



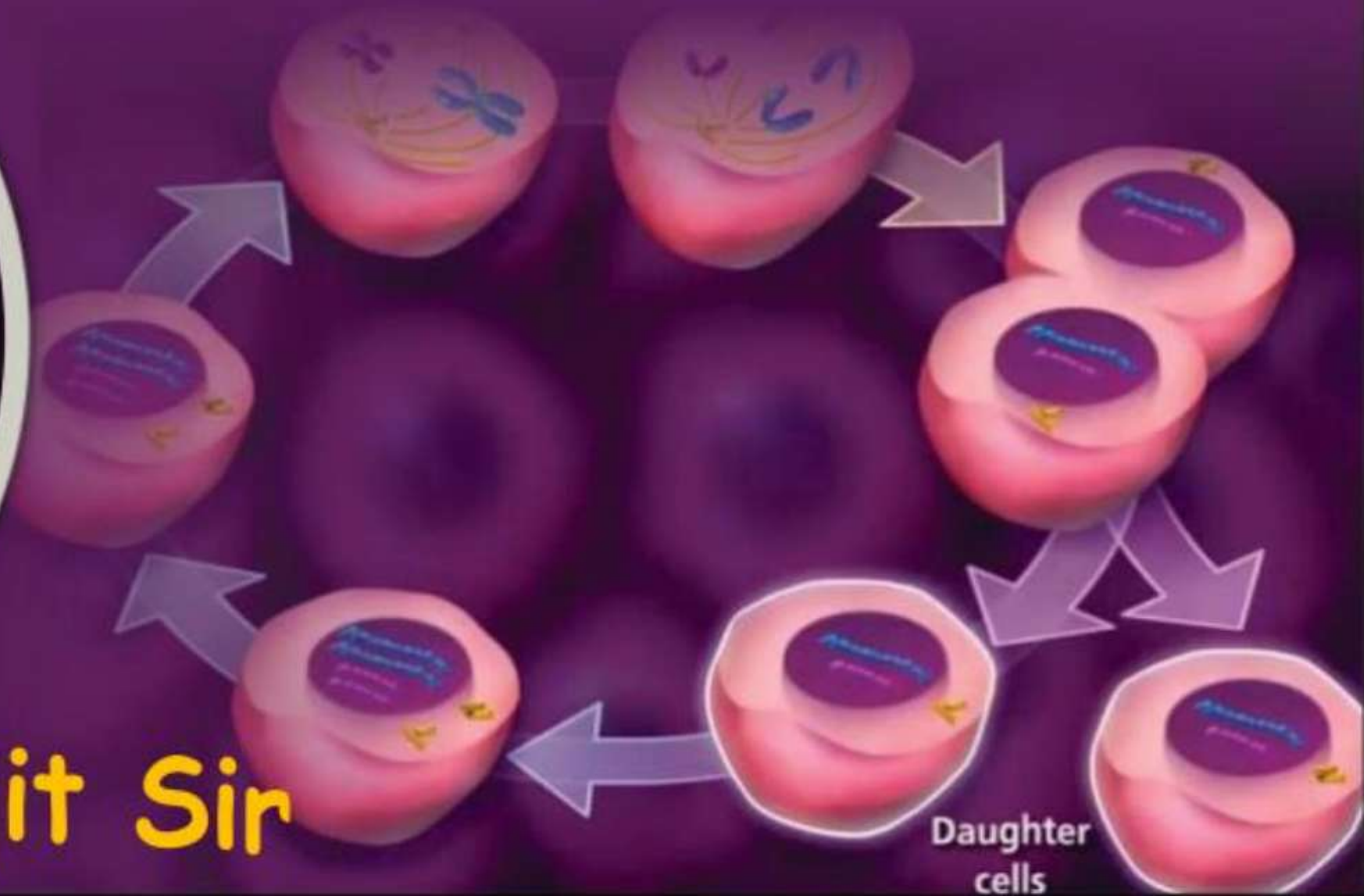
ARJUNA NEET BATCH



CELL CYCLE AND CELL DIVISION



By : Biswajit Sir

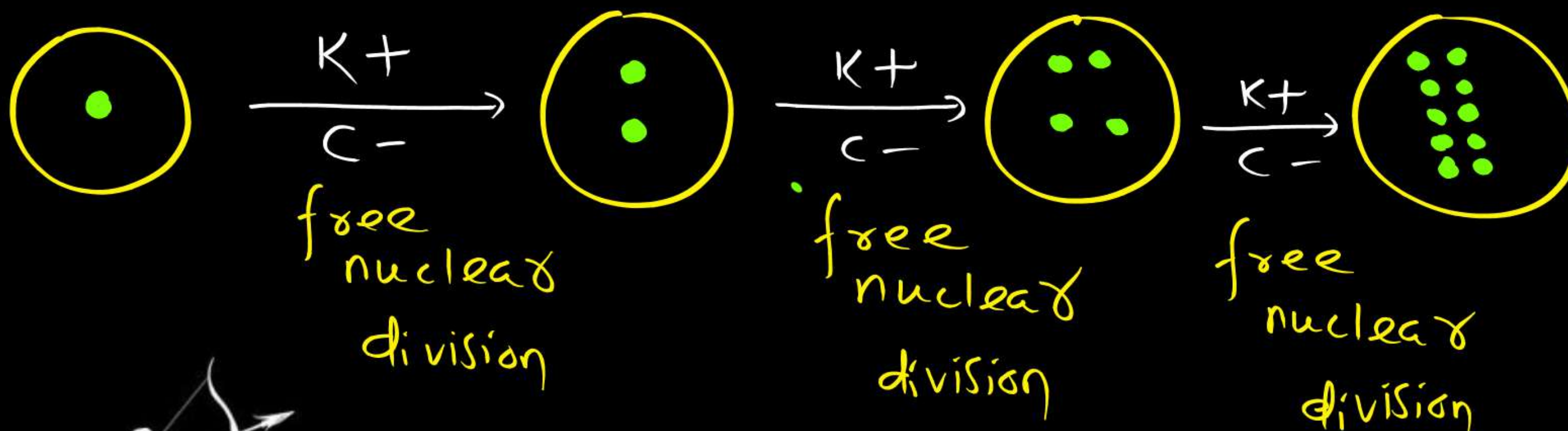




Note :-

Karyokinesis without cytokinesis leads to multinucleate condition (Syncytium).

E.g., Liquid endosperm in coconut.





Significances of mitosis

(i) **Growth:**

(Unicellular/multicellular) $E_k \rightarrow \text{growth} \rightarrow \text{mitosis}$.

(ii) **Repair :**

Replacement of cells of epidermis, gut, blood cells, etc.

NCERT:

