

## Cell Division Jadon's remarks: Mitosis and Meiosis are not cell divisions

What is cell division? Process of nuclear division + cytoplasmic division (cytokinesis)

Types  $\left\{ \begin{array}{l} \text{Mitotic cell division (mitosis + cytoplasmic division)} \\ \text{Meiotic cell division (meiosis + cytoplasmic division)} \end{array} \right.$

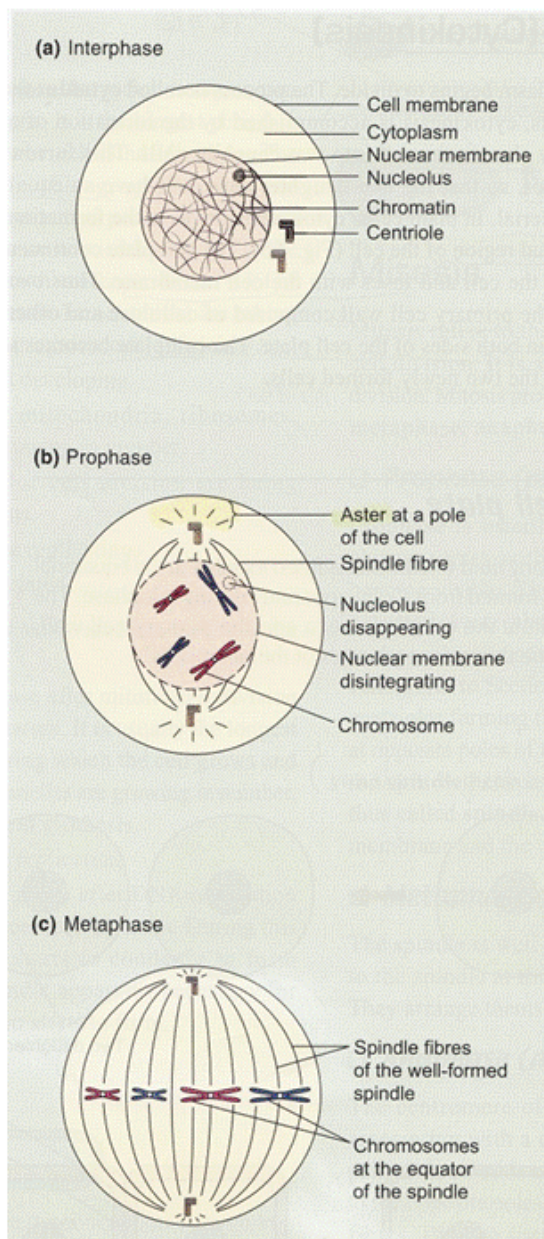
### Mitotic Cell Division

What? A process of a cell dividing into 2 daughter cells with same no. of chromosomes as parental cell

Function:  $\rightarrow$  for growth & repair (Increases cell number)  
 $\rightarrow$  asexual reproduction (eg. binary fission of bacteria)

How?  $\rightarrow$  I, P, M, A, T (5 stages)

$\rightarrow$  NOT included in cell division



#### (a) Interphase (I)

$\rightarrow$  DNA replication & organelle synthesis (2009 AL)

$\rightarrow$  can only see chromatins (hair-like structures)

### **Mitosis:**

#### (b) Prophase (P)

$\rightarrow$  visible chromosome (thickened & shortened)

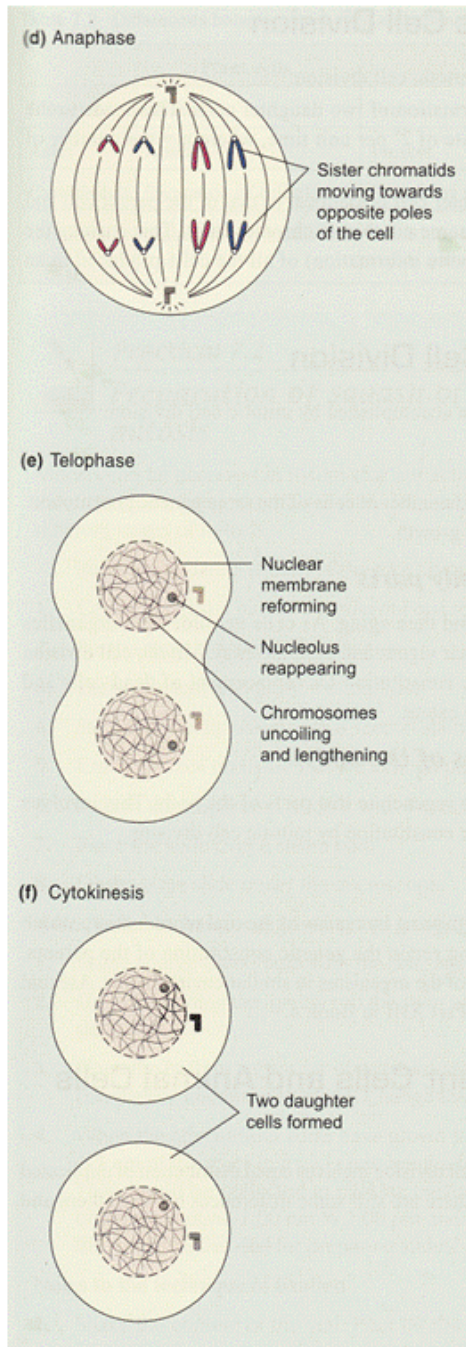
$\rightarrow$  formation of aster --- produce spindle fibres

