YAKEEN NEET 2.0

2026

Cell Cycle and Cell Division

Botany | Lecture - 05

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Topics to be covered

1. MEIOSIS
2.
3.
4.

MONDAY

- ★ SUMMARY
- ★ SIGN OF MIT & MEIOSIS
- ★ INTRODUCTION
- ★ 150 + QUESTION.

	NO. OF CHROMOSOME	DNA AMOUNT	NO. OF CHROMATID IN ONE CHROMOSOME
PARENT CELL	4	2C	1
G_1	4	2C	1
S	4	4C	2
G_2	4	4C	2
PROPHASE-I	4	4C	2
METAPHASE-I	4	4C	2
ANAPHASE-I	4	4C	2
TELOPHASE-I / MEIOSIS-I	2	2C	2

INTERPHASE

PROPHASE-II

METAPHASE-II

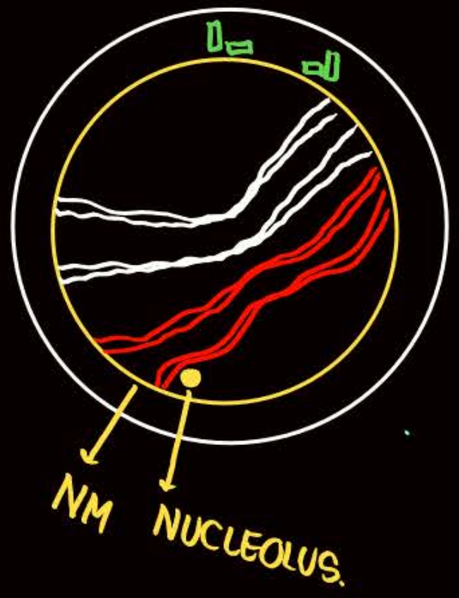
ANAPHASE-II

TELOPHASE-II / MEIOSIS-II

MEIOSIS-I

PROPHASE-I → DIVIDED INTO '5' STAGES LEPTOTENE, ZYGOTENE, PACHYTENE, DIPLOTENE, DIAKINESIS
MORE COMPLEX/ELABORATE & LONG COMPARE TO PROPHASE OF MITOSIS

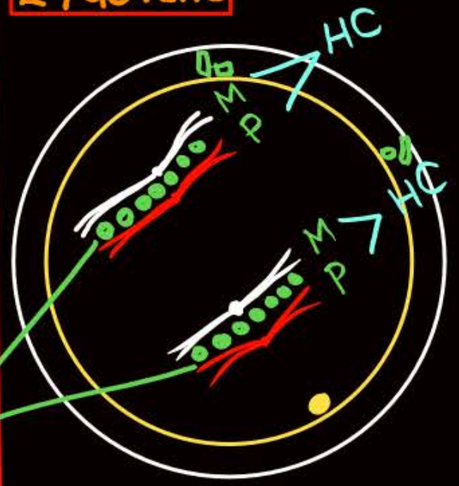
LEPTOTENE



★ COMPACTION / CONDENSATION OF CHROMOSOME : BEGIN & CONTINUE

★ VISIBLE IN LIGHT MICROSCOPE

ZYGOTENE



★ PAIRING OF HOMOLOGOUS CHROMOSOME : SYNAPSIS

★ SYNAPTONEMAL COMPLEX FORMED.

★ 1 PAIR : 2 CHROMOSOME : 1 BIVALENT

★ 1 PAIR : FOUR CHROMATID : 1 TETRAD

BUT All FOUR CHROMATID NOT COMPLETELY DISTINCT

PROTEIN STRUCTURE (SYNAPTONEMAL COMPLEX) ↓ HOLD CHROMOSOME TOGETHER.