In animals many cells divide occasionally, as needed to replace cells that have been lost because of injury or cell death

mitosis
↑



Note

In PK \rightarrow

mitosis -ve
meiosis -ve

growth \rightarrow cell no. \uparrow

cell divⁿ \rightarrow mitosis \rightarrow EK
 \rightarrow Amitosis \rightarrow PK



(iii) To restore Karyocytoplasmic ratio (nucleocytoplasmic ratio) :

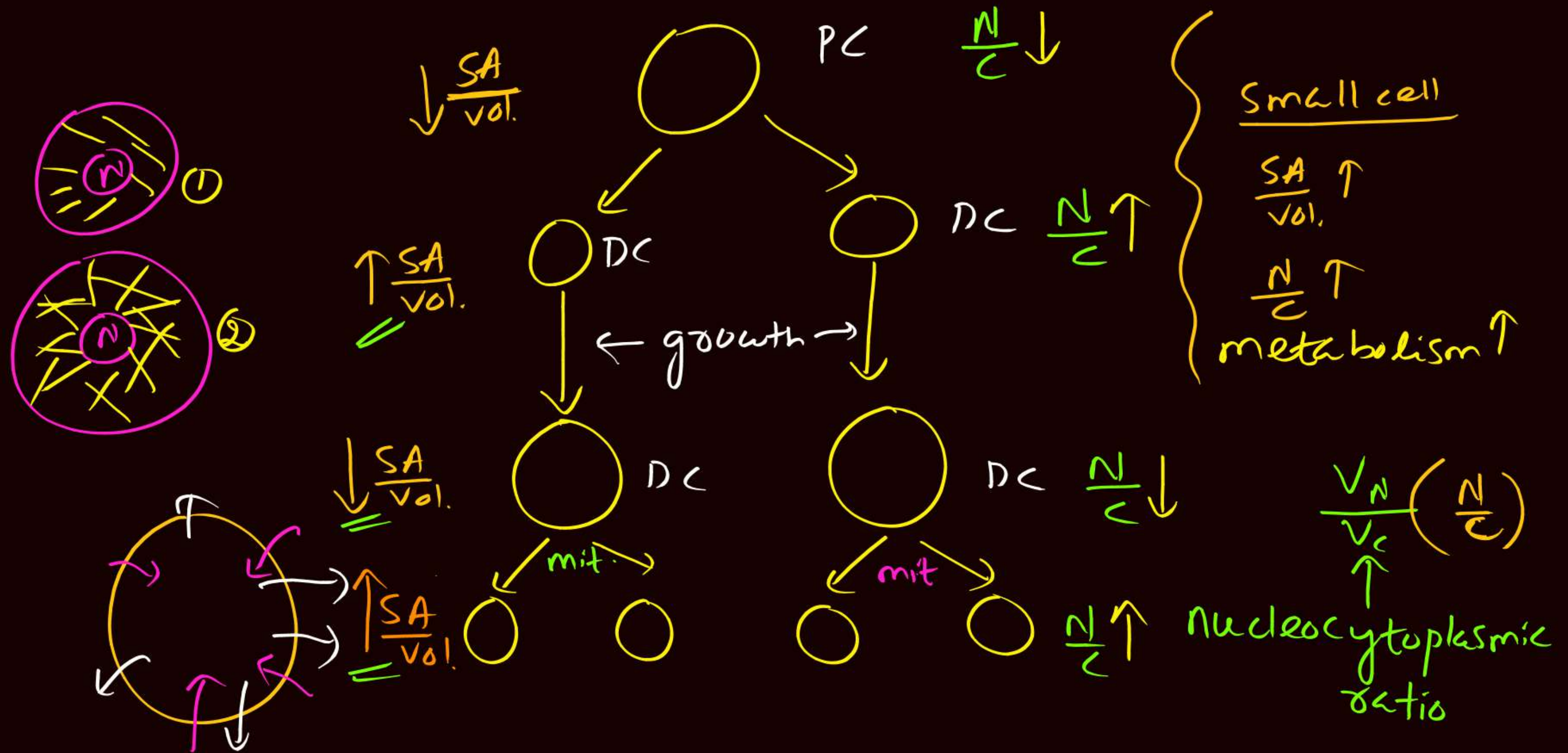
(a) Small cells:

- Metabolically active
- High N/C ratio - Better control of cytoplasmic activities by nucleus.

