

Name:

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Biology Lab Activities:

Meiosis

Last updated: 06/02/25

> **Background Questions**

Based on what you've learned in class, in your textbook, and from using Visible Body, answer the following questions about meiosis.

1. Which type of cells divide via meiosis?
2. What are the names of the five stages of meiosis I and II?
 - a.
 - b.
 - c.
 - d.
3. New cells are produced through cell division. However, before cell division can occur, the cell needs to grow and duplicate its DNA and organelles. The phase before meiosis begins is called _____.
4. In meiosis I and II, the phase in which the cell(s) divide is called _____.
 - a. In meiosis I, the cell divides into _____ daughter cells.
 - b. In meiosis II, the cells divide to form _____ daughter cells.
5. In 1–2 sentences, describe the main goal of meiosis.

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Lab 1: Meiosis I

> **Activity 1: Label a cell going through meiosis I**

1. Launch the view
 - Launch Visible Body.
 - Browse or use the Search tool to view the Meiosis I model.
2. Label the image below
 - Explore the 3D model of a reproductive cell dividing through meiosis I to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

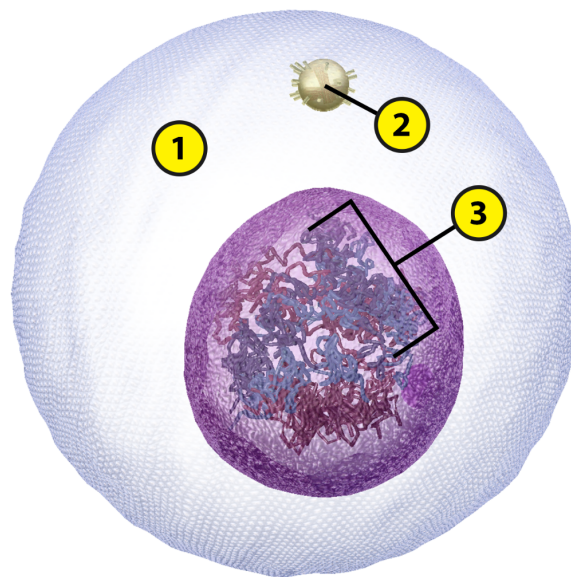
Part A: Label the cell structures during interphase

Word List:

Chromatin

Plasma membrane

Meiotic spindle (centrosome)



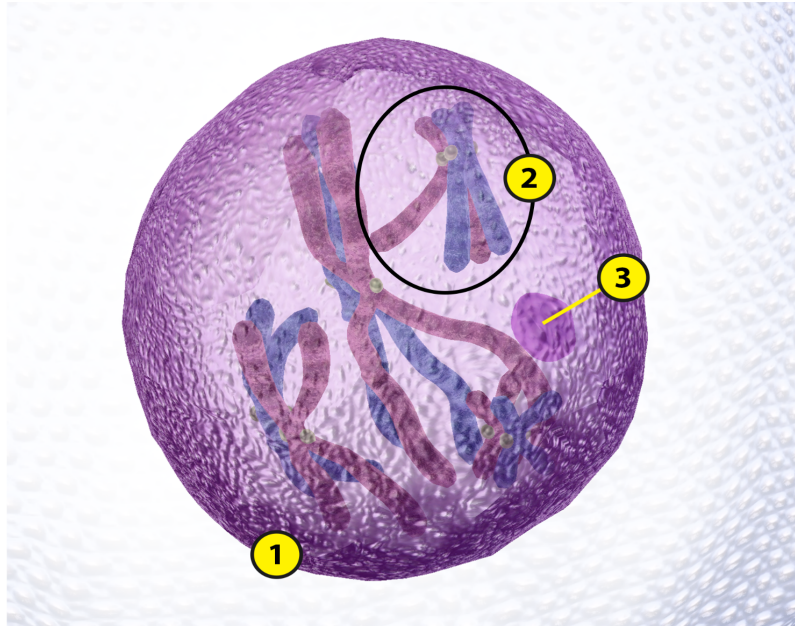
Part B: Label the cell structures during prophase I

Word List:

Homologous chromosome pair (tetrad) _____

Nuclear envelope _____

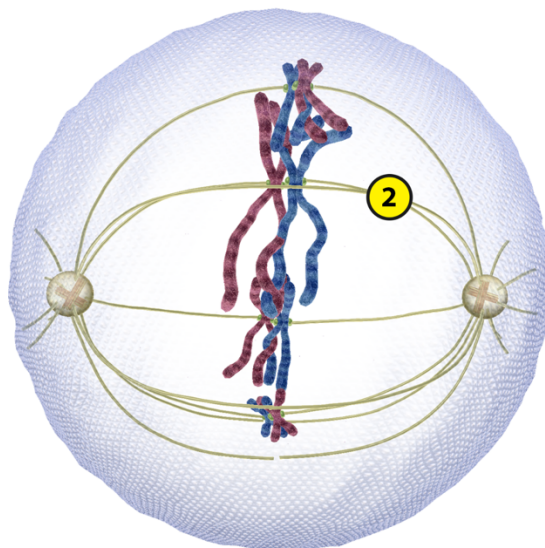
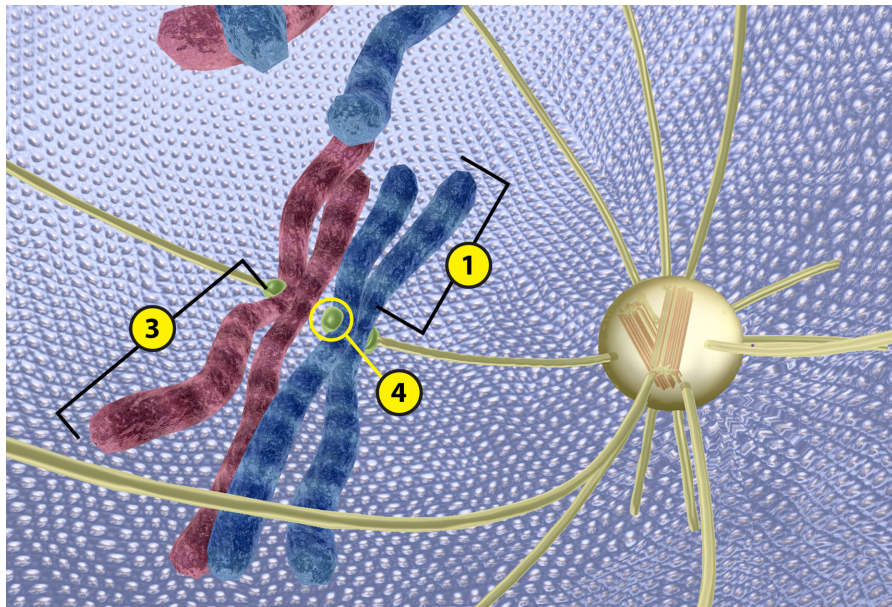
Nucleolus _____



Part C: Label the cell structures during prometaphase I and metaphase I.

Word List:

Kinetochore _____
P arm _____
Q arm _____
Spindle fibers (microtubules) _____



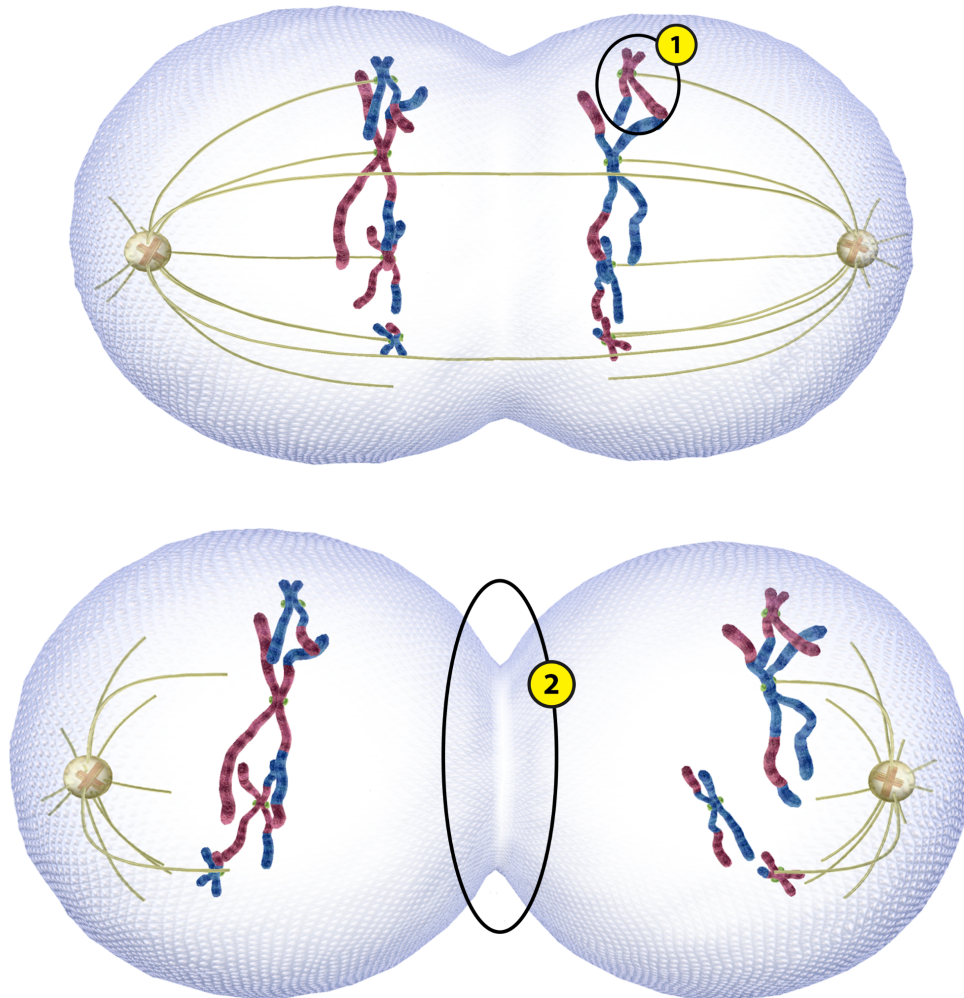
Part D: Label the cell structures during anaphase I and telophase I.