● : MATERNAL CHROMOSOME

● : PATERNAL CHROMOSOME

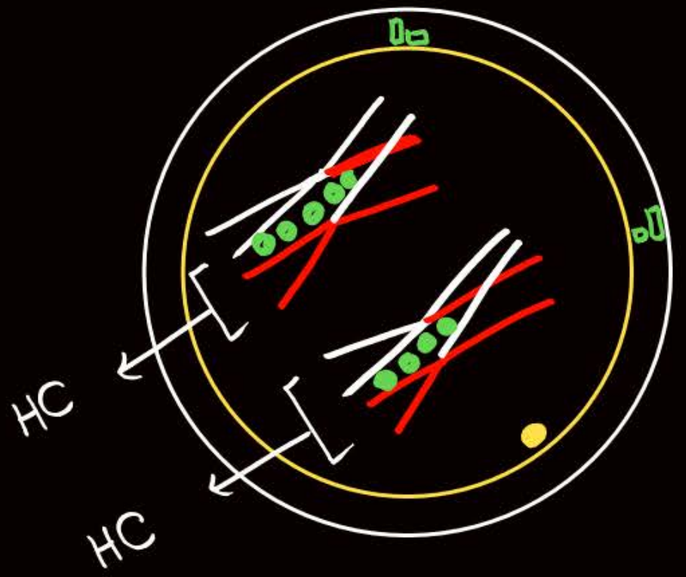
★ : CHROMOSOME OF SAME PAIR : HOMOLOGOUS CHROMOSOME (HC)

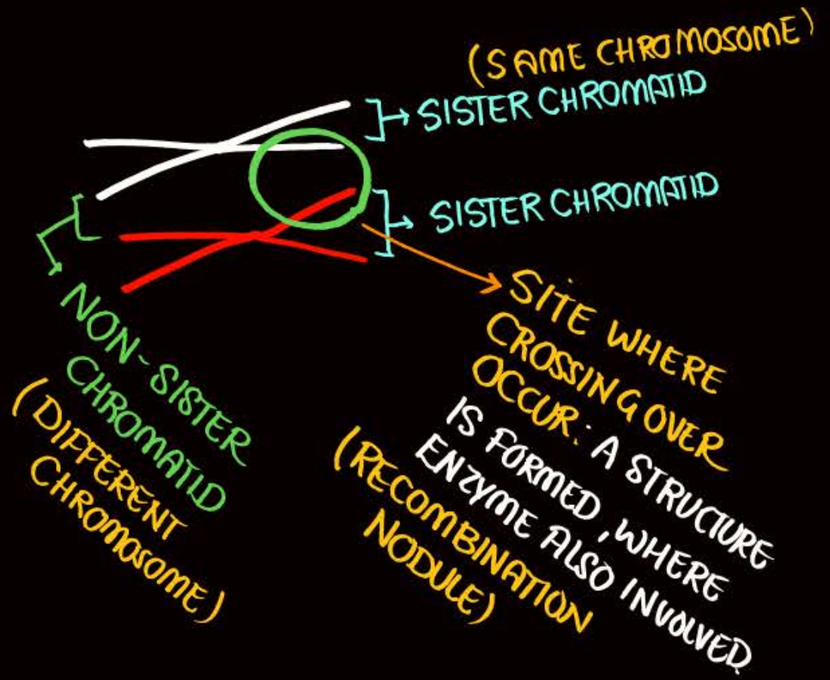
Q PARENT CELL : 40 CHROMOSOME IN G-1

NO. OF BIVALENT : 20

NO. OF CHROMATID : 40 x 2 = 80

PACHYTENE



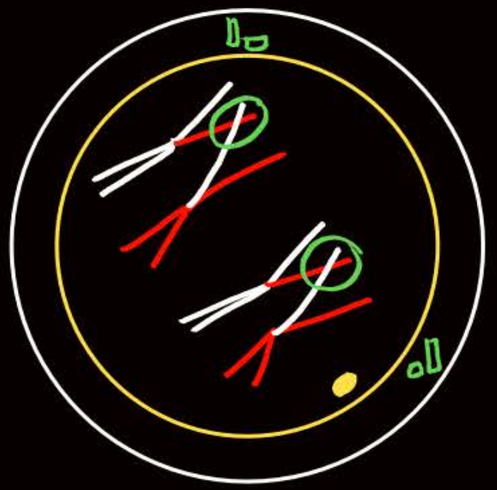


- ALL FOUR CHROMATID: CLEARLY VISIBLE/DISTINCT. (TETRAD)
- EXCHANGE OF DNA OF NON-SISTER CHROMATID B/W HOMOLOGOUS CHROMOSOME: CROSSING OVER / RECOMBINATION → LEADS TO VARIATION.
- RECOBINASE ENZYME
- LEPTOTENE (L) & ZYGOTENE (Z): SHORT LIVED
- IT IS LONG COMPARE TO (L) & (Z)