(b) Large cells:

- Metabolically less active
- Low N/C ratio





(iv) To restore surface area/Volume ratio $\left(\frac{SA}{Vol}\right)$
(Unicellular/multicellular) Ek → growth → mitosis.



(a) Small cells:

- (Larger) high $\frac{SA}{Vol}$ ratio- Better exchange of materials

(b) Large cells:

- Low $\frac{SA}{Vol}$ ratio

➤ Uptake of nutrients

➤ Release of waste products.



Sequence of some events

Anaphase \Rightarrow formation of contractile ring, phragmoplast



Reformation of nuclear envelope



Telophase

Reassembly of nuclear lamina



Decondensation of chromosome



Transcription





Objective of today's class

MEIOSIS I





In mitosis:

1 × round of DNA replication



followed by

1 × round of separation, and 1 × round of nuclear division

In meiosis

one round of DNA replication



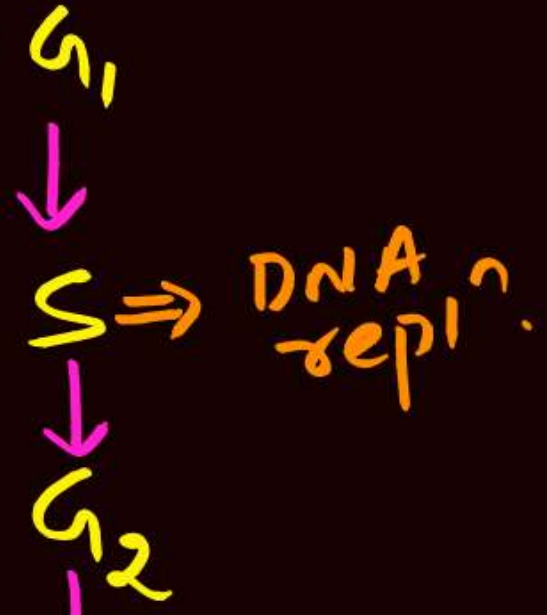
followed by

2 × rounds of separation, and 2 × rounds of nuclear division

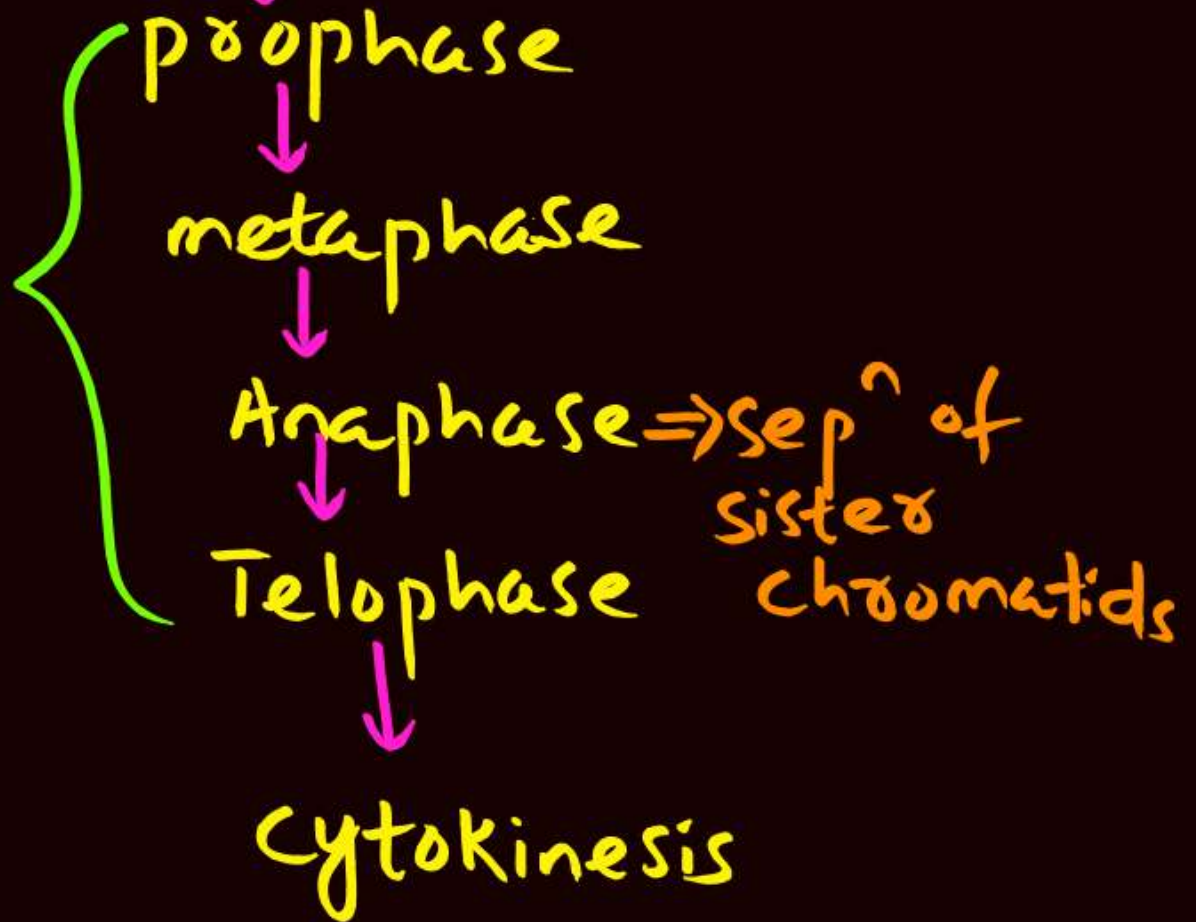


Mitosis

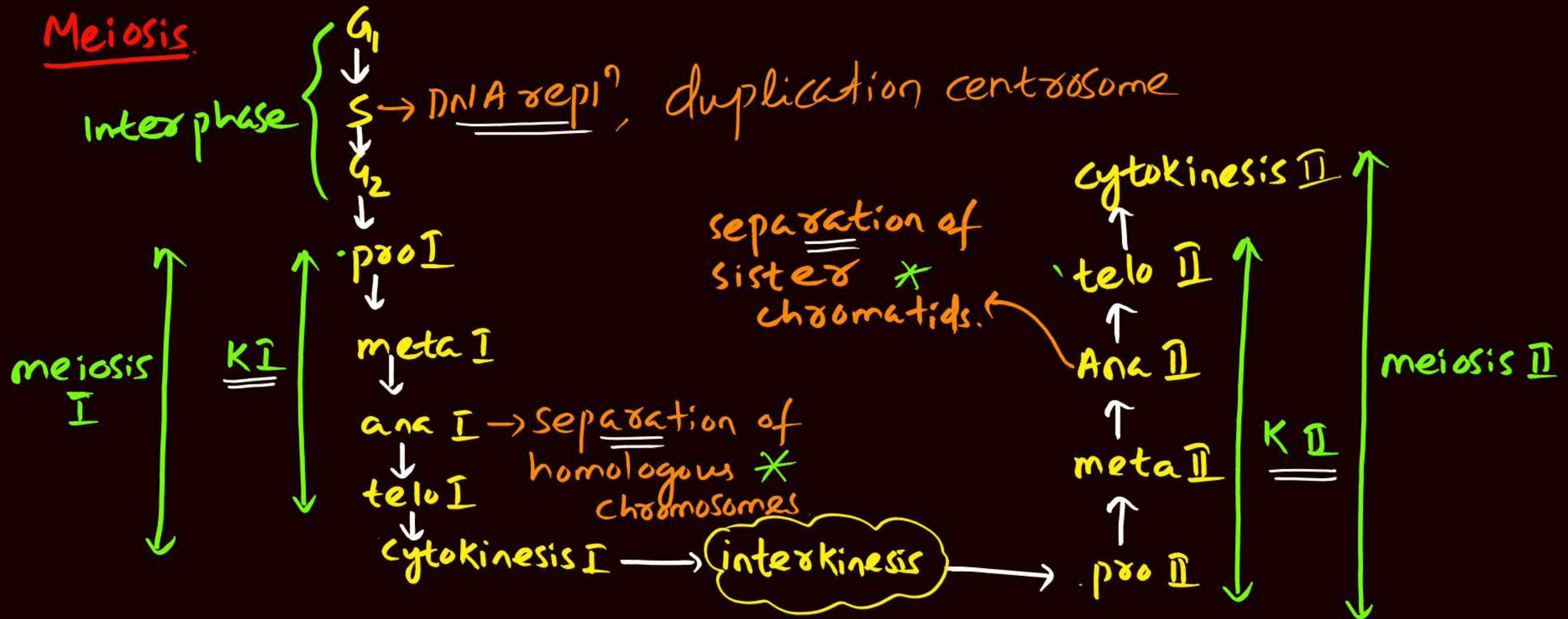
Interphase

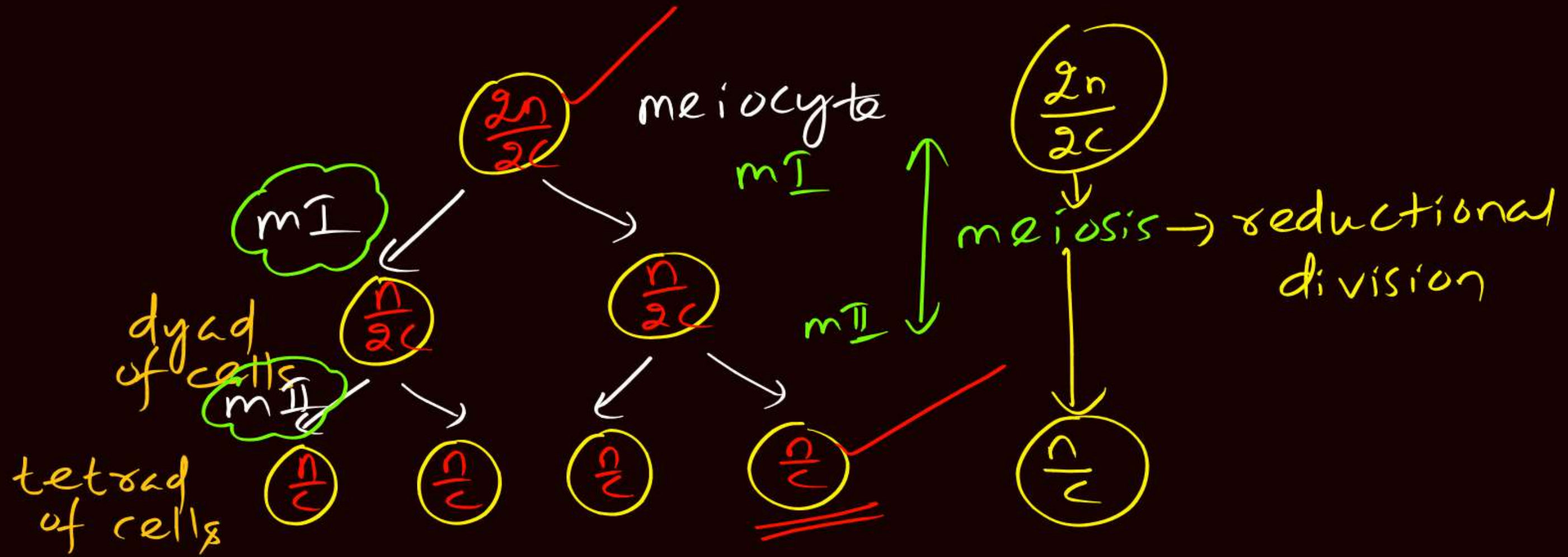


Karyo-Kinesis



Meiosis







Meiocyte:-

- Cell undergoing meiosis.
- Can be $2n$, $4n$, $6n$, $8n$, etc. but never n , $3n$, $5n$, etc.

$3n$
↓
 ~~$\times 1.5n$~~

mitocyte $\rightarrow n, 2n, 3n, 4n, \dots$

meiocyte $\rightarrow (2n), (4n), (6n), (8n)$
 ~~(n)~~ , ~~$(3n)$~~ , ~~$(5n)$~~



Types of meiosis

① gametic

* meiosis in which the product is gamete.

* in diplontic organism
↓

* animals

* angiosperms,
gymnosperms

② sporic

* meiosis in which the product is spore

* in haplodiplontic organism
↓

bryophytes

