**Exercise 7**

**Aim:** Study of stages of meiosis using permanent slides

**Principle:** Meiosis is a type of cell division in which the number of chromosomes is halved (from diploid to haploid) in the daughter cells, i.e., the gametes. The division is completed in two phases, meiosis I and meiosis II. Meiosis I is a reductional division in which the chromosomes of homologous pairs separate from each other. Meiosis II is equational division resulting in the formation of four daughter cells. Stages of meiosis can be observed in a cytological preparation of the cells of testis tubules or in the pollen mother cells of the anthers of flower buds.

**Requirement:** Permanent slides of meiosis and compound microscope

**Procedure**

Place the slide on the stage of the microscope and search for the dividing cells using lower magnification. When dividing cells are located observe them under higher magnification.

**Observation**

Observe various stages of meiosis and identify them on the basis of the specific features given in the table 7.1. A significant number of cells will be in the Interphase. These cells have a centrally positioned densely stained nucleus. In case of slide of animal tissue a few mitotically dividing spermatogonial cells may also be seen.

<table>
<thead>
<tr>
<th>Table 7.1 Different stages of meiosis and their features</th>
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<td><strong>Meiosis I</strong></td>
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<td>1. <strong>Prophase I</strong></td>
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<td>Unlike the prophase of mitosis, it is a comparatively complex phase characterised by a number of events. Five sub-phases can be identified in it.</td>
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<tr>
<td>(a) <strong>Leptotene</strong> <em>(leptos = slender tene = band or thread)</em></td>
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<tr>
<td>(i) The nuclear membrane and nucleolus are not distinctly observable (Fig. 7.1 a).</td>
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<tr>
<td>(ii) Fine network of thin threads are seen uniformly distributed in the nucleus. These are chromatin threads, which may be observed as more prominent structures in the later stages.</td>
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**Fig. 7.1** Sub-phase of Prophase I (a-d) – actual microscopic view on left side and its diagrammatic representation on the right hand side
**Exercise 7**

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| **2. Metaphase I** | *(b) Zygote* (Zygon = paired)  
This stage is characterised by the pairing of the homologous chromosomes, which can be seen as paired chromatin threads *(bivalents)* (Fig. 7.1b). |
|   | *(c) Pachytene* (pachy = thick)  
The chromatin threads get condensed and appear shortened and thick. Pairs of homologous chromosomes can be seen. Each chromosome has two chromatids and thus each bivalent consists of four chromatids. This configuration is called tetrad (Fig. 7.1c). |
|   | *(d) Diplotene* (diplos = double)  
The homologous chromosomes (each made up of two chromatids) show distinct separation from each other except at few regions where attachments are seen (Fig. 7.1d). These are *chiasmata* (sing. chiasma) representing the site of exchange of the parts between two homologous chromosomes (i.e. crossing over). |
|   | *(e) Diakinesis* (Dia = opposite; kinesis = separation or movement)  
(i) The homologous pair of chromosomes appear more shortened, thick and prominent (Fig. 7.1d).  
(ii) Chiasmata can be still observed.  
(iii) All the homologous pairs appear scattered in the cell. |

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**3. Anaphase I**  
The chromosome pairs appear to have moved towards the two opposite poles of the cell. At the later stage, the anaphase - I may show the assembly of chromosomes at two poles (Fig. 7.2b). This results into the reduction of number of chromosomes to half.  
This stage can be identified by the presence of two chromatids in each chromosome.  

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**4. Telophase I**  
The chromosomes present at the two poles appear decondensed and form two distinct nuclei (Fig. 7.2c).  
**Note:** *After the telophase I stage there may or may not be cytokinesis. Thereafter the cell enters into the second meiotic division.*

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**Meiosis II**

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<td><strong>1. Prophase II</strong></td>
<td><em>(i) Distinct thread-like chromatin fibres or rod-shaped chromosome are seen.</em></td>
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</table>
Fig. 7.2 Phases of Meosis I (a-c) – actual microscopic view on left side and its diagrammatic representation on the right hand side.

Fig. 7.3 Phases of Meosis II (a,b) – actual microscopic view on left side and its diagrammatic representation on the right hand side.
## Questions

1. What is the significance of meiosis?
2. What is synapsis and crossing over?
3. How can anaphase I and anaphase II be distinguished from each other?
4. Indicate distinguishing feature of metaphase I of meiosis and metaphase of mitosis.
5. How many daughter cells are produced at the end of meiosis?
6. The daughter cells produced at the end of meiosis are genetically different. Explain.
7. What is the significance of synapsis?