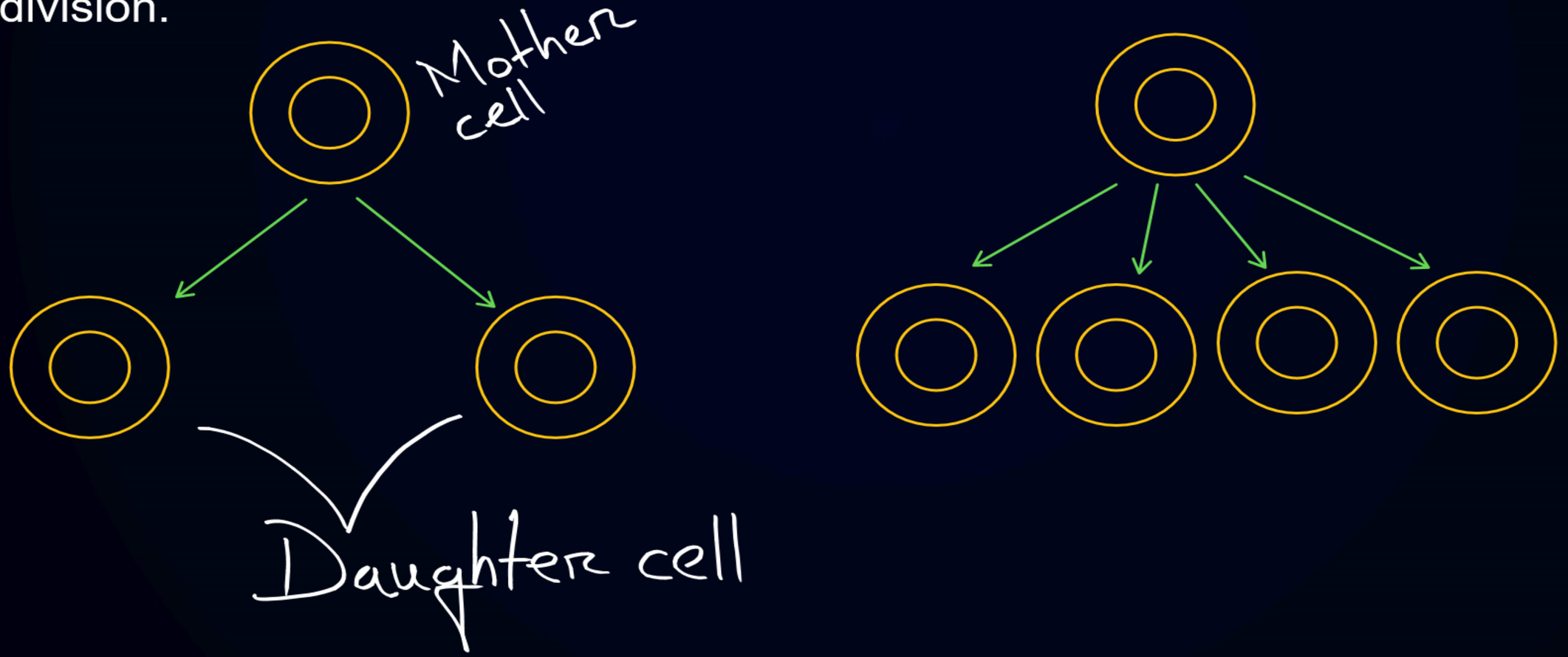
# Science

## Chapter : 2

## Growth and Heredity of Living Organism

Dr. Rafi
MBBS

The process by which a mother cell divides to form two or four daughter cells is called cell division.



# Types of Cell Division



a, an, ab

Cell Division

## Amitosis

a → absent
mito → thread
osis → process

→ Direct division

## Mitosis

mito → thread
osis → process

→ Equational division

## Meiosis

↓
to reduce

→ Reductional division

# Which division occurs where?



## Amitosis

- Bacteria
- Blue green algae
- Yeast
- Amoeba
- Fungi (Some)

## Mitosis

Plant

- Apex of root & stem
- New leaves
- Plumule
- Radicle

- Buds

Animal

- Somatic cell

## Meiosis

- Reproductive mother cell

Plant

- In anther
- In ovule

Animal

- Testis
- Ovary

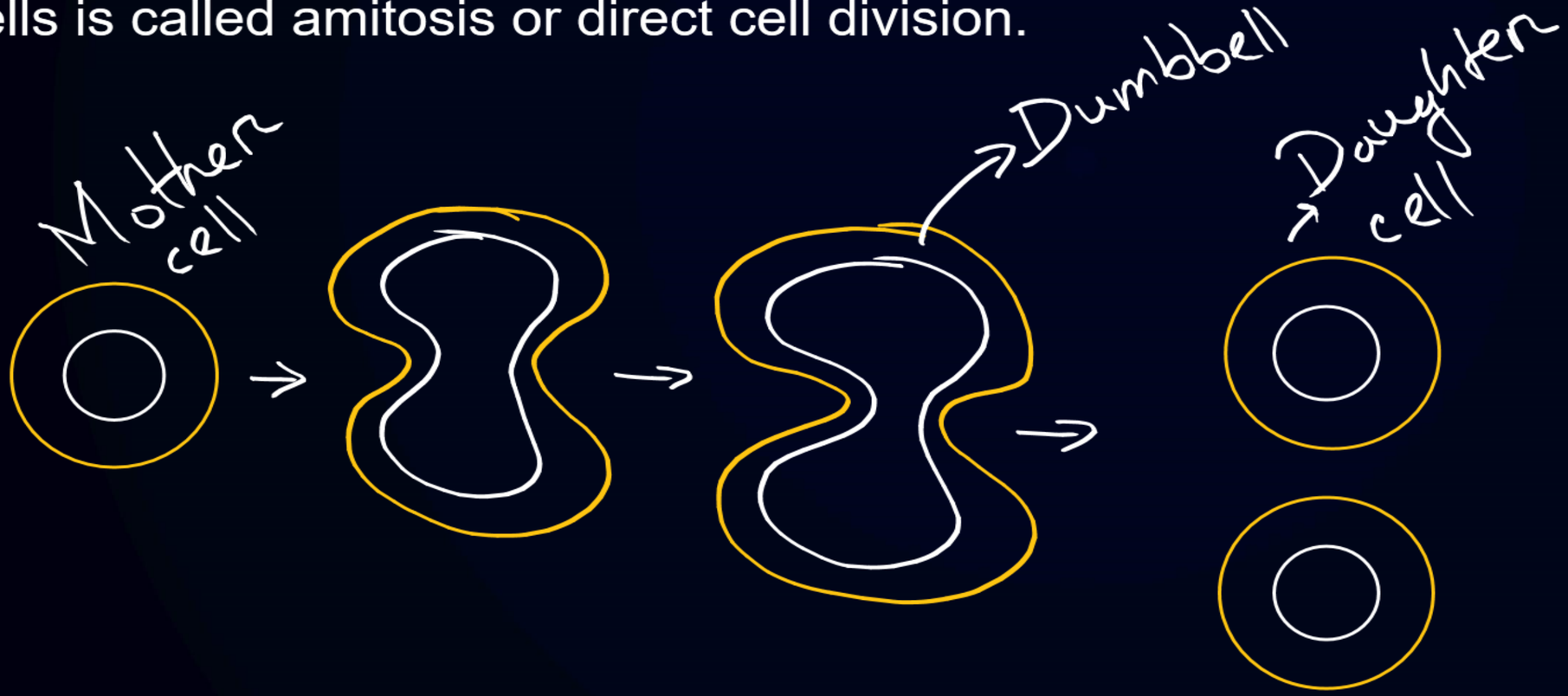
# Where doesn't cell division occur?

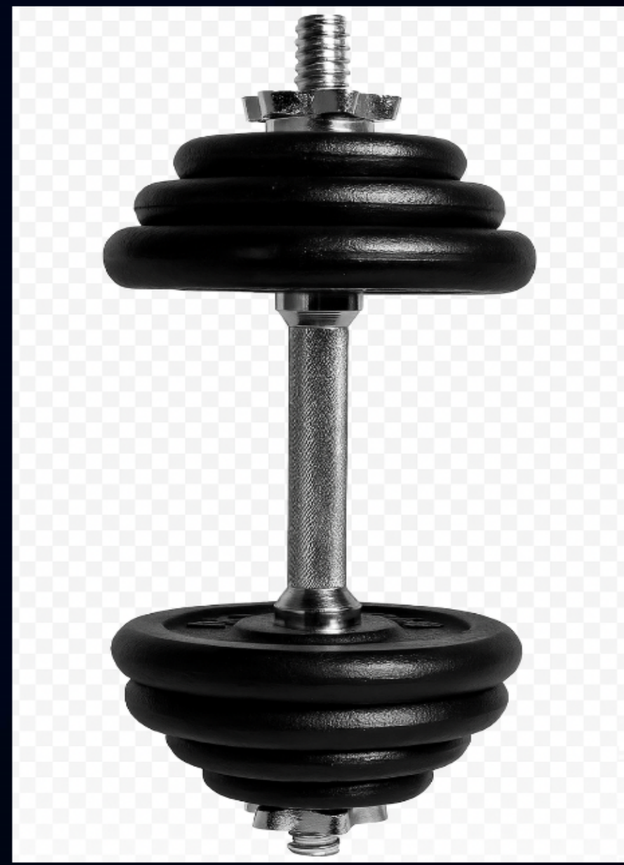


- Neuron
- Mature RBC
- Platelet
- Cells of permanent tissue of plant

# Amitosis

The cell division process in which a mother cell directly divides to form two daughter cells is called amitosis or direct cell division.



