

# Modelling Meiosis

Name:

Date:

Block:

**Objective:**

To model and represent the phases of meiosis.

**Materials:**

- Pipe cleaners (4 red, 4 blue, and 4 green)
- Pencil crayons
- 6 beads
- Thread (6 pieces)
- Yarn (4 red, 4 white)

**Procedure:**

1. Interphase: Growth and Development Stage

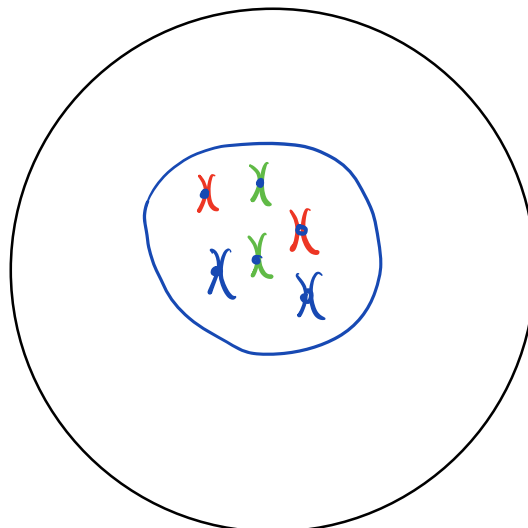
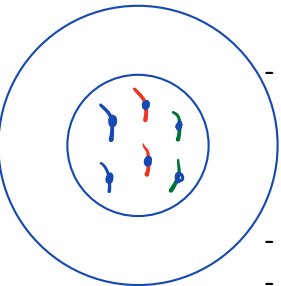
- Take out the four pieces of red yarn and make a large circle. This will represent your **cell membrane**.
- Take out the four pieces of white yarn and make a smaller circle inside of the red one. This will represent the **nuclear membrane**.

Remove the pipe cleaners from the bag and sort them out by colour.

For each colour, put back 2 pipe cleaners of each colour into the bag. The remaining pipe cleaners will represent your **diploid cell**. One set of colours (red, blue, and green) represents the paternal chromosomes while the other set of colours (red, blue, and green) represents the maternal chromosomes.

- Place the pipe cleaners into the nuclear membrane
  - i. What does the term **diploid** mean? The full set of chromosomes are present
  - ii. How many chromosomes are in the diploid cell? 46
  - iii. Why are there two of each colour? One is maternal, one is paternal
- Remove the remaining pipe cleaners from the bag. These are the copied chromosomes.
- Attach the chromosome copies to the originals (same colour) with a bead
  - i. What does the bead represent? centromere
  - ii. What is a chromosome attached to its copy called? sister chromatids
- Draw the cell:

*Start of Interphase  
(diploid cell)*



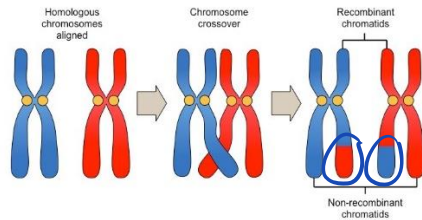
*End of Interphase  
(chromosomes are duplicated, but still diploid cell)*

2. **Prophase I**: Chromosomes have replicated and are attached to their sister chromatids
- Remove the nuclear membrane
  - Pair up the chromosomes randomly. The paired up chromosomes are called **homologous chromosomes**. Homologous chromosomes are a set of maternal and paternal chromosomes that pair up with each other inside the cell. Each carry the same genes in the same order.

↳ ex. eye colour, etc.

**DO NOT DO THIS PART ON YOUR MODEL**

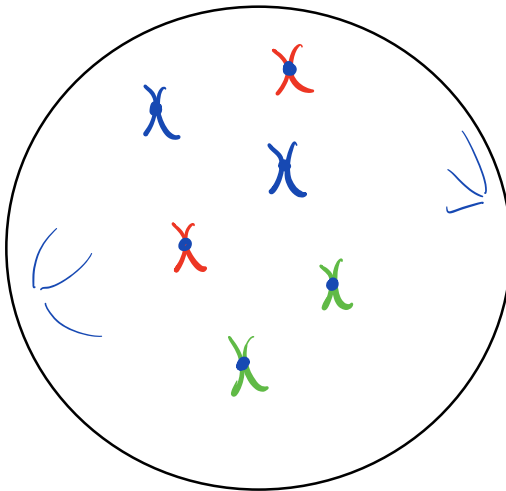
During **Prophase I**, the homologous chromosomes will undergo a process called **crossing over**. This is where parts of one chromosome will exchange parts of itself with the other chromosome in the same homologous pair.