$\rightarrow$  nuclear membrane disintegrates  
 + nucleolus disappears

#### (c) Metaphase (M)

$\rightarrow$  chromosomes line up at equator

$\rightarrow$  spindle fibres attach to the centromeres of sister chromatids



(d) Anaphase (A)

→ sister chromatids are pulled apart to 2 poles

(e) Telophase (T)

→ nuclear membrane reforms

→ chromosomes uncoil --- chromatins

→ nucleolus reappears

### Cytoplasmic division

(right after telophase)

### Meiotic Cell Division

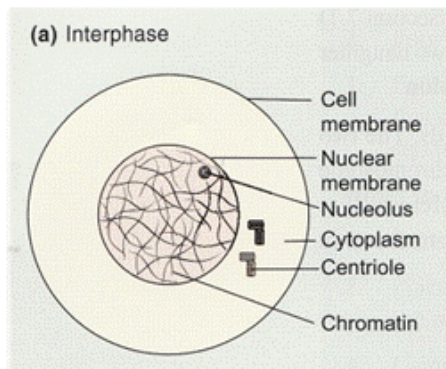
What? a process of cell dividing into 4 daughter cells with half of the no. of chromosomes as parental cell

Function: form gametes during sexual reproduction (eg. Spermatogenesis in seminiferous tube)

How does it proceed? → 2 rounds

- 1st round:  $4n \rightarrow 2n$  [(a) - (g)]
- 2nd round:  $2n \rightarrow 1n$  [(h) - (k)] (Similar to mitotic cell division)

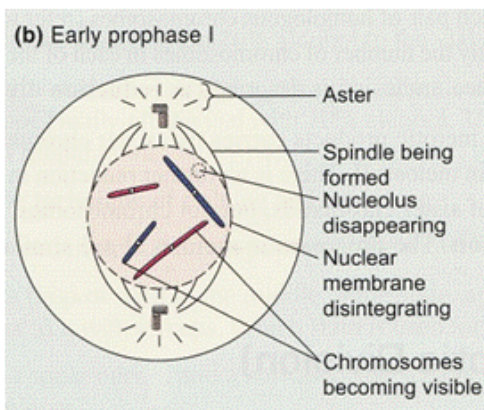
haploid



(a) Interphase

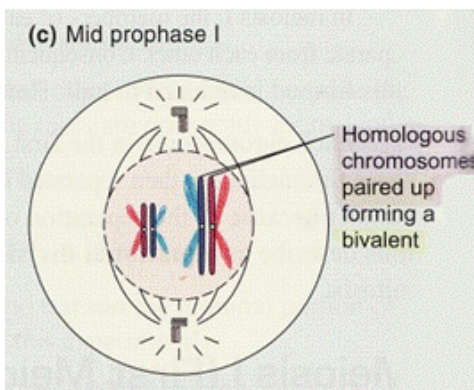
- DNA replication & organelle synthesis
- can only see chromatin (hair-like structures)

**Meiosis I:**



(b) Early prophase I

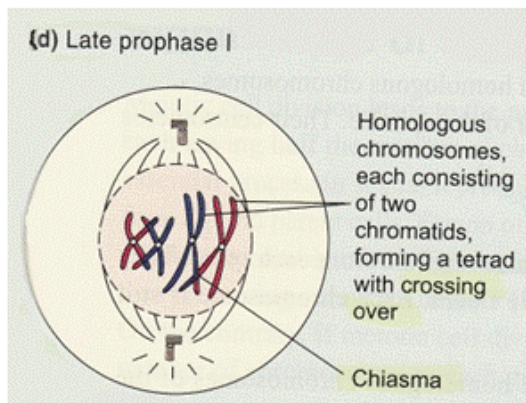
- visible chromosome (thickened & shortened)
- formation of aster --- produce spindle fibres
- nuclear membrane disintegrates and nucleolus disappears