→ end of PACHYTENE

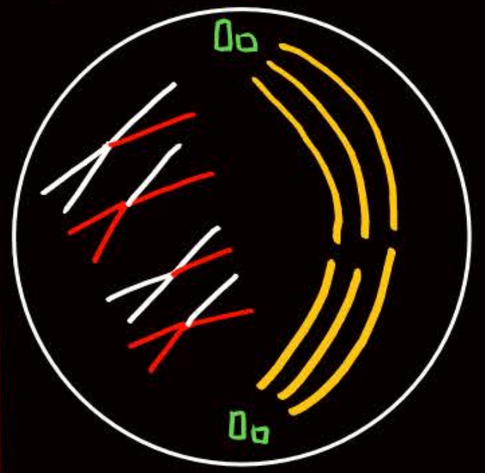
Q: 40 CHROMATID IN PACHYTENE ⇒ 20 CHROMOSOME
CHROMOSOME IN G-1: (20)

DIPLOTENE



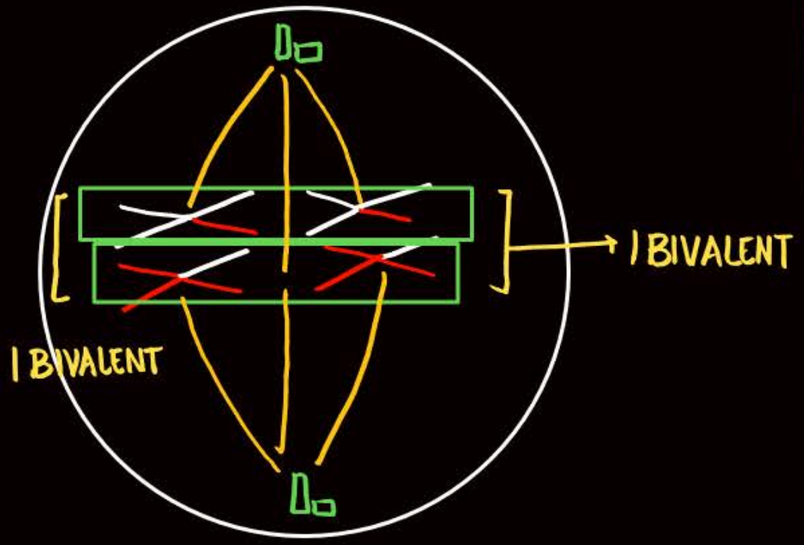
- SYNATONEMAL COMPLEX BEGINS TO DISSOLVE SO HOMOLOGOUS CHROMOSOME BEGINS TO SEPERATE EXCEPT AT THE SITE WHERE CROSSING OVER OCCURED, THIS SITE WHERE CROSS LIKE STRUCTURE FORMED : CHIASMATA.
- IN OOCYTE OF VERTEBRATE THIS STAGE OCCUR FOR MONTH/ YEAR.

DIAKINESIS



- NM, NUCLEOLUS : DISAPPEAR
- CENTRIOLE REACHED AT OPPOSITE POLE.
- TRANSITION TO METAPHASE-I
- SPINDLE FIBRE FORMED
- TERMINALISATION OF CHIASMATA (DISAPPEARENCE)
- CONDENSATION OF CHROMOSOME COMPLETED.

METAPHASE-1



★ BIVALENT ON EQUATORIAL PLATE : (2)

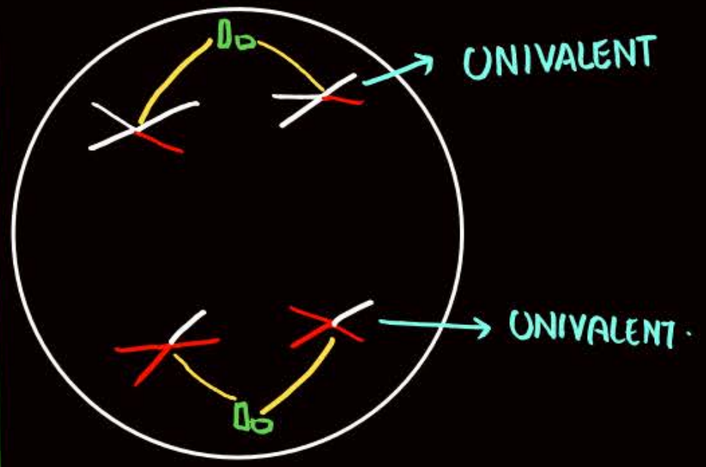
Q : 40 CHROMOSOME IN G-1

METAPHATE-1 (1 PLATE) = 20

2 (PLATE) = 40

★ NO. OF CHROMATID IN ONE PLATE : 20X2 ⇒ 40

ANAPHASE-1



⇒ SEPERATION/SEGREGATION OF HOMOLOGOUS CHROMOSOME.