What is the reason for chromosomes to undergo the process of crossing over?

To exchange different parts of their genetic material

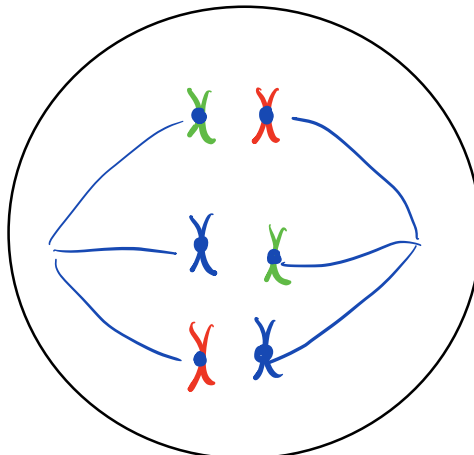
- Add the thread near the border of the cell membrane. This will be the **spindle fibres** that form in the cell.
- Draw the cell:



Prophase I

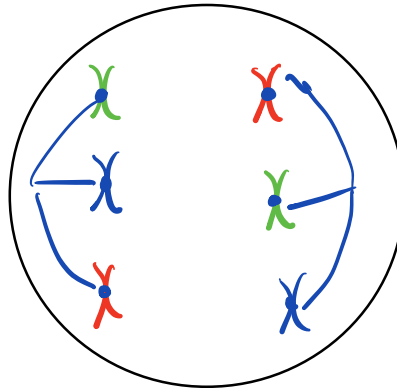
- No more nuclear membrane
- Crossing over has occurred
- Spindle fibres formed

3. **Metaphase I**: The spindle fibres move the homologous chromosomes to the middle of the cell
- Move the homologous pairs so that they line up in the middle of the cell. They should make **two equal lines**.
  - The **homologous pairs** move with the help of the spindle fibres attaching to the centromere of each chromosome.
  - Draw the cell:



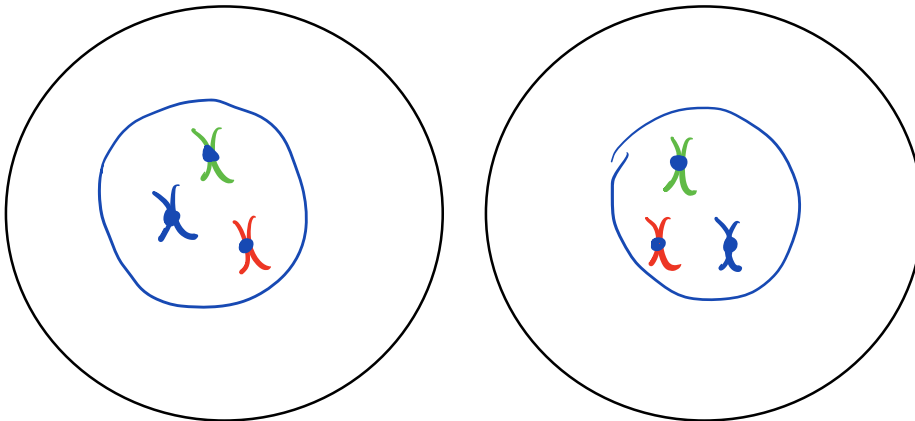
4. **Anaphase I:** The spindle fibres pull the homologous pairs apart.

- Separate the homologous pairs to **opposite ends** of the cell. They will move with the help of the spindle fibres.
- Draw the cell:



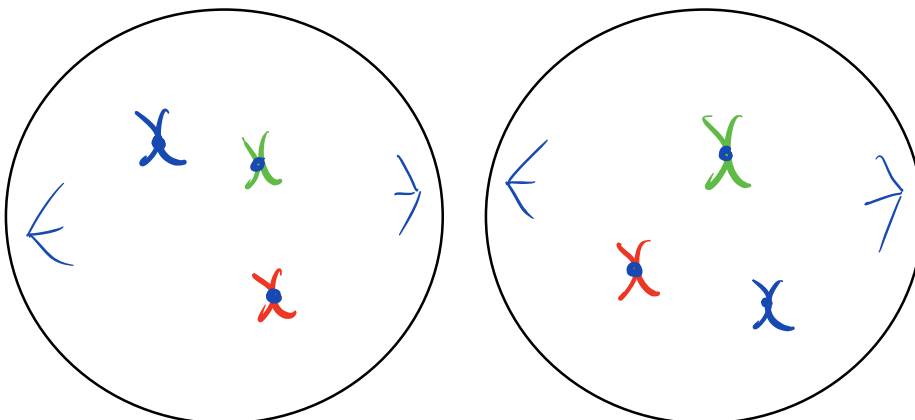
5. **Telophase I and Cytokinesis:** The end of Meiosis I

- Place two pieces of white yarn around each group of chromosomes. This will be the **nuclear membrane** forming around the two sets of chromosomes.
- **Spindle fibres dissolve** (remove the thread)
- Separate the cell into two cells
  - i. The cells that are produced are haploid (haploid/diploid) cells. (Hint: think about the number of centromeres there are during this phase compared to the original cell at the start)
- Draw the cells:



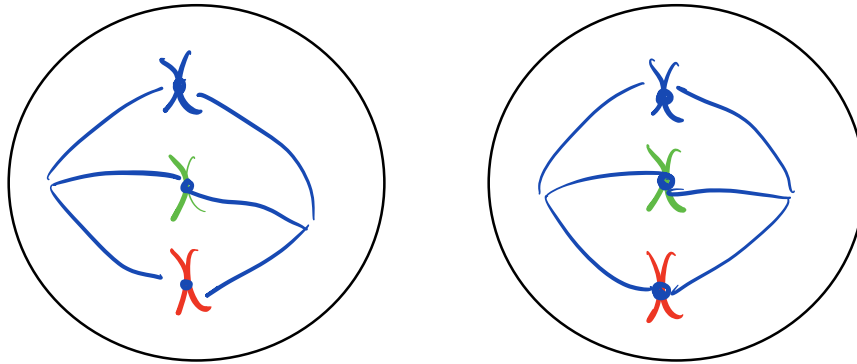
6. **Prophase II:** Meiosis II begins

- **Remove the nuclear membrane**
- **Spindle fibres** begin to form (the thread)
- Draw the cells:



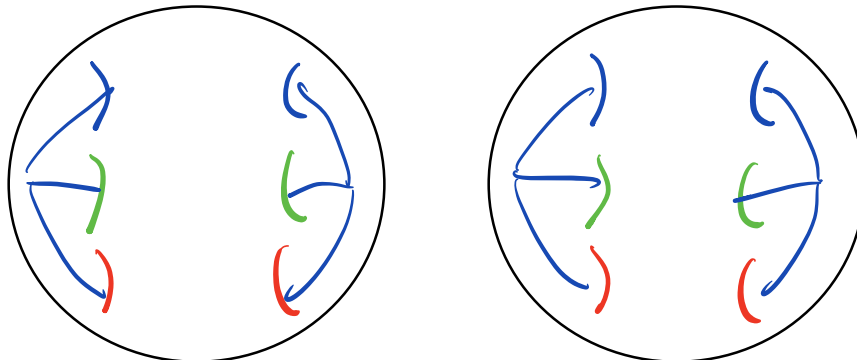
7. **Metaphase II:** The spindle fibres move the chromosomes to the middle of the cell

- Move the chromosomes to the middle of the cell in a straight line
  - i. What is the spindle fibres attached to on the chromosomes? centromere
- Draw the cells (don't forget to draw the spindle fibres):



8. **Anaphase II:** The spindle fibres pull the chromosomes apart

- Remove the bead and separate the chromosomes to the opposite ends of the cells
- Put the beads back into the bag
  - i. What structure separates the chromosomes? spindle fibres
  - ii. What is each half of the separated chromosome called? chromatid
- Draw the cells:



9. **Telophase II and Cytokinesis:** The end of meiosis

- Place white yarn around each group of chromosomes. This will be the nuclear membrane forming around the four sets of DNA.
- Spindle fibres dissolve
- Separate the cells into four cells
  - i. Are these cells diploid or haploid? Why? Haploid - they contain half of the number of the original chromosomes
  - ii. What are these new cells called? gametes
- Draw the cells:

