

SNC2D/2P Tissues, Organs, and Systems of Living Things/Tissues, Organs, and Systems

Teacher Demo: Sock Mitosis

Topics	Timing
mitosis and the cell cycle	preparation: 10–15 min demonstration: 15 min

Specific Expectations

SNC2D

A1.1 formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

B3.1 describe the cell cycle in plants and animals, and explain the importance of mitosis for the growth of cells and repair of tissues

B3.2 explain the importance of cell division and cell specialization in generating new tissues and organs (e.g., the division of stem cells into specialized cells such as muscle cells or nerve cells in humans; the division of meristematic cells to expand and differentiate plant tissue)

SNC2P

A1.1 formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

B3.1 describe the cell cycle in animals, and explain its importance for the growth of cells and repair of tissues

Introduction

This demonstration is a great way for students to model the stages of mitosis. Images of the different stages in textbooks are static snapshots and many students have difficulty grasping the idea that mitosis happens as part of a continuous cycle.

Materials

roll of magnetic tape (or tape that will stick to white board/chalkboard)

4 pairs of socks (each visibly different from the other pairs)

dry erase markers or chalk (3 different colours)
large white board or chalkboard

2 matching magnets

4 clothespins

Safety Considerations

None

Procedure

Item	What it represents
1 st colour of marker/chalk	cellular membrane
2 nd colour of marker/chalk	nuclear membrane
3 rd colour of marker/chalk	spindle fibres
pair of socks	chromosome and duplicate chromosome
clothespin	centromere
pair of magnets	centrioles

Prepare the following before performing the demonstration.

1. Attach a piece of magnetic tape to each sock and place one sock inside its matching partner (so only one sock is visible for each pair of socks). These represent four different unduplicated chromosomes.
2. Using the first coloured marker, draw a large circle on the board (approximately 1.5 m in diameter) to represent the cell membrane.
3. Using the second coloured marker, draw a smaller circle within the large circle. This represents the nuclear membrane. (It should be large enough to fit 8 socks inside.)
4. Place the two magnets anywhere in the cell, representing the two centrioles.
5. Place the four unduplicated chromosomes jumbled up in the nucleus.

Organize your class into groups of 2–4 students.

6. **Predict/Explain**

Ask each group to explain what the objects on the board represent and to predict how the cell will divide. Each group should also attempt to come up with a rationale for their predictions.

7. **Observe**

Conduct the demonstration outlined below and provide time for students to record their observations. Have students sketch diagrams of interphase and each of the phases of mitosis, and label each component.

- a. **INTERPHASE:** The board is already set up to represent interphase. This is before mitosis begins. The cell spends most of the time in this part of the cell's life cycle. Now pull out the inside sock from each set, stick it to the board and use a clothespin to attach each pair of socks. This represents the chromosomes being duplicated and attached with a centromere (the clothespin).
- b. **PROPHASE:** Erase sections of the nuclear membrane so it is now a dotted circle. This represents the nuclear membrane beginning to break down. Spread the socks out to make an "X" since you can now see the chromosomes in this phase. Move the centrioles (magnets) to opposite sides of the cell. Using the 3rd colour marker, draw spindle fibres coming from each of the centrioles.
- c. **METAPHASE:** Erase the rest of the nuclear membrane. Move each pair of socks so they line up in a straight line perpendicular to the imaginary line formed

between the two centrioles. Extend the spindle fibre lines so they connect to the centromeres (clothespins).

- d. ANAPHASE: Remove the centromeres (clothespins). Erase part of the spindle fibres (representing the shortening of the fibres) and move each pair of chromosomes apart.
- e. TELOPHASE: Erase the spindle fibres. Erase the central part of the cell membrane and draw the membrane pinching in from the sides. Form two new nuclear membranes with the second marker colour, one around each set of chromosomes.
- f. CYTOKINESIS: Erase the middle part of the cell membrane and redraw that portion so there are now two distinct cells.

8. **Explain**

Ask the groups to reconvene and explain their observations.

Disposal

The materials can be reused for future demonstrations/activities.

What happens?

Students will observe a model going through each stage of mitosis.

How does it work?

The life of a cell includes both the growth of the cell and cell division. The cell spends most of its time in interphase, where it undergoes growth, cellular respiration, DNA replication, and specific functions. Mitosis is cell division in which one parent cell splits into two identical daughter cells. Cell division is important for growth and to replace dead cells. Cells cannot grow continuously as there is a limit to cell size so they must divide. The process of cell division can be split into four major phases (prophase, metaphase, anaphase and telophase). Specific events occur in each of these phases that lead to the production of two identical daughter cells from one parent cell.

Teaching Suggestions/Hints

1. This demonstration could be easily modified into a student activity to be done in small groups on a large table or on the floor.
2. Pieces of rope or yarn could be used to represent the cell membrane, nuclear membrane, and spindle fibres.

Next Steps

Once students can visualize mitosis, they can then move on to an activity in which they identify cells at each stage of mitosis under a microscope (e.g., onion root tip). This demonstration could be modified to introduce meiosis and to help students compare mitosis and meiosis.

Additional Resources

1. Animation of mitosis in an animal cell: <http://www.cellsalive.com/mitosis.htm>
2. Animation of mitosis in an animal cell: <http://www.johnkyrk.com/mitosis.html>
3. Student activity modelling both mitosis and meiosis:

<http://www.carolina.com/teacher-resources/Interactive/modeling-mitosis-and-meiosis-activity/tr10797.tr?coId=10850&mCat=&trail=4008:LifeScience:7002:10850:4010:Genetics>