Word List:

Cleavage furrow

Duplicated chromosome (sister chromatids)

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Lab 1: Meiosis I

> **Activity 2: Explore the roles cell structures play in meiosis I**

Refer to your labeled meiosis I images from Activity 1 and the content in Visible Body. Based on what you've learned, match each of the following structures with the brief description of its role in meiosis I.

Structures:

- a. Chromatin
- b. Cleavage furrow
- c. Duplicated chromosomes (sister chromatids)
- d. Homologous chromosome pairs (tetrads)
- e. Kinetochores
- f. Meiotic spindles (centrosomes)
- g. Nuclear envelope
- h. P arm
- i. Plasma membrane
- j. Q arm
- k. Spindle fibers (microtubules)

Descriptions:

- ___ These structures move to each end of the cell during prophase I and organize spindle fibers.
- ___ Spindle fibers connect to these structures, located on each chromosome's centromere.
- ___ This structure duplicates during interphase and condenses to form duplicated chromosomes.
- ___ This forms when the plasma membrane pinches inward to separate the daughter cells.
- ___ Once the cell's DNA replicates, it forms these X-shaped structures.
- ___ This structure contains the chromatin that condenses during interphase, and it dissolves during prometaphase I.
- ___ These structures form when matching chromosomes from the mother and father join together.
- ___ This is the long segment of the chromosome, separated from the other segment by the centromere.

___ This is the short segment of the chromosome, separated from the other segment by the centromere.

___ These structures help organize homologous chromosome pairs (tetrads) at the midline of the cell.

___ This structure is the barrier between the inside and the outside of the parent cell and the daughter cells.

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Lab 2: Meiosis II

> **Activity 1: Label a cell going through meiosis II**

1. Launch the view
 - Launch Visible Body.
 - Browse or use the Search tool to view the Meiosis II model.
2. Label the image below
 - Explore the 3D model of two reproductive cells dividing through meiosis II to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

Part A: Label the cell structures during prophase II and prometaphase II

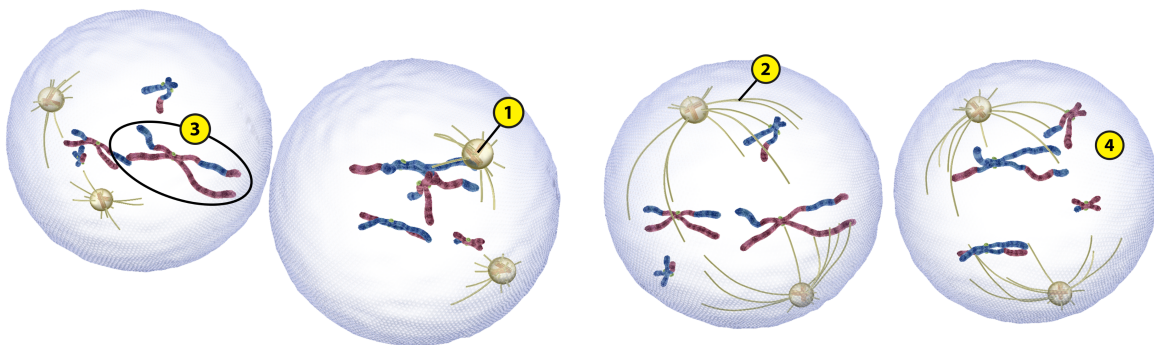
Word List:

Daughter chromosomes (duplicated)

Meiotic spindles (centrosomes)

Plasma membrane

Spindle fibers (microtubules)



Part B: Label the cell structures during metaphase II, anaphase II, and telophase II.