(c) Mid prophase I

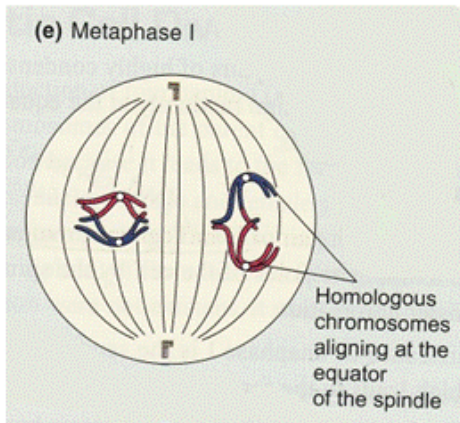
- homologous chromosomes pair up (=synapsis)
- forming bivalent

Exchange of genetic materials  
→ ↑ genetic variation



(d) Late prophase I

- non-sister chromatids of homologous chromosomes cross over
- forming chiasma

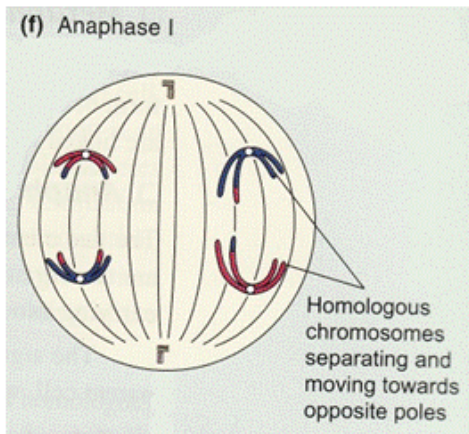


(e) Metaphase I

→ homologous chromosomes line up independently / equator

→ spindle fibres attach to centromeres

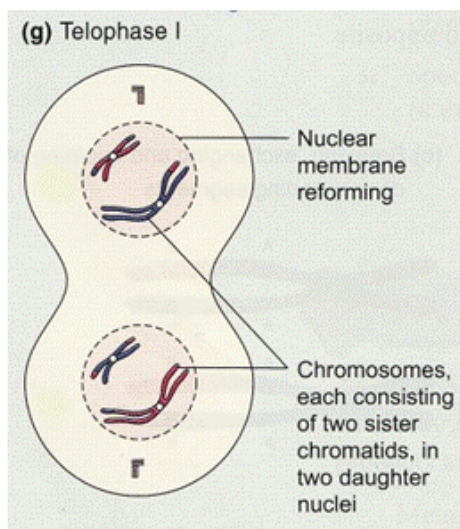
so



(f) Anaphase I

→ homologous chromosomes separate randomly

↑ genetic variation

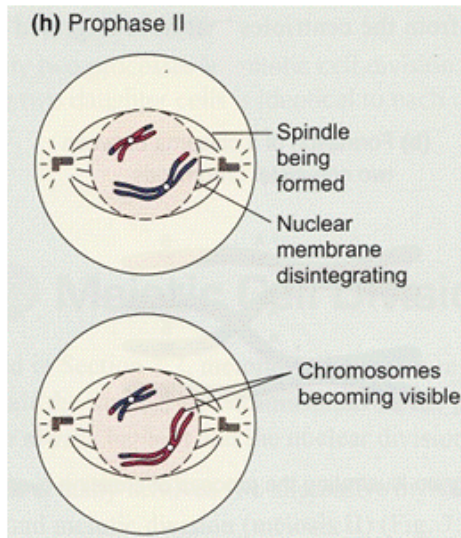


(g) Telophase I

→ nuclear membrane reforms

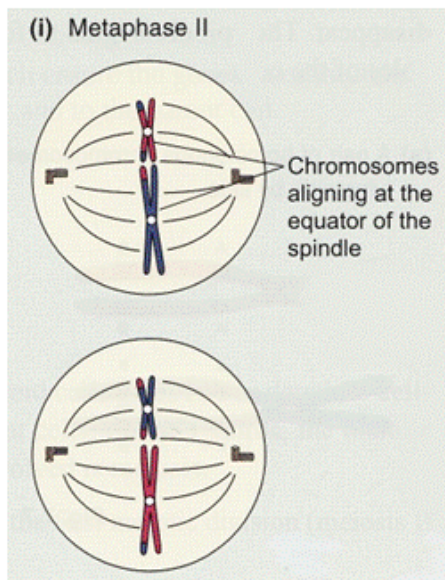
→ chromosomes uncoil

### Meiosis II:



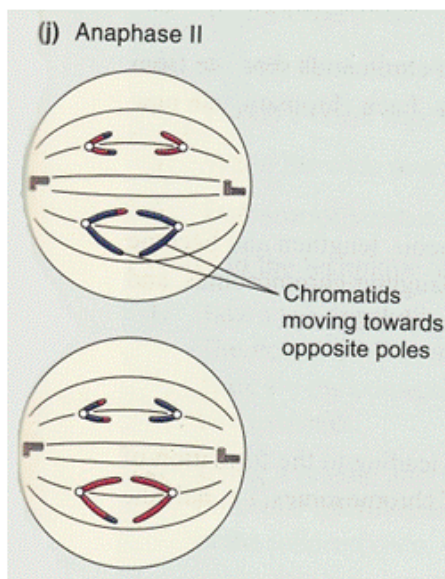
(h) Prophase II

- visible chromosomes
- formation of aster --- produce spindle fibres
- nuclear membrane disintegrates