In which division does the nucleus assume a dumbbell shape? [Comilla Board 2018]

a) Bud

b) Grass root

c) Fungus ✓

d) Stem

In which organism does cell division occur by amitosis method?[J. B. 17, S. B. 16]

a) Human

b) Hydra

c) Amoeba ✓

d) Earthworm

Where doesn't amitosis occur? [D. B.15]

a) In yeast

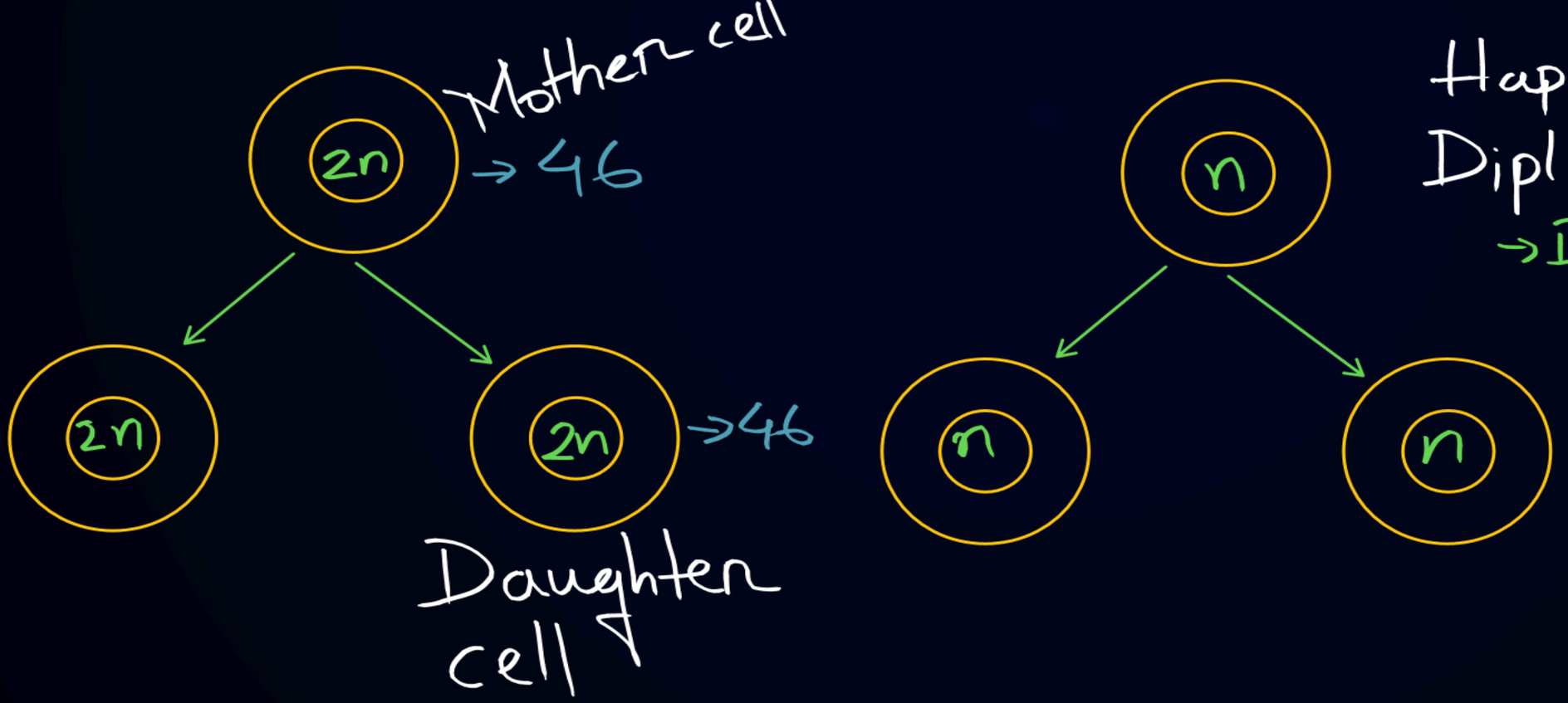
b) In amoeba

c) In fungi

d) In virus

# Mitosis

The cell division process in which a mother cell divides to form two daughter cells of the same size and characteristics is called mitosis cell division.