⇒ CHROMOSOME MOVES : OPPOSITE POLE.

⇒ NO SPLITTING OF CENTROMERE

Q G_1 : 40 CHROMOSOME

ANAPHASE-1 (1 POLE) : 20

ANAPHASE-1 (BOTH POLE) : 40

TELOPHASE-1

⇒ NUCLEOLUS, NM : REAPPEAR.

⇒ KARYO & CYTOKINESIS : DONE

⇒ TWO CELLS / DYADS ARE FORMED

⇒ CHROMOSOME UNDERGOE SOME DISPERSION BUT DO NOT REACH THE EXTENDED STATE OF INTERPHASIC NUCLEUS.

(1) M phase (CORRECT)

A. most dramatic period

B. not involve reorganisation of component

C. number of chromosomes same but not also DNA amount in daughter cell as parents

D. Resuctional (equational.) division

Options

(A) 1 (B) 2 (C) 3 (D) 4

(2)

Correct

(A) mitosis divided into 5 (4) stages of karyokinesis

(B) cell division is not progressive

(C) clear cut lines can not be drawn between different stages of cell division

(D) None

(3) Prophase (CORRECT)

(A) DNA are distinct but (NOT) intertwined

(B) initiation of condensation (chromosomal.) material occur

(C) chromosome material become (un.) tangled

(D) Centrosome moves towards opposite pole in plant (animal.) cell

(4) Prophase (CORRECT)

(A) Chromosome consist of two chromatid connected by kinetochore (centromere.)

(B) Each centrosome radiate microtubule called aster in plant (animal.)

(C) two aster with spindle called mitotic Apparatus

(D) GB, nucleolus, Nuclear membrane, ER disappear in early (Late.) prophase

(5) Metaphase (CORRECT)

(A) complete disintegration of NM, nucleolus is beginning of second phase of ~~cytokinesis~~ karyok.

(B) chromosomes present in cytoplasm and not fully condensed

(C) morphology of chromosome easily studied

(D) one chromosome consist of ~~one~~ 2 chromatid

(6)

Correct

A. ~~Large~~ small disc shape, protein structure present on centromere : kinetochore

B. It helps in attachment of spindle fibre

C. all chromosome arranged at equator

D. plane of alignment of chromosome at metaphase called metaphasic plate

E. 2 metaphasic plate formed

Options

(A) 1 (B) 2 (C) 3 (D) 4

(7) Anaphase (incorrect)

A. at ~~end~~ onset (Begining) all chromosome split simultaneously & two daughter chromatid formed

B. daughter chromosome moves towards opposite pole

C. centromere ~~trailing~~ lead ~~behind~~ Behind & arms ~~leading~~ edge

D. chromosome number becomes double as compare to metaphase (8)

Options (4)

(A) 1 (B) 2 (C) 3 (D) 4

(8) Telophase Incorrect

(A) At beginning of final stage of ~~cytokinesis~~ karyok. chromosome decondense & lose their individuality

(B) chromatin material collect at each pole

(C) Nuclear membrane nucleolus ,ER reform

(D) None

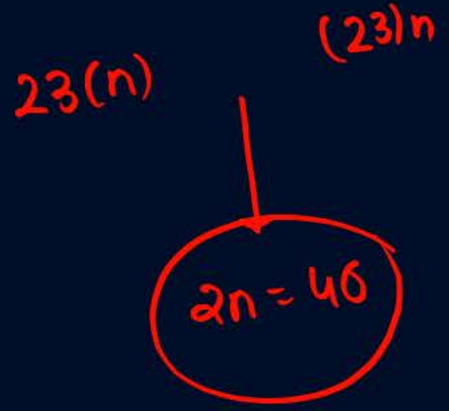
10.4 MEIOSIS

fertilisation

The production of offspring by sexual reproduction includes the fusion of two gametes, each with a complete haploid set of chromosomes. Gametes are formed from specialised diploid cells. This specialised kind of cell division that reduces the chromosome number by half results in the production of haploid daughter cells. This kind of division is called **meiosis.**

23 & 23.