pteridophytes

③ zygotic

meiosis that takes place in zygote.

* in haplontic organisms.
↓

most of algae.



Mechanism of meiosis

Prophase – I

- Rel. complex and longer than prophase of mitosis and prophase II.
- **Include 5 sub phase:-**
Leptotene → Zygotene → Pachytene → Diplotene →
Diakinesis



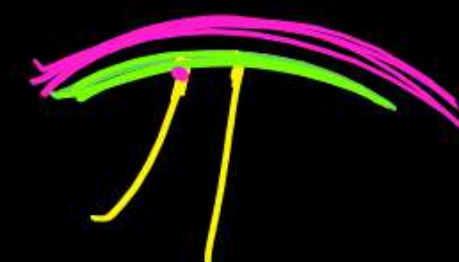
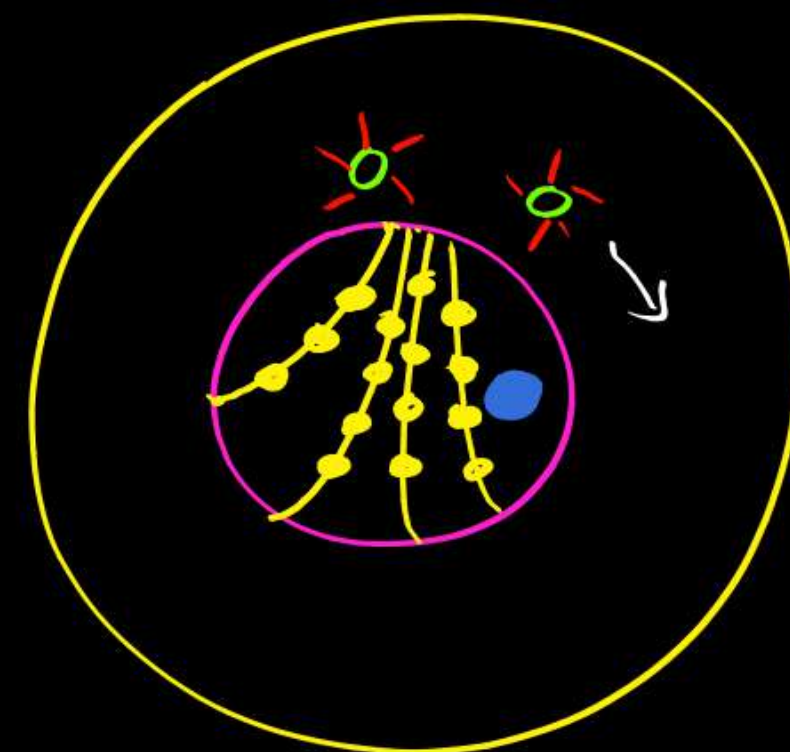


Leptotene :-

Chromatin ^(start)
Condensation → **Chromosomes**

chromosomes

- Longest, thinnest.
 - Contains a no. of swellings called chromomeres.
 - * ➤ Telomeres are attached to (nuclear envelope) attachment plate. *
 - One end of each chromosome converge towards the end having centrosome.
- Leptotene called Bouquet stage
- One of the daughter centrosomes starts moving.
 - Astral rays formation starts.



