

Educational Resources from *Phenomenon Science Education*

Student Proficiency Goals for NGSS HS-LS1-4



Information about HS-LS1-4

NGSS Performance Expectation HS-LS1-4.

Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Clarification Statement.

No clarification statement is listed for this Performance Expectation.

Assessment Limits.

Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.

Science and Engineering Practice (Developing and Using Models)

- Use a model based on evidence to illustrate the relationships between systems or between components of a system.

Disciplinary Core Idea (LS1.B: Growth and Development of Organisms)

- In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.

Crosscutting Concept (Systems and System Models)

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

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Student Proficiency Goals for **NGSS HS-LS1-4**



Student Proficiency Goals

SEP (Developing and Using Models):

- Students use a model to illustrate the role cellular division (including mitosis) plays in producing and maintaining complex organisms.
- Students use a model to illustrate the role differentiation plays in producing and maintaining complex organisms.

DCI (LS1.B Growth and Development of Organisms):

- Students know that in many multicellular organisms, individual cells grow and divide through mitosis.
- Students know that many organisms begin as a single cell that divides to produce two daughter cells who divide successively to produce many and multiple types of cells.
- Students know that during each cell division the parent cell passes identical genetic material, including two variants of each chromosome pair, to each daughter cell.
- Students know that cells differentiate to produce systems of tissues and organs that work together to meet the needs of the whole organism.
- Students know that cellular division and differentiation produce and maintain a complex organism.

CCC (Systems and System Models):

- Students consider the flows of information, energy, and/or matter that occur through the processes of cellular division and differentiation.
- Students consider how information, energy, and/or matter flow through systems at different scales to produce and maintain complex organisms.
- Students consider, using a model, how to simulate the roles cellular division and differentiation play in producing and maintaining complex organisms.