(i) Metaphase II

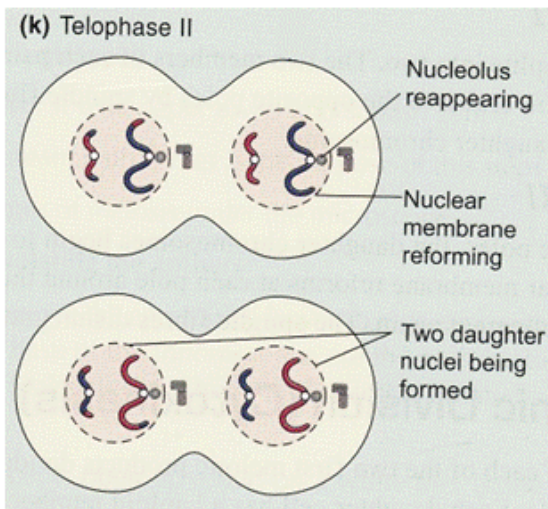
- chromosomes line up at equator
- spindle fibres attach to the centromeres



(j) Anaphase II

- sister chromatids are pulled apart to 2 poles

Random separation  
→ ↑genetic variation for the gametes

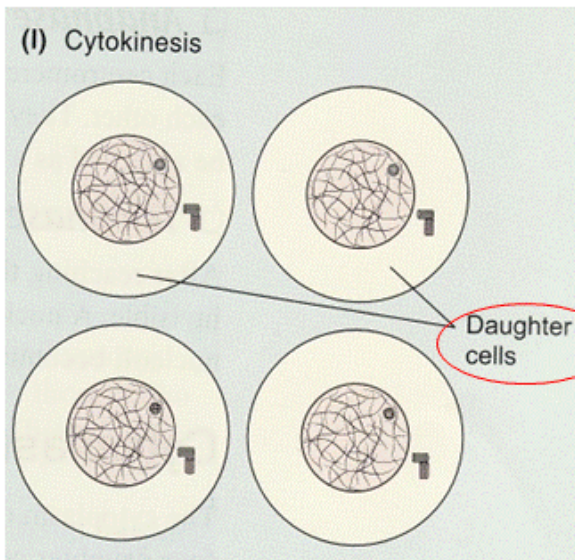


(k) Telophase II

→ nuclear membrane reforms

→ chromosomes uncoil

→ nucleolus reappears



(l) Cytoplasmic division

(right after telophase II)

→ haploid gametes

→ restore diploid condition  
(by fertilization)

## Exam Tips

### High frequency items in Exam

1. Compare and contrast the mitosis and meiosis?
2. When do mitosis and meiosis occur in sexual reproduction?
3. What are the functions of mitotic and meiotic cell division ?
4. What are the significance of meiosis?

### **Jadon's remarks on Question 1: (Very important for the exam!!)**

Many students don't know how to answer the compare and contrast type of questions, but in biological process comparison, just simply follows the planning below, **always PLAN before ANSWERING.**

1. List the key features of one of the process first.
2. List another sides and works like matching.
3. States the similarities first with the word "both"

### Solution to Question 1 : Compare and contrast the mitosis and meiosis?

#### Similarities between the processes of mitosis and meiosis

- **Both** involve nuclear division.
- **Both** involve duplication / replication of DNA/ chromosomes and movement of chromosomes along the spindle fibres.
- **Both** involve spindle formation.

**Differences between the processes of mitosis and meiosis**

<b>Mitosis</b>	<b>Meiosis</b>
2 identical daughter nuclei are formed each is genetically similar to the parent nucleus	4 daughter nuclei are formed which are genetically different from the parent nuclei and each other
Only <b>1</b> division of the nucleus, <b>same</b> chromosome number as the parent nucleus	2 divisions of the nucleus, chromosome number <b>reduced to half</b> .
<b>No</b> pairing up of homologues, linear alignment at the equator(14)	<b>Homologous chromosomes pair up</b> at the equator in the first division.
<b>Chromosome splits into chromatids</b> which move to opposite poles.	<b>No splitting into chromatids</b> in first division Entire chromosome migrates to opposite poles; homologue separates
<b>No such events</b>	May <b>involve chiasma formation</b> , may involve crossing over of genetic material between homologous chromatids; results in variation.

未完

**Presented by Jadon Lam**



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