Spindle



$G_1 \rightarrow \underline{S} \rightarrow G_2 \rightarrow \underline{\text{lepto}} \rightarrow \underline{\text{zygo}} \rightarrow \underline{\text{pach}}$

1 chromosome

2 x chromatid



Zygotene :-

* Synapsis takes place *

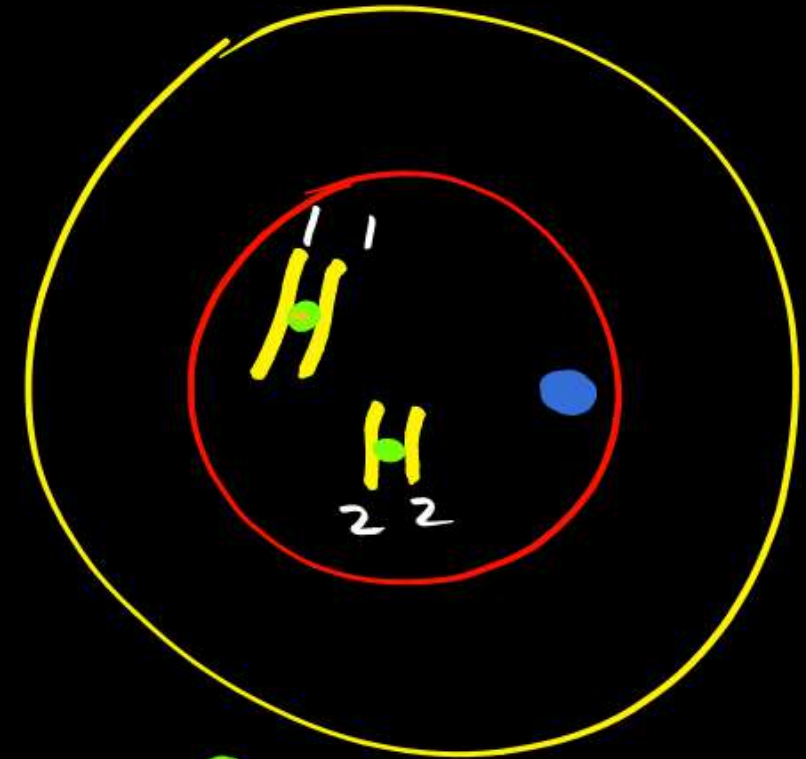
- (a) Pairing of homologous chromosomes.
- (b) By synaptonemal complex.
- (c) Produces bivalent.
 - Consists of 2 homologous chromosomes
 - Number = n (if meiocyte \rightarrow 2n)
 - Synaptonemal complex holds 2 homologous chromosomes till crossing over is completed.
 - Stage of nucleoprotein complex formation.

*

Each bivalent \rightarrow 4 chromatids



Tetrad (but becomes visible in pachytene)



$$\frac{2n}{2} = 4$$



papaji



x



mataji

sperm



egg



chromosome

homologous

nonhomologous

1-1
2-2
22-22

1-2
1-3
X-5
11-13



zygote →



Pachytene :-

* Crossing over takes place. *

(a) Mutual exchange of segments of nonsister chromatids of 2 homologous chromosomes.

(b) Mediated by recombination nodule

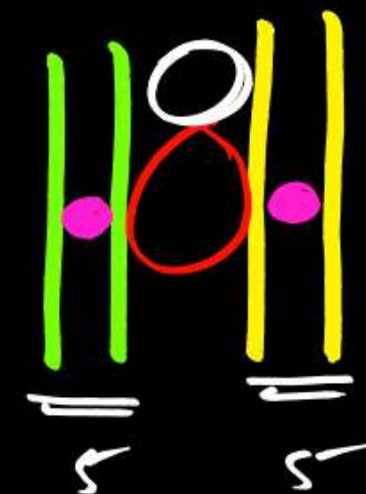
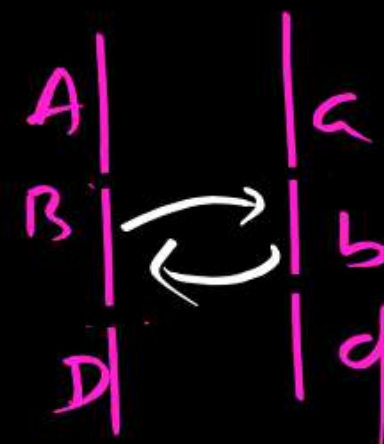
↓ called

- Has recombinase enz. (complex)