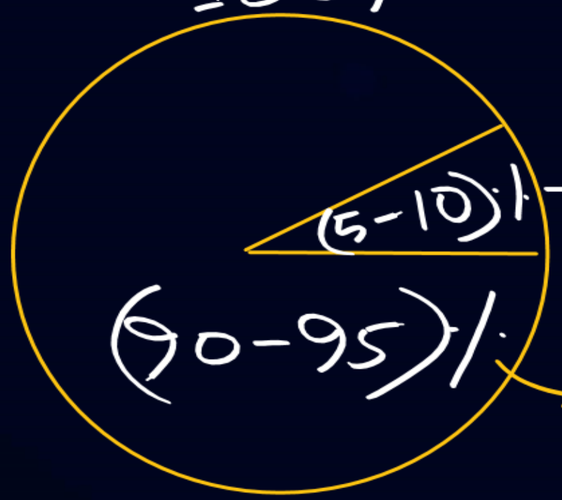



Haploid → Hapla → Single

Diploid

→ Diplo → Double

100% → Cell cycle [ Mitosis phase + Interphase

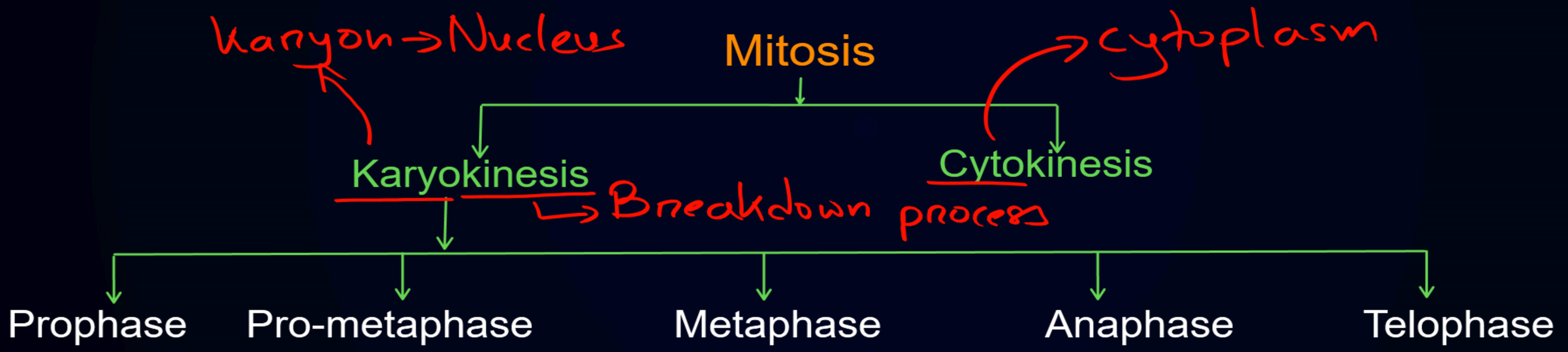



(5-10)% → Mitosis phase / Divisionphase

(90-95)% → Interphase / Preparational phase

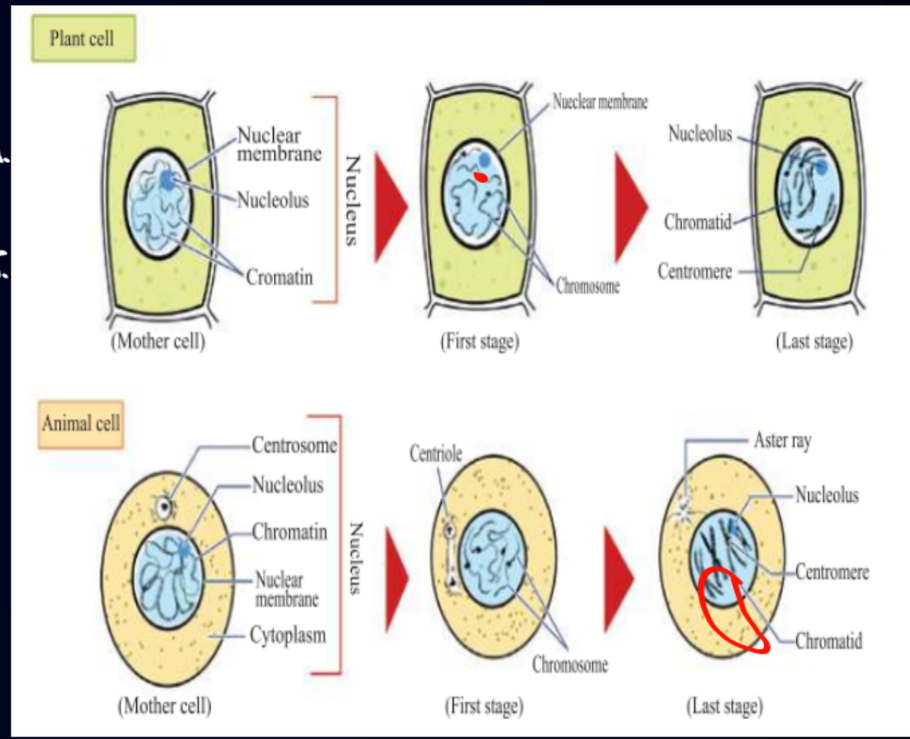
# Stages of Mitosis

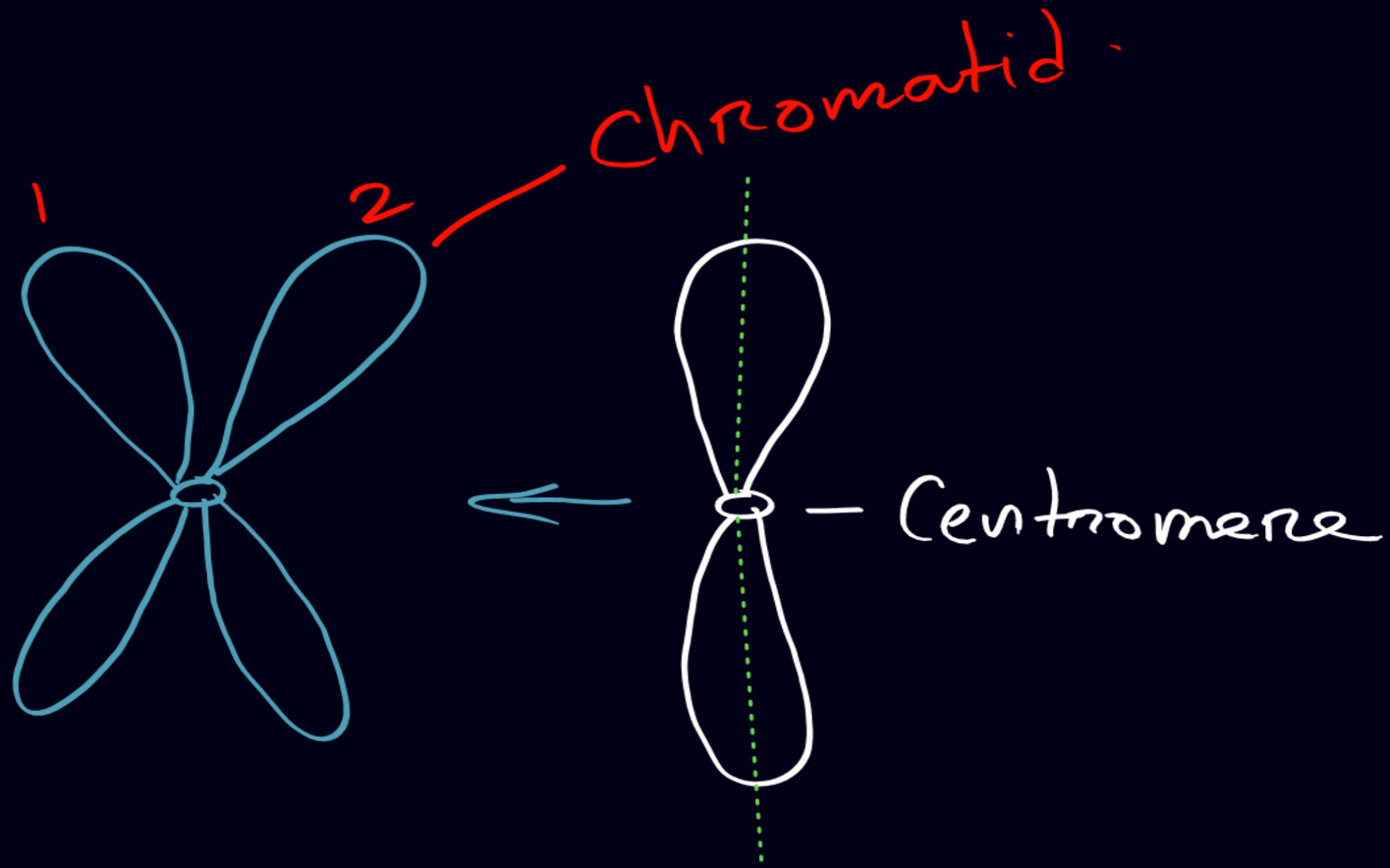




⇒ It is the longest phase.

- The of the nucleus will be increased.
- Reduction of water from chromosome.
- Chromosomes will be shorter & thicken.
- Each chromosome divide longitudinally to form to chromatids except the centromere.

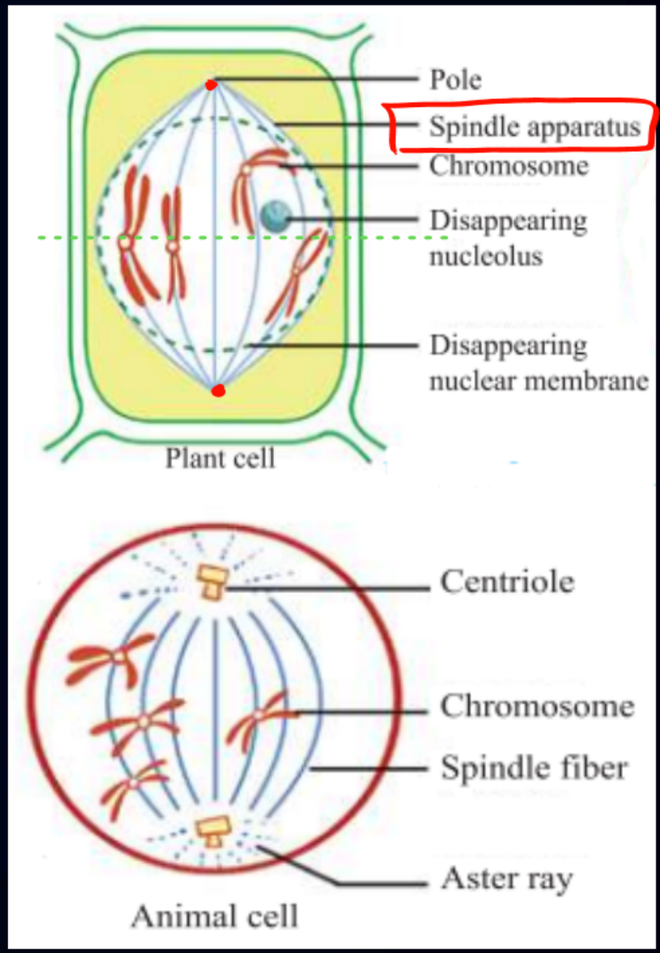



1
2
Chromatid
Centromere

# Pro-metaphase

⇒ It is the shortest phase.