Meiosis ensures the production of haploid phase in the life cycle of sexually reproducing organisms whereas fertilisation restores the diploid phase. We come across meiosis during gametogenesis in plants and animals. This leads to the formation of haploid gametes. The key features of meiosis are as follows:



- Meiosis involves two sequential cycles of nuclear and cell division called **meiosis I** and **meiosis II** but only a single cycle of DNA replication.
- Meiosis I is initiated after the parental chromosomes have replicated to produce identical sister chromatids at the S phase.
- Meiosis involves pairing of homologous chromosomes and recombination between non-sister chromatids of homologous chromosomes.
- Four haploid cells are formed at the end of meiosis II.

Karyok

[DNA REP IN S-2) → G2 → MEIOSIS START

1 chromo : 2 chromatid

SYNAPSIS (ZYGOTENE)

CROSSING OVER IN PACHYTENE

Identical

Last lecture

Meiotic events can be grouped under the following phases:

Meiosis I	Meiosis II
Prophase I	Prophase II
Metaphase I	Metaphase II
Anaphase I	Anaphase II
Telophase I	Telophase II

10.4.1 Meiosis I

Prophase I: Prophase of the first meiotic division is typically longer and more complex when compared to prophase of mitosis. It has been further subdivided into the following five phases based on chromosomal behaviour i.e., Leptotene, Zygotene, Pachytene, Diplotene and Diakinesis.

During **leptotene** stage the chromosomes become gradually visible under the light microscope. The compaction of chromosomes continues throughout leptotene. This is followed by the second stage of prophase I called **zygotene**. During this stage, chromosomes start pairing together and this process of association is called synapsis. Such paired chromosomes are called homologous chromosomes. Electron micrographs of this stage, indicate that chromosome synapsis is accompanied by the formation of complex structure called **synaptonemal complex.**

conden. start

dense

⇒ IMAGE

HELPLACHEIVE?

(PROTEIN)

The complex formed by a pair of synapsed homologous chromosomes is called a **bivalent** or a tetrad. However, these are more clearly visible at the next stage. The first two stages of prophase I are relatively short-lived compared to the next stage that is **pachytene**. During this stage, the four chromatids of each bivalent chromosomes becomes distinct and clearly appear as tetrads. This stage is characterised by the appearance of recombination nodules, the sites at which crossing over occurs between non-sister chromatids of the homologous chromosomes.

Crossing over is the exchange of genetic material between two homologous chromosomes. Crossing over is also an enzyme-mediated process and the enzyme involved is called recombinase. Crossing over leads to recombination of genetic material on the two chromosomes. Recombination between homologous chromosomes is completed by the end of pachytene, leaving the chromosomes linked at the sites of crossing over.

The beginning of **diplotene** is recognised by the dissolution of the synaptonemal complex and the tendency of the recombined homologous chromosomes of the bivalents to separate from each other except at the sites of crossovers. These X-shaped structures, are called **chiasmata.** In oocytes of some vertebrates, diplotene can last for months or years.

→ CROSS OVER
क्रास्ओवर
आपस में हैं.

→ CELL.

LONGEST STAGE.

The final stage of meiotic prophase I is **diakinesis.** This is marked by terminalisation of chiasmata. During this phase the chromosomes are fully condensed and the meiotic spindle is assembled to prepare the homologous chromosomes for separation. By the end of diakinesis, the nucleolus disappears and the nuclear envelope also breaks down. Diakinesis represents transition to metaphase. - I.

Metaphase I: The bivalent chromosomes align on the equatorial plate (Figure 10.3). The microtubules from the opposite poles of the spindle attach to the kinetochore of homologous chromosomes.

Anaphase I: The homologous chromosomes separate, while sister chromatids remain associated at their centromeres (Figure 10.3).

NO SPLITTING OF CENTROMERE

Telophase I: The nuclear membrane and nucleolus reappear, cytokinesis follows and this is called as dyad of cells (Figure 10.3). Although in many cases the chromosomes do undergo some dispersion, they do not reach the extremely extended state of the interphase nucleus. The stage between the two meiotic divisions is called interkinesis and is generally short lived. There is no replication of DNA during interkinesis. Interkinesis is followed by prophase II, a much simpler prophase than prophase I.

CHANGE

Homework from YAKEEN NEET 2.0 2026 Module

MEIOSIS

45, 46, 47, 48, 49, 52, 57, 55,
56, 59, 63, 60,
65, 66

Rev. PLANNER: MONDAY

THANK YOU