- Endonuclease + ligase

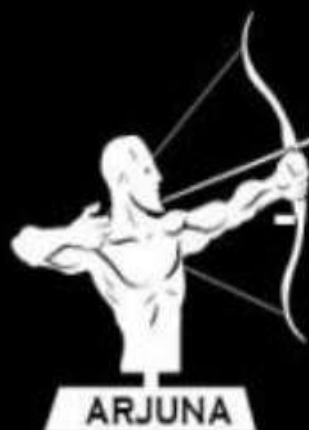
(c) Results recombination

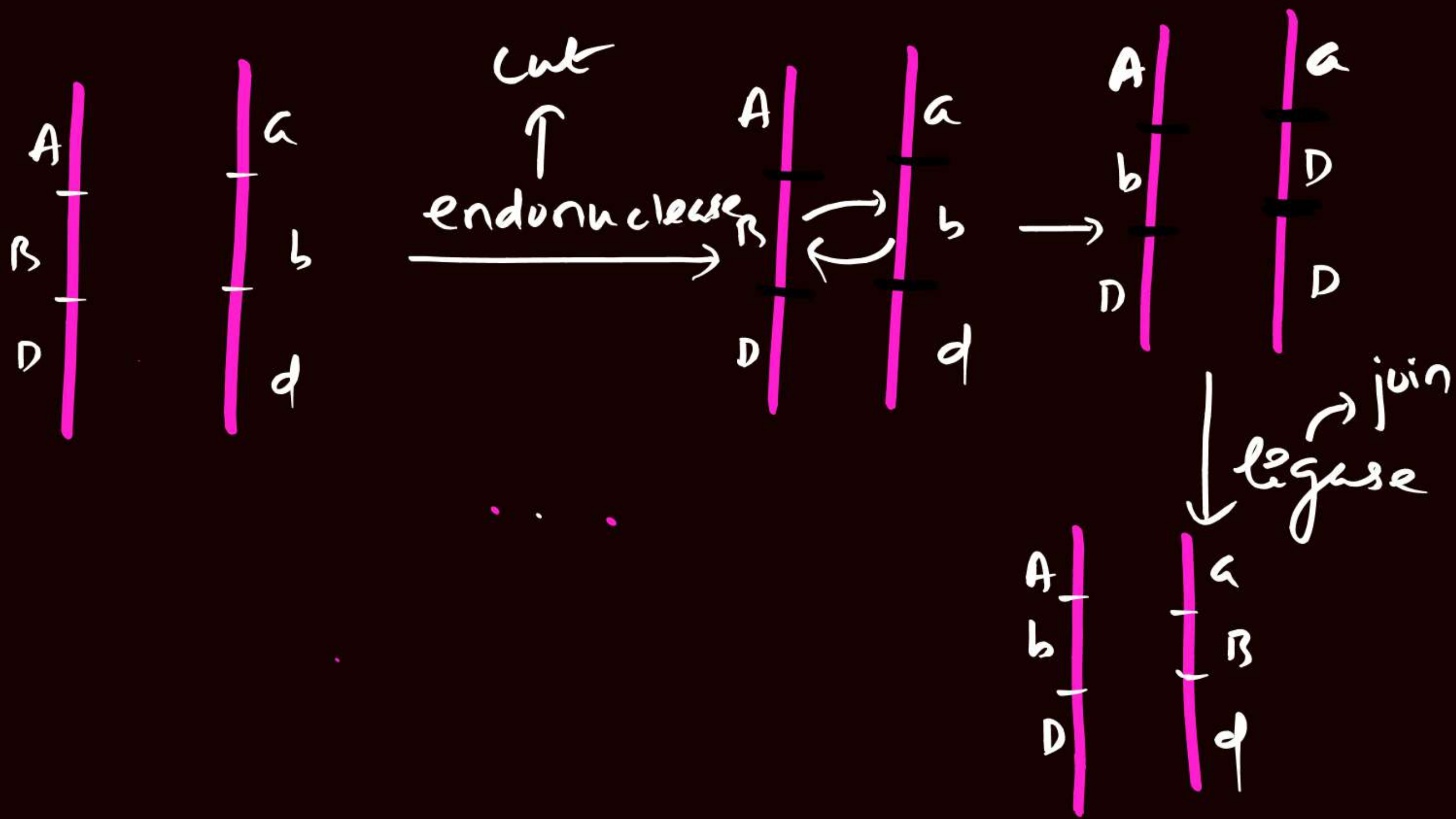
- Chromatids become visible



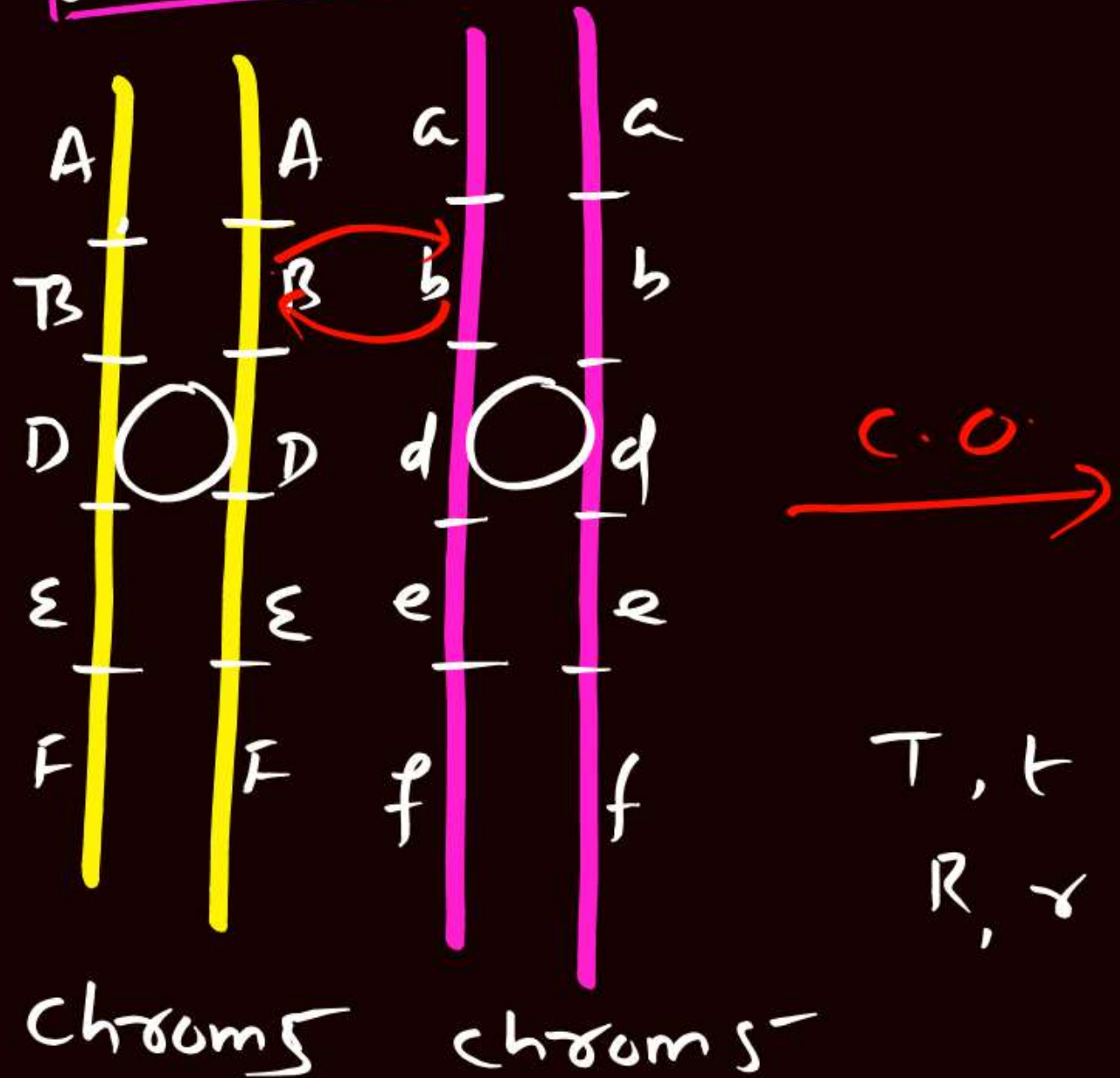
Each bivalent → Tetrad.