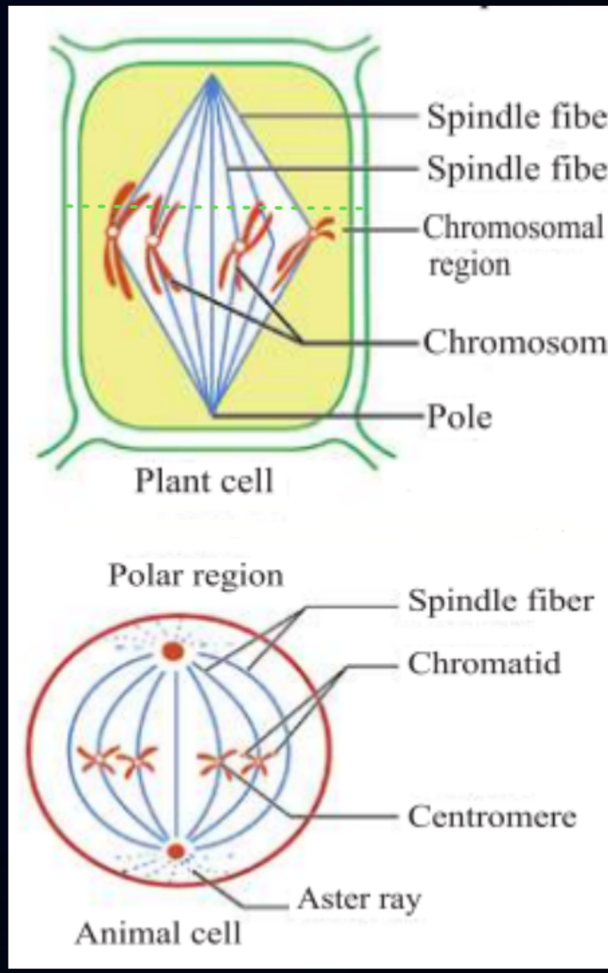
- Formation of spindle apparatus
- The spindle fibre with which chromosomes remain attached is called traction fibre or chromosomal fibre.
- Nucleolus & nuclear membrane begin to disappear.



- In animal cell centrioles will remain at two poles & helps in cell division, it also emits astar rays from the poles

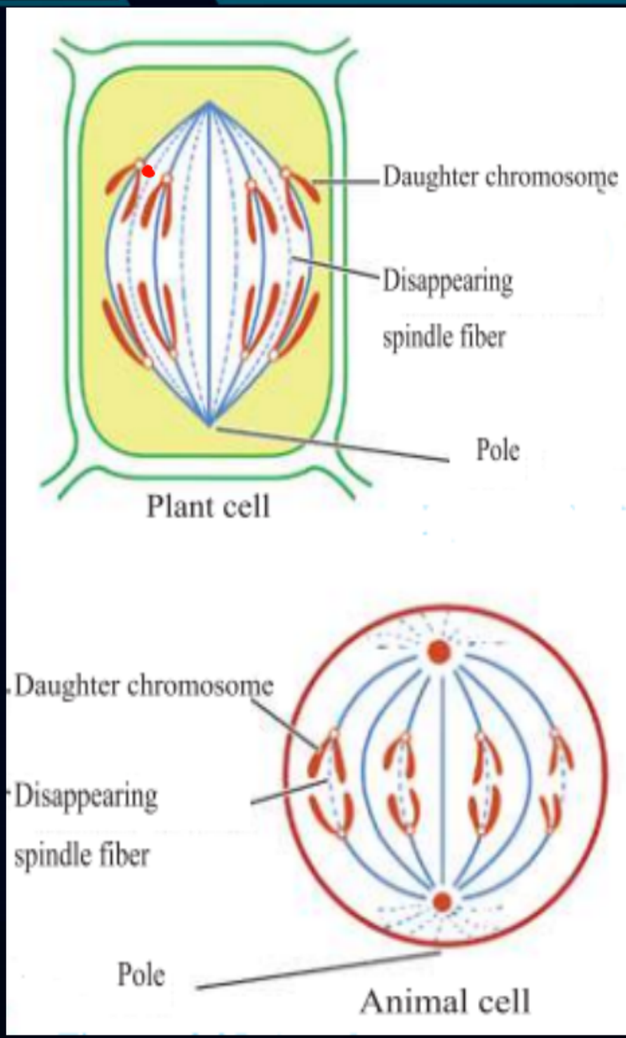
# Metaphase

- All the chromosomes will be at the equator. → Metakinesis
- Chromosomes will be shortest & thickest.
- Nucleolus & nuclear membrane will be completly disappeared
- Division of centromere starts.



# Anaphase

- Centromere will be completely divided to form to daughter chromosomes.
- Daughter chromosomes start to move towards to opposite poles.
- During the movement of Daughter chromosomes, the shape will

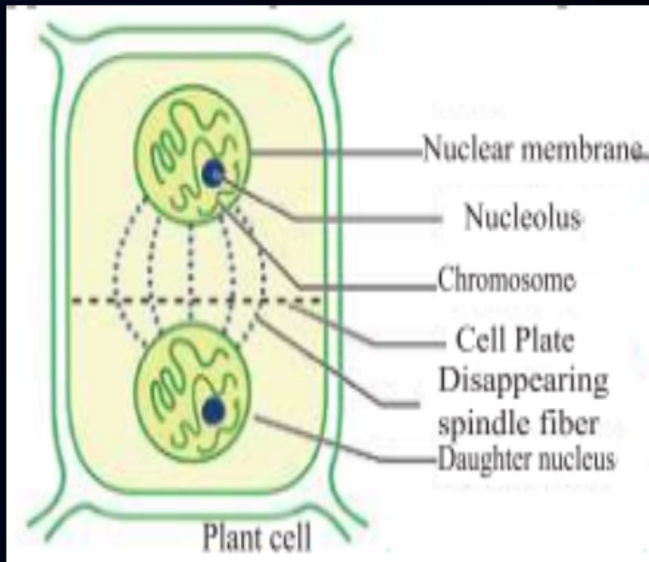


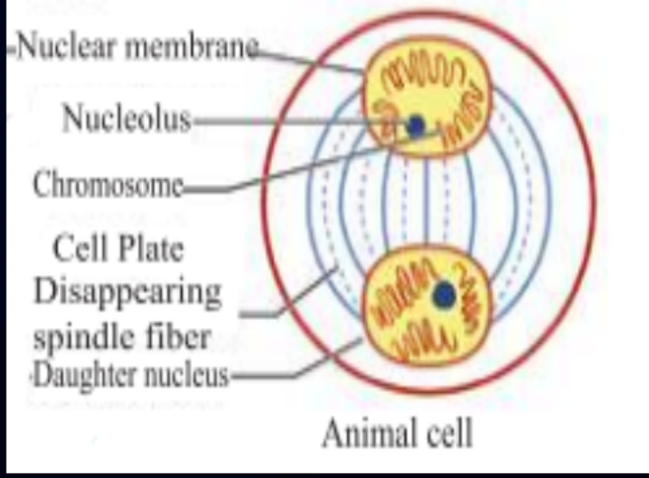
be like English letters V, L, J & I and these be named respectively as metacentric, submetacentric, acrocentric & telocentric.

V L J I ⇒ Telocentric

Metacentric Sub-metacentric Acrocentric

- All the chromosome will reach at two opposite poles.
- Rehydratio of chonosomes.
  addition of water.
- All the chromosomes will be longer & thinner.
- Sindle apparatus will be disappeared



- Nucleolus & nuclear membrane will reappear.
- Formation of two daughter nucleus.

# Cytokinesis



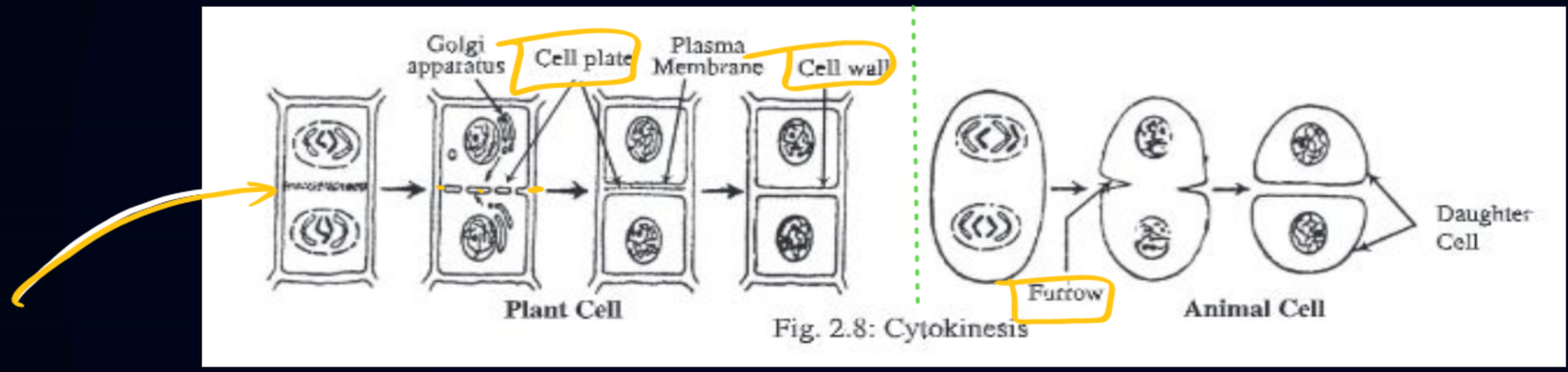
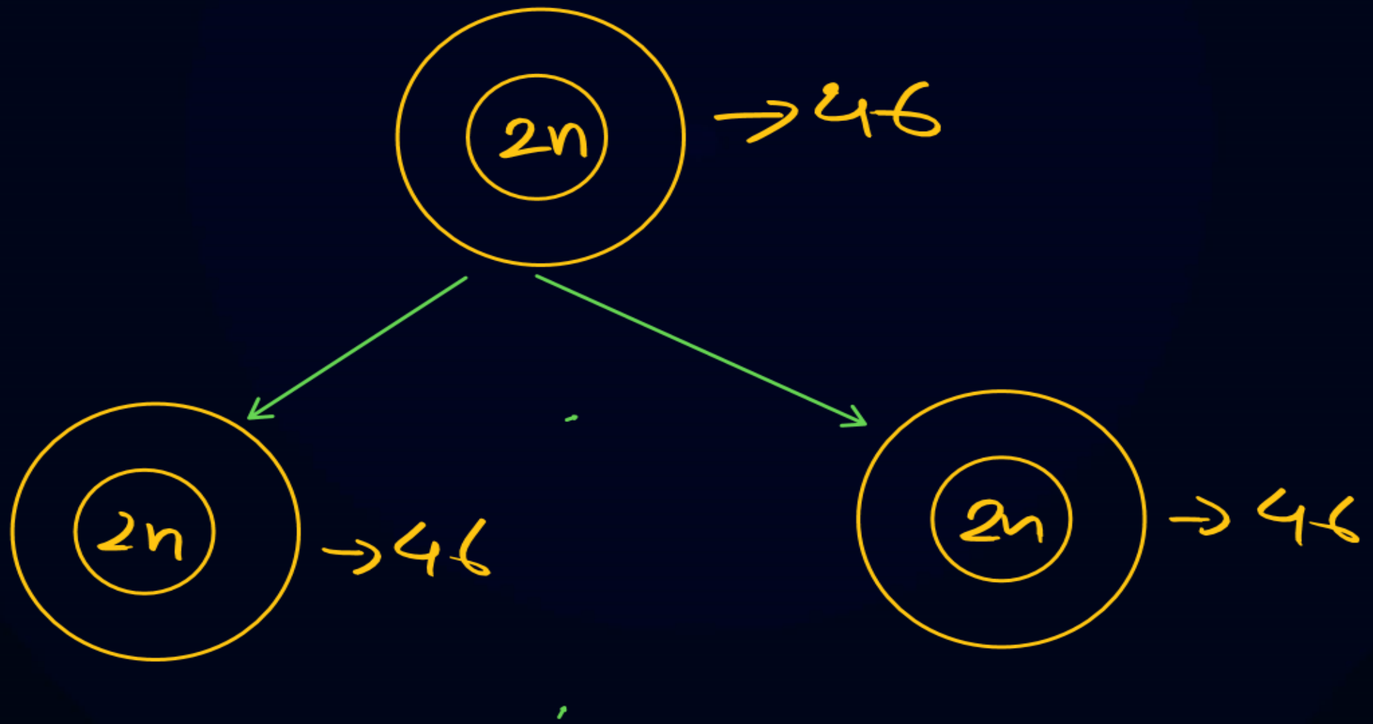



Fig. 2.8: Cytokinesis

# Equational division





# Importance of Mitosis



1. Builds body structure and promotes physical growth
2. Carries out reproduction (in unicellular and primitive organisms) → Asexual
3. Creates reproductive organs and increases the number of reproductive cells
4. Maintains specific shape and size
5. Keeps chromosome number constant
6. Performs regeneration of cell.
7. Heals wounds/fills damaged areas
8. Creates tumors
9. Causes cancer

> Uncontrolled mitosis.

Which stage of mitosis cell division is short-lived? [C.B.19]

a) Prophase

b) Pro-metaphase ✓

c) Metaphase

d) Anaphase

In which stage of mitosis is the spindle apparatus formed? [R.B. 15,17]

a) Prophase

b) Pro-metaphase

c) Metaphase

d) Anaphase

In which stage of mitosis division are daughter chromosomes created?[R.B 16,18 ,D.B 17 ]

a) Prophase

b) Pro-metaphase

c) Metaphase

d) Anaphase ✓

In which stage does the centromere of chromosomes divide into two parts? [B. B.18]

a) Prophase

b) Metaphase

c) Anaphase ✓

d) Telophase

In which phase of cell division does the nucleus size increase? [R.B.16]

a) Prophase ✓

b) Pro-metaphase

c) Metaphase

d) Telophase

By which method does cytokinesis occur in animal cells?

a) Meiosis

b) Spore formation

c) Cleavage

d) Budding

✓ Funnowing

Which occurs first in mitosis division?

a) Cell plate formation ✗

b) Nuclear reticulum formation ✗

c) Creation of spindle apparatus ✓

d) Disappearance of nucleolus ✗

The stage before the start of mitosis division process is-

a) Prophase

b) Interphase

c) Anaphase

d) Metaphase

"Anik was observing cell division in an onion root with the help of a microscope. In one phase of cell division, he saw the chromosomes exactly in the middle of the cell and they were shortest and thickest." [Ctg.B.15]

→ Metaphase

In the next phase of Anik's observed phase-

→ Anaphase

i. Chromosomes separate from centromere ✗
ii. Chromatids separate from each other ✓
iii. Centromere divides into two parts ✓

Which is correct?