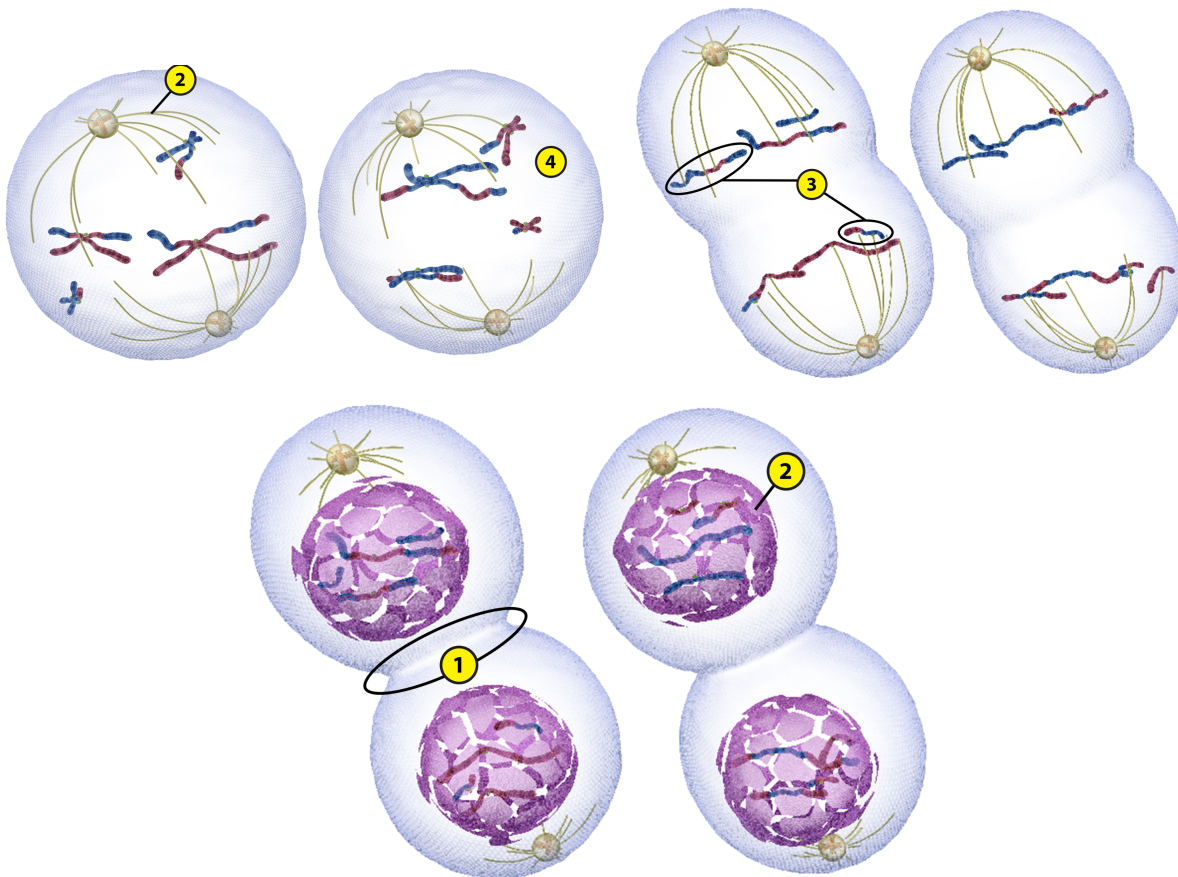
Word List:

Cleavage furrow

Kinetochores

Nuclear envelope

Daughter chromosomes (single)



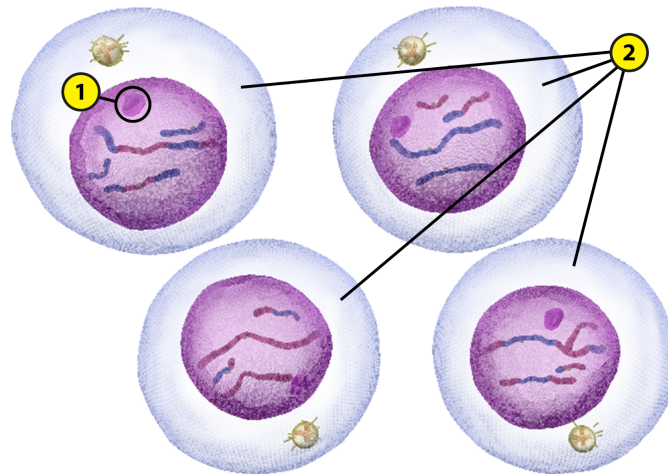
Part C: Label the cell structures following cytokinesis.