- No. of tetrads = no. of bivalents = n (if meiocyte = $2n$)

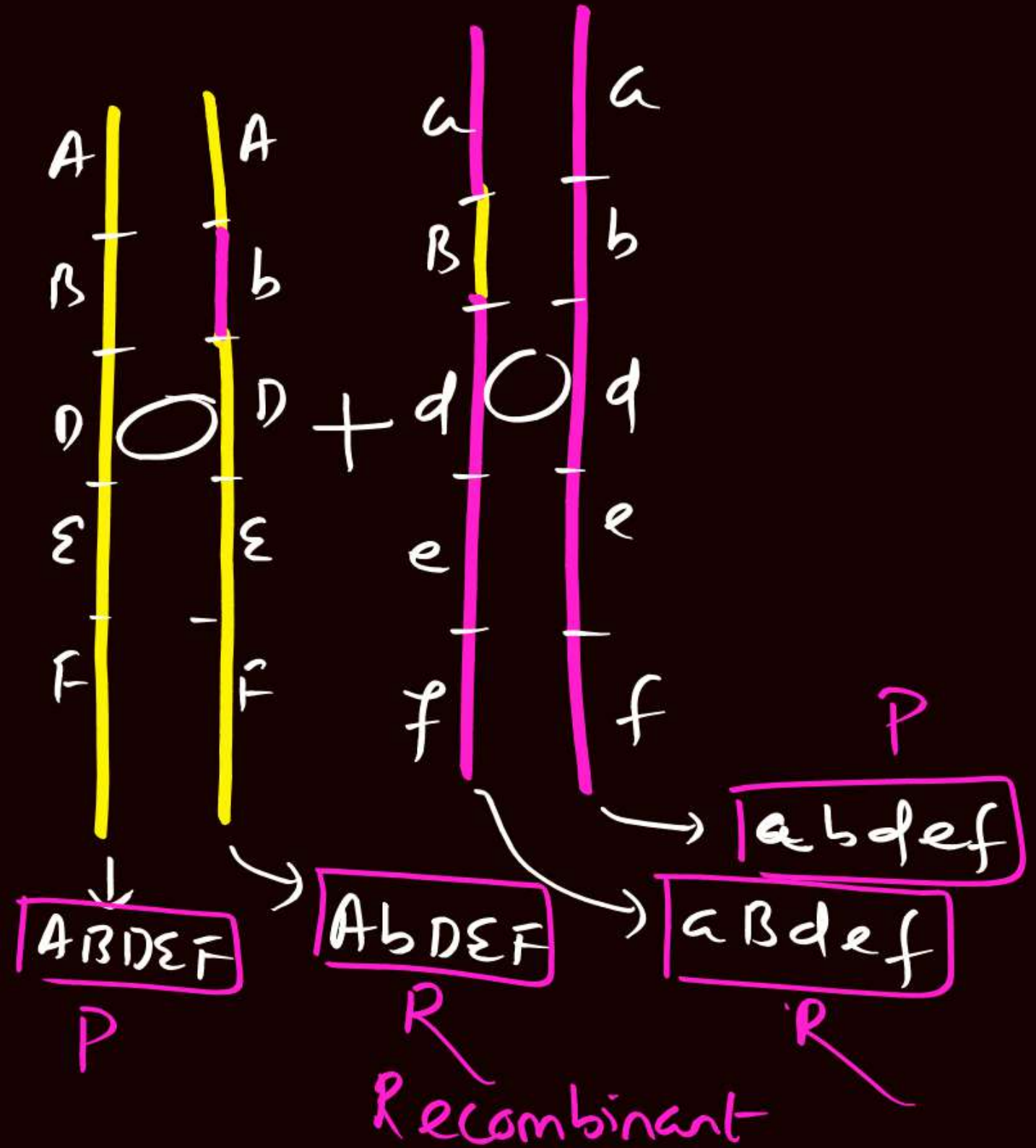




A B D E F → Parental
a b d e f → Parental



homologous chromosomes



Q/ If a gamete contains 10 chromosomes, then how many bivalent and tetrads would be formed in corresponding meiocyte?



*thanks
for watching*