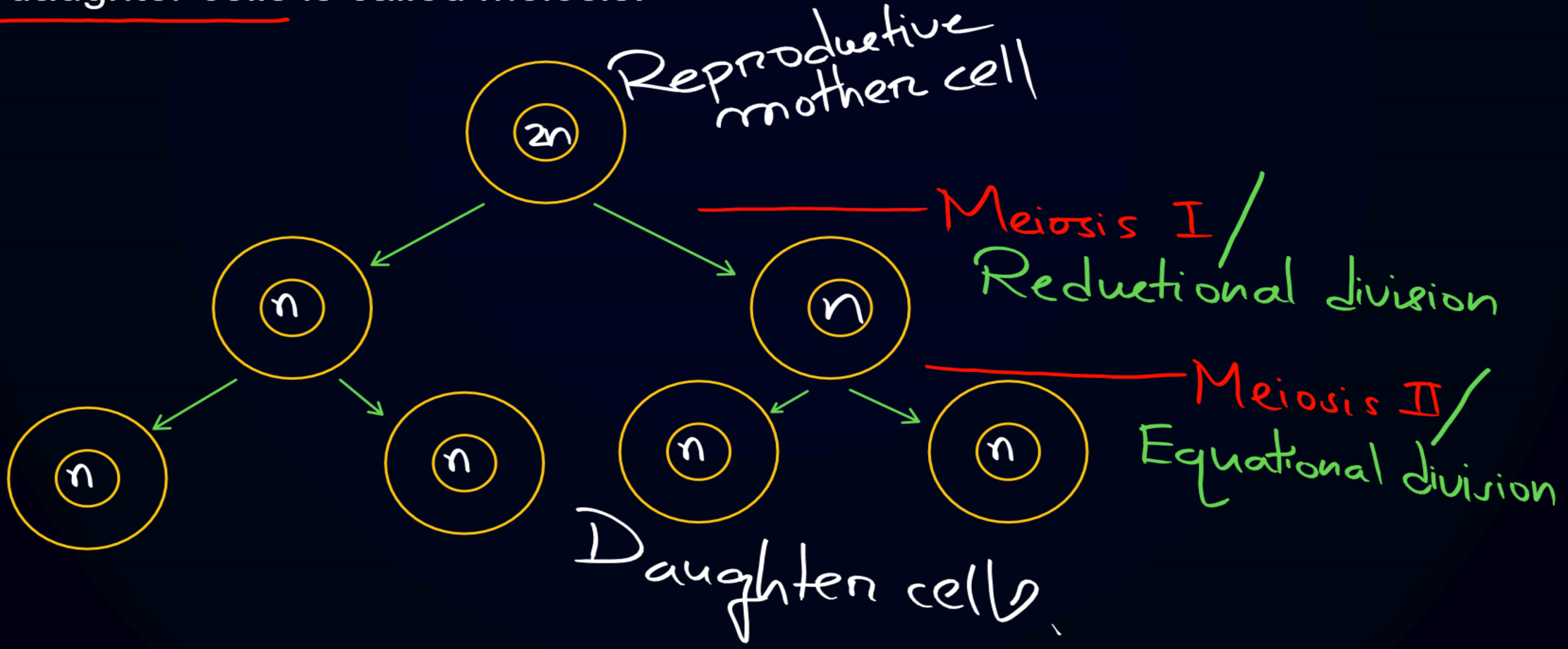
a) i and ii

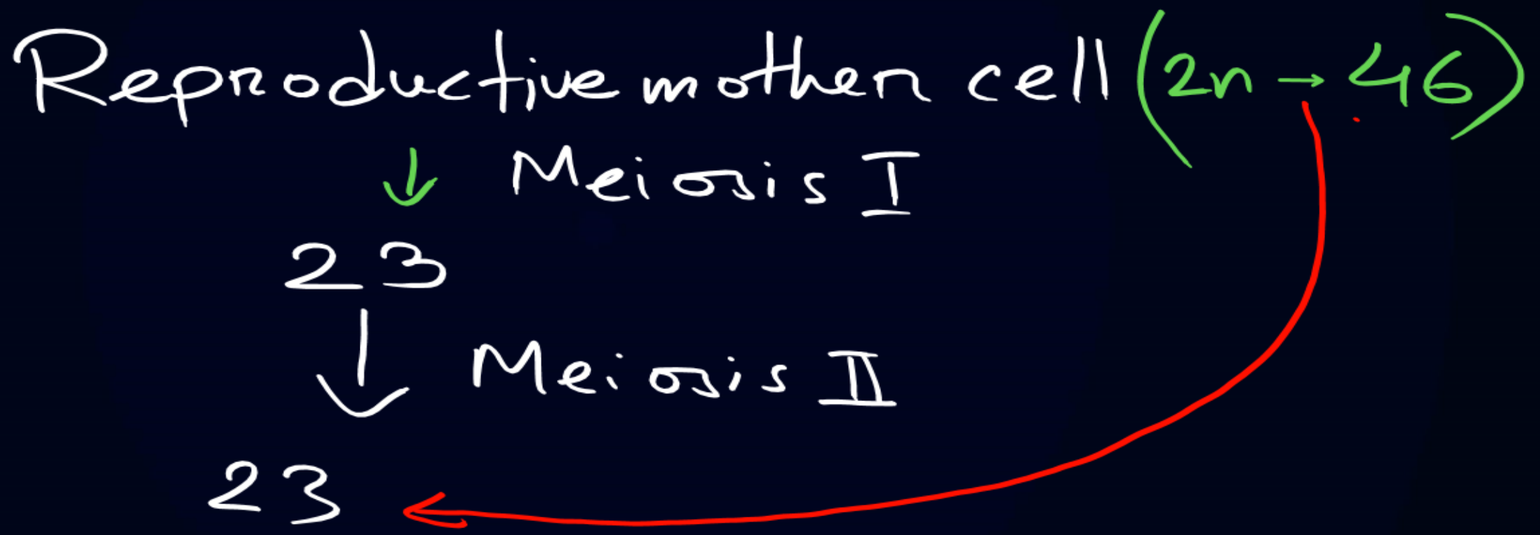
b) i and iii

c) ii and iii ✓

d) i, ii and iii

The cell division process in which one diploid mother cell divides to produce four haploid daughter cells is called meiosis.




Reproductive mother cell (2n → 46)
Meiosis I
23
Meiosis II
23

# Importance of Meiosis



Sperm (23) + Ovum (23)
Fertilization
46

1. Maintains the constant chromosome number of the species.
2. Maintains the continuity of hereditary characteristics.
3. Essential for sexual reproduction.
4. Creates genetic diversity.
5. Ensures the survival of species.
6. Helps in evolution.
7. Can explain Mendel's laws.

# Differences between Mitosis and Meiosis



| Points of Difference | Mitosis | Meiosis |
|---|---|---|
| 1. Where it occurs | Somatic cell | Reproductive mother cell |
| 2. Nuclear division and chromosome division | 1 time.<br>1 time | 2 times.<br>1 time. |
| 3. Number of daughter cells | 2 | 4 |
| 4. Number of chromosomes in daughter cells | same as mother cell | Half of mother cell |
| 5. DNA synthesis | Interphase | Prophase-I |
| 6. Interphase stage | Long | short |

At which stage of division does the chromosome number in daughter cells become half of the mother cell's chromosomes? [J.B.17]

a) Meiosis-I

b) Meiosis-II

c) Pro-metaphase

d) Telophase

Which is a characteristic of meiosis cell division? [M.B.19]

a) It occurs in body cells

b) It is equational division

c) The nucleus divides once

d) Chromosomes divide once

Meiosis cell division occurs in- [D.B.18]

i. Anther and ovule

ii. Testis and ovary

iii. Blood cells and nerve cells

Which of the following is correct?

a) i and ii

b) i and iii

c) ii and iii

d) i, ii and iii

Through meiosis division- [C.B.15]

i. Chromosomes divide once

ii. Chromosome number in gametes becomes half

iii. Constancy of chromosome number is maintained

Which of the following is correct?

a) i and ii

b) i and iii

c) ii and iii

d) i, ii and iii

Parents
↓ Characteristics → Heredity.
Child

The process by which characteristics of parents are transferred to their children is called heredity.

## Genetics

The branch of biology which deals with the study of heredity is called genetics.

→ Gregor Johan Medel

### Heridity materials

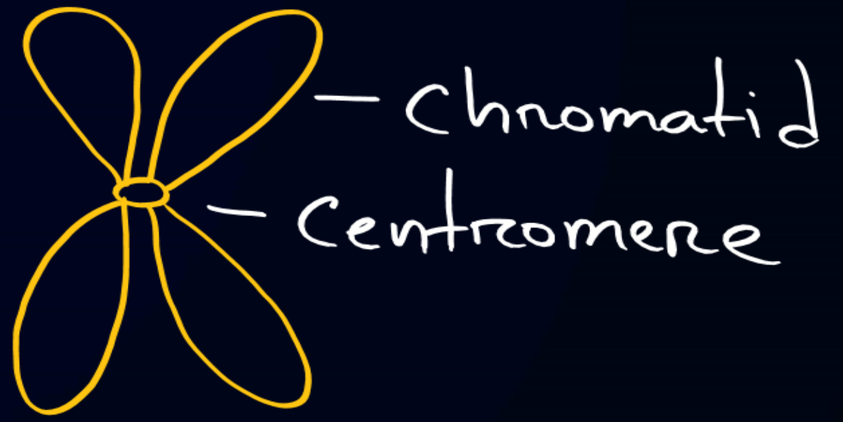
- Chromosome
- DNA
- Gene
- RNA

→ Location ⇒ Nucleus.

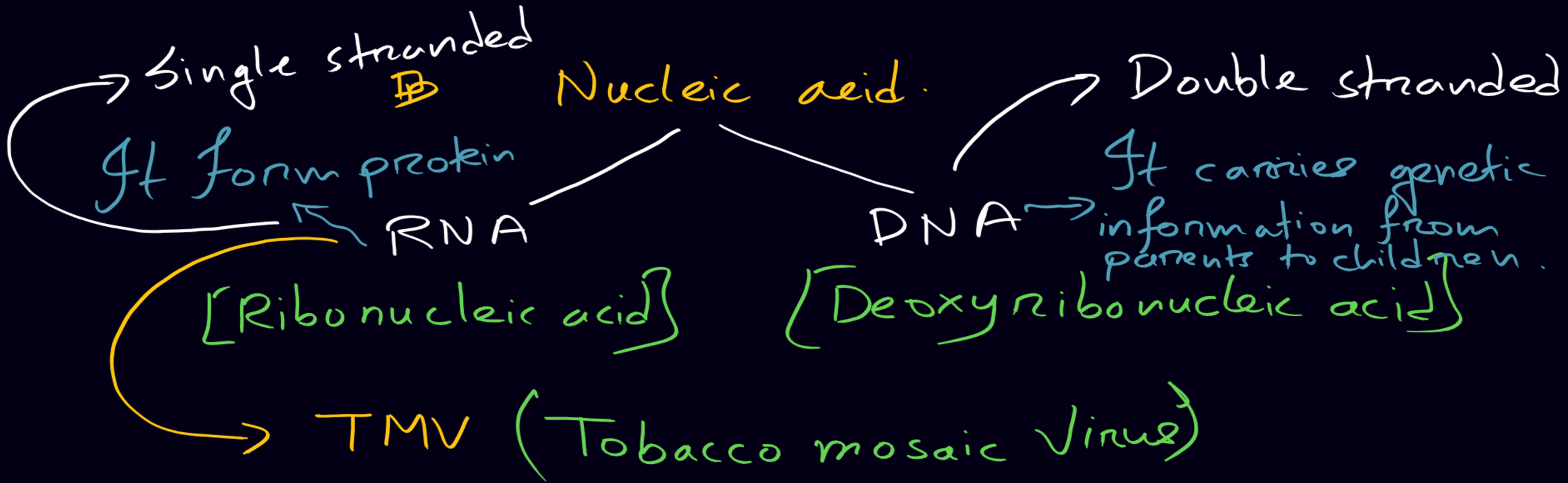
⇒ Physical basis of heredity.

Chromosome

Centromere  Chromatid.




⇒ DNA + Protein


Single stranded
Nucleic acid.
Double stranded
It form prokin
RNA
DNA
It carries genetic information from parents to children.
[Ribonucleic acid]
[Deoxyribonucleic acid]
TMV (Tobacco mosaic Virus)

- **Gene**: It is the structural unit of chromosome.

Chromosome
↓
DNA
↓
Gene → It expresses the characteristics of an organism

Who is the father of genetics?[S.B.18,16 ,C.B.16,14 ,D.B. 16,Ctg.B.15,J.B.15]

a) Aristotle

b) Carolus Linnaeus

c) John Ray

d) Gregor Johann Mendel ✓

The physical basis of heredity is— [S.B 18,D.B 14]

a) Chromosome

b) DNA

c) Gene

d) RNA

Which controls human skin color? [B.B 16,Di.B 16]

a) Centromere

b) Nucleolus

c) Gene ✓

d) RNA

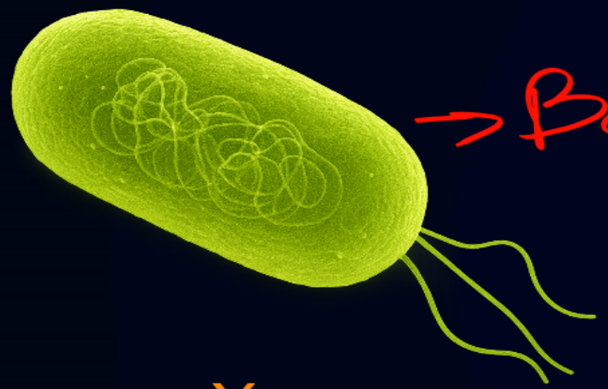
Which does not contain DNA? [J.B. 16]

a) Bacteria

b) TMV (Tobacco Mosaic Virus)

c) E. coli

d) Amoeba



→ Bacteria

X

Division

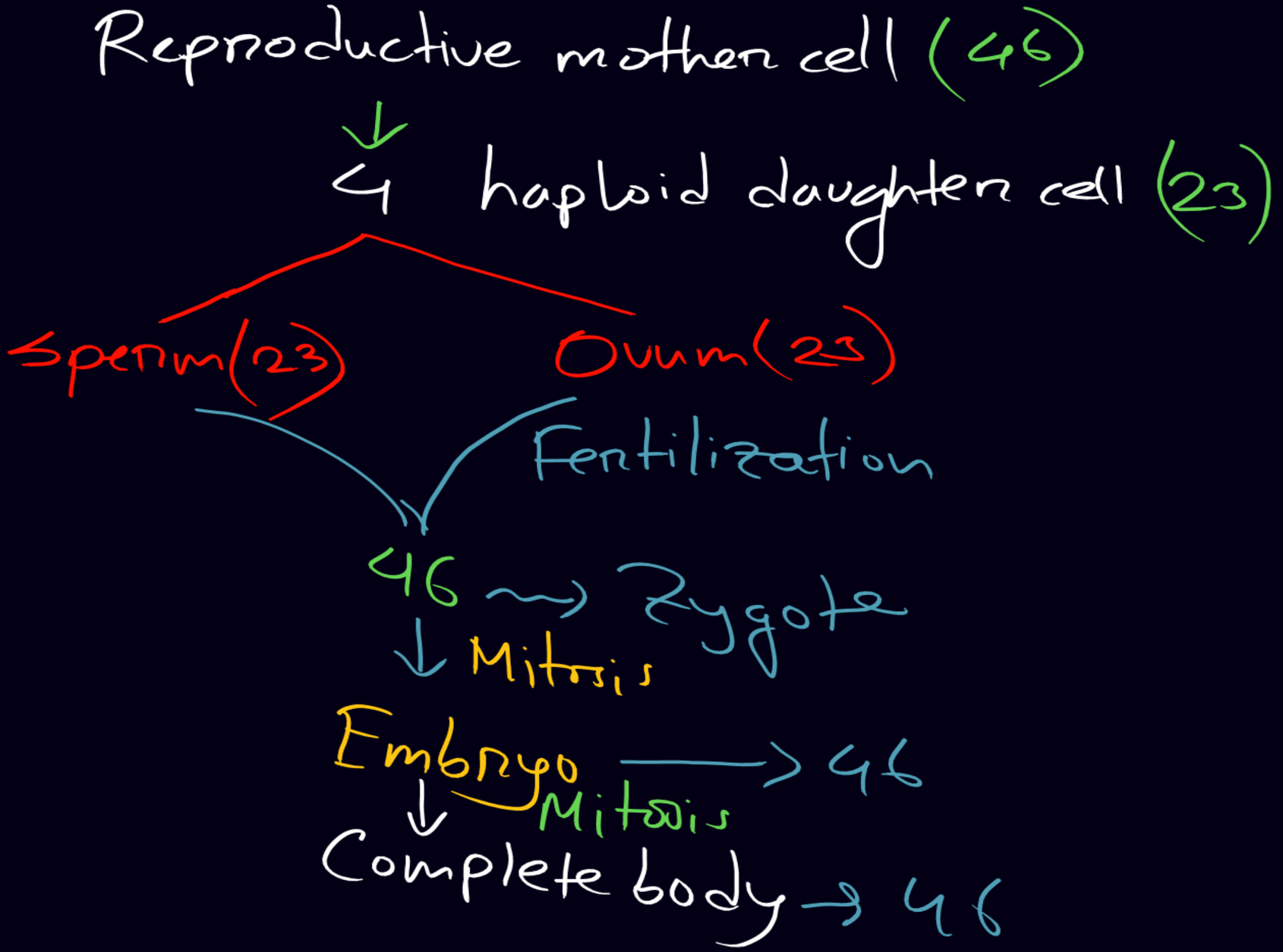
Somatic cell — Y — mitosis

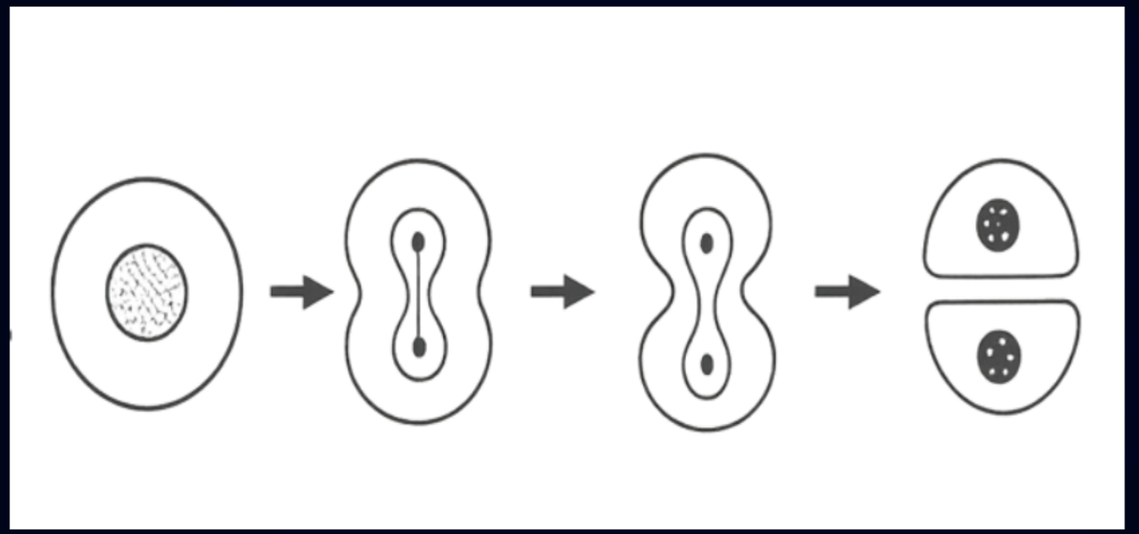
Germ cells — Z — meiosis

[R.B.19]

c. Describe the reproduction process of 'X'. → amitosis

d. 'Y' and 'Z' are important in keeping the chromosome constant in humans - Give your opinion with logic.