Word List:

Gametes

Nucleolus

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Lab 2: Meiosis II

> **Activity 2: Explore the roles cell structures play in meiosis II**

Refer to your labeled meiosis II images from Activity 1 and the content in Visible Body. Based on what you've learned, match each of the following structures with the brief description of its role in meiosis II.

Structures:

- a. Daughter chromosomes (single)
- b. Cleavage furrow
- c. Gametes
- d. Kinetochores
- e. Meiotic spindles (centrosomes)
- f. Nuclear envelope
- g. Plasma membrane

Descriptions:

- ___ These are produced at the end of meiosis II.
- ___ This forms around the separated daughter chromosomes during telophase II.
- ___ This elongates during anaphase II, pinches inward during telophase II, and splits to enclose each daughter cell.
- ___ These structures move to each end of the cell during prophase II and organize spindle fibers.
- ___ This forms when the plasma membrane pinches inward to separate the daughter cells.
- ___ Spindle fibers connect to these chromosome structures.
- ___ Each daughter cell contains a genetically unique set of these structures.

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Lab 3: Cell Division via Meiosis

Refer to your labeled meiosis I and II images from Labs 1 and 2, Activity 1.

1. In the space that follows, draw the chromosomes (or paste a screenshot of your drawing) and show what happens to them during each phase of meiosis. Your drawing should include the following structures: chromosomes, kinetochores, meiotic spindles (centrosomes), and spindle fibers (microtubules).
 - a. Prophase I
 - b. Prometaphase I
 - c. Metaphase I
 - d. Anaphase I
 - e. Telophase I and cytokinesis
 - f. Prophase II
 - g. Prometaphase II
 - h. Metaphase II
 - i. Anaphase II
 - j. Telophase II and cytokinesis
2. Based on your drawings and what you've learned about meiosis, put the following phases of meiosis into the correct order (from 1–10).
 - ___ Spindle fibers pull the sister chromatids apart.
 - ___ Spindle fibers form in both daughter cells.
 - ___ The cleavage furrow forms and the parent cell splits into two daughter cells.
 - ___ Spindle fibers connect to the kinetochores of the tetrads' chromosomes.
 - ___ Spindle fibers connect to the kinetochores of the duplicated chromosomes.
 - ___ Spindle fibers arrange the tetrads at the midline of the cell.
 - ___ Chromatin condenses into duplicated chromosomes.
 - ___ The cleavage furrow forms and the two daughter cells split into four daughter cells.
 - ___ Spindle fibers arrange the duplicated chromosomes at the midline of the cell.
 - ___ Spindle fibers pull the tetrads apart.

3. Genetic variation is an important part of animal reproduction. Two processes introduce genetic variation during meiosis I: crossing over and independent assortment. Fill in the blanks in the following sentences about these processes.
- a. During crossing over, _____ chromosomes cross over their p and _____ arms and exchange genetic information.
 - b. During metaphase I, the homologous chromosome pairs line up at the midline of the cell. There are _____ different ways each chromosome pair can be arranged at the midline, and how they are arranged determines which chromosomes are pulled into each daughter cell. This concept is known as independent assortment.

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Lab 4: Compare Meiosis and Mitosis

Refer to your labeled images of meiosis I and II from Labs 1 and 2, as well as your labeled images in the mitosis lab, to answer the following questions.

1. Meiosis and mitosis are two types of cell division. These processes are similar in many ways. Fill in the blanks in the following sentences about their shared characteristics.
 - a. Both processes start off with the cell in _____. During this phase, the _____ and organelles duplicate in preparation for cell division.
 - b. Cells dividing via meiosis and mitosis both undergo these phases by the same names: prophase, prometaphase, _____, anaphase, and _____.
 - c. In meiosis II and mitosis, _____ are split between the resulting daughter cells.
2. Now, let's look at how meiosis and mitosis differ from each other. Fill in the blanks in the following sentences about their distinguishing characteristics.
 - a. Meiosis is how _____ cells are produced, whereas mitosis is how _____ cells divide.
 - b. Meiosis produces _____ daughter cells via two rounds of cell division, whereas mitosis produces ____ daughter cells in one round of cell division.
 - c. Meiosis produces _____ cells, meaning they have half the number of chromosomes as the parent cell (one set). On the other hand, mitosis produces _____ cells, which have the same number of chromosomes as the parent cell (two sets).
 - d. Meiosis produces cells that are genetically _____, whereas mitosis produces cells that are genetically _____.
3. In 3–5 sentences, explain why genetic variation is an important part of meiosis, but it isn't introduced during mitosis.