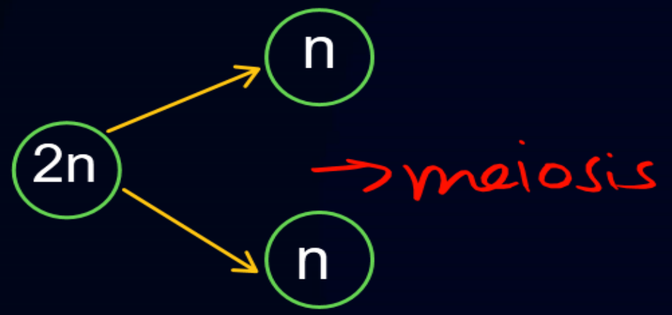

Reproductive mother cell (46)
4 haploid daughter cell (23)
Sperm(23)
Ovum(23)
Fertilization
46 ⇝ Zygote
Mitosis
Embryo
Mitosis
46
Complete body → 46



→ amitosis

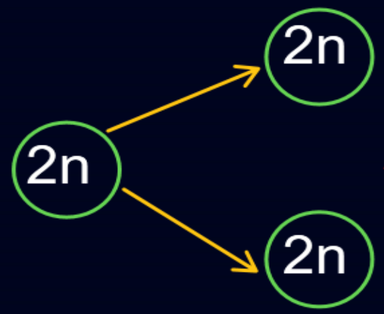
c. Describe the characteristics of the cell division mentioned in the stimulus. → Done

d. Describe the stages of the cell division process mentioned in the stimulus with diagrams. → Done




→ meiosis

P




mitosis.

Q

c. Explain P cell division. → Done

d. Compare P and Q cell divisions in higher animals. → Done.

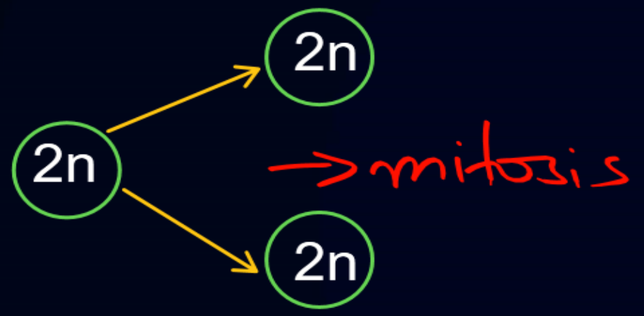



Figure: X

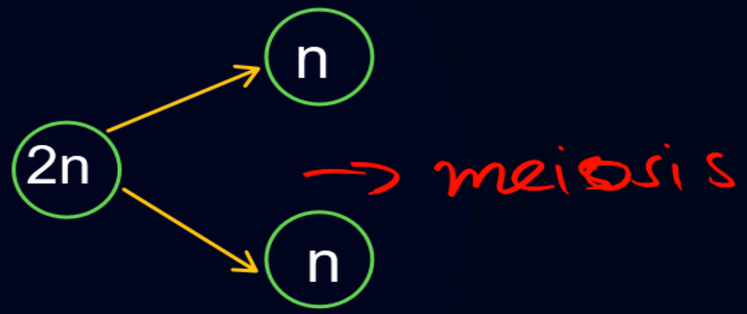



Figure: Y

[C.B 18]

c. Describe the role of Y cell division in maintaining the existence of organisms.

d. The activities of the first and last phase of X division are opposite to each other - Discuss with logic.

Prophase → Telophase.

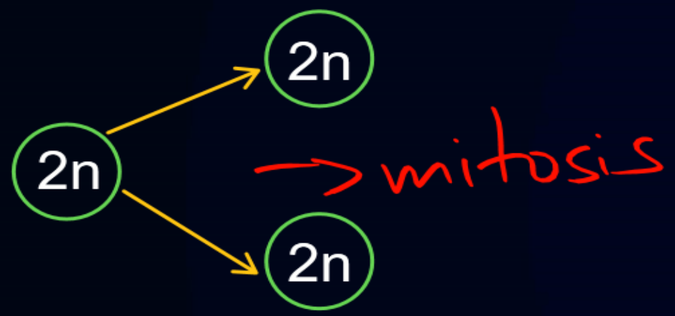



Figure: R

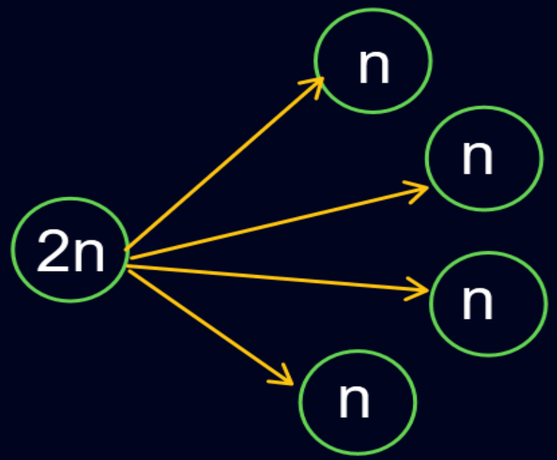



Figure: S

anaphase.

[D.B.19]

c. Draw a labeled diagram of the fourth stage of R in the figure. → Done.

d. Analyze the importance of S cell division shown in the figure for maintaining species heredity.

→ Done.

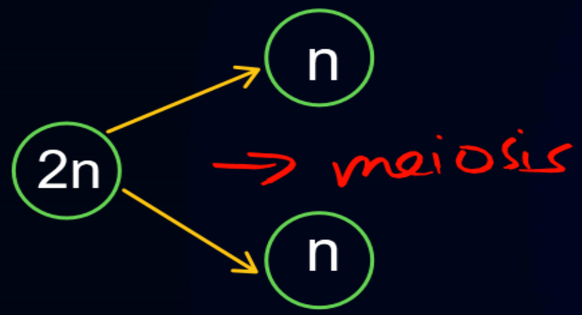



Figure: P

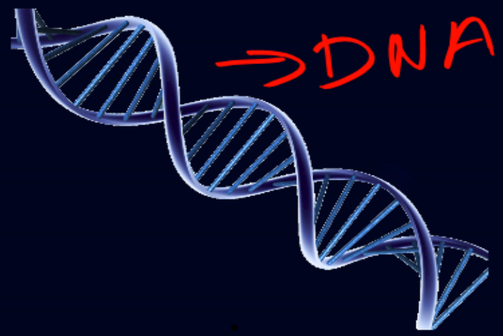



Figure: Q

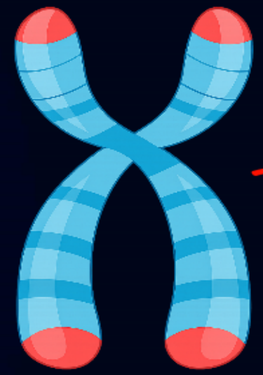



Figure: R

[D.B. 19]

c. Explain the 'P' cell division. → Done

d. Analyze the role of Q and R in determining heredity. → Done

Miraj's facial structure is like his mother's, but his hair type, eye color, and body structure are exactly like his father's. Although his parents are fair, his skin color is dark like his grandmother's.

[R.B.17; S.B.17]

c. Describe how Miraj's parents' characteristics were transmitted to his body.

d. Describe the characteristics of the cell division through which the hereditary sequence in the stimulus occurs. → meiosis.

What is karyokinesis? [D.B.18, 19; D.B.19; C.B. 17, 19; M.B.19; B.B.17,18]

→ Done.

What is chromatid? [C.B.18]

When a chromosome is longitudinally divided then two equal thread like structures are formed called chromatid.


What is cytokinesis? [R.B.19]

→ Done

What is zygote? [C.B. 19]

The structure which is formed by the union of sperm & ovum is called zygote.

What is interphase? [S.B.19; R.B.18; C.B.18]

→ Done.

What is DNA? [B.B.19]

→ Done.

What is heredity? [R.B.17; S.B.17]

→ Done.

What is chromosome? [D.B.17]

→ Done.

What is meiosis? [D.B.16]

Done

What is amitosis cell division? [J.B.16]

Done

What is mitosis? [D.B.17]

Done

Why is cell division in Amoeba/Bacteria/Fungi called direct cell division? [D.B.19; M. B. 19; R.B.18; C.B. 18; J.B.18; Ctg.B.18; B.B.18; R.B.17; S. B.17]

- Done

Why are chromosomes called the physical basis of heredity? [D.B.19; B.B. 16]

- Done.

Why is meiosis cell division called reduction division? [C.B.19; D.B.18; D.B. 17; D. B.17; C. B.15]

- Done.

When do the chromosomes in the nucleus become shortest and thickest - explain. [R.B.19; C.B.19]

- Done

metaphase

Why is meiosis necessary? [D.B.19]

- Done.

Explain the reason why a boy's hair is like his father's. [S.B.19]

- Done

What do you mean by gene? [J.B.18]

— Done.

Why is mitosis cell division called equational division?

— Done.