

Grade 6 Science, Unit 1

Growth and Development of Organisms

Overview

Unit abstract

By the end of this unit, students will understand how the environment and genetic factors determine the growth of an individual organism. They can connect this to the role of animal behaviors in animal reproduction and to the dependence of some plants on animal behaviors for their reproduction. Students will be able to provide evidence to support their understanding of the structures and behaviors that increase the likelihood of successful reproduction by organisms.

Students will have opportunities to practice analyzing and interpreting data, using models, conducting investigations, and communicating information. Crosscutting concepts of cause and effect and structure and function support understanding across this topic.

Essential question

- How do organisms grow, develop, and reproduce?

Written Curriculum

Next Generation Science Standards¹

MS. Growth, Development, and Reproduction of Organisms

Students who demonstrate understanding can:

MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Engaging in Argument from Evidence</p> <p>Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).</p> <ul style="list-style-type: none"> Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS1-4) 	<p>LS1.B: Growth and Development of Organisms</p> <ul style="list-style-type: none"> Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4) Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4) 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4)
<p><i>Connections to other DCIs in this grade-band:</i> MS.LS2.A (MS-LS1-4)</p>		
<p><i>Articulation to DCIs across grade-bands:</i> 3.LS1.B (MS-LS1-4); HS.LS2.A (MS-LS1-4); HS.LS2.D (MS-LS1-4)</p>		
<p><i>Common Core State Standards Connections:</i></p> <p><i>ELA/Literacy –</i></p> <p>RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-4)</p> <p>RI.6.8 Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-4)</p> <p>WHST.6-8.1 Write arguments focused on discipline content. (MS-LS1-4)</p> <p><i>Mathematics –</i></p> <p>6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. (MS-LS1-4)</p> <p>6.SP.B.4 Summarize numerical data sets in relation to their context. (MS-LS1-4)</p>		

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MS. Growth, Development, and Reproduction of Organisms		
Students who demonstrate understanding can:		
MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]		
The performance expectations above were developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> :		
<p style="text-align: center;">Science and Engineering Practices</p> <p>Constructing Explanations and Designing Solutions</p> <p>Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.</p> <ul style="list-style-type: none"> Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-5) 	<p style="text-align: center;">Disciplinary Core Ideas</p> <p>LS1.B: Growth and Development of Organisms</p> <ul style="list-style-type: none"> Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5) 	<p style="text-align: center;">Crosscutting Concepts</p> <p>Cause and Effect</p> <ul style="list-style-type: none"> Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-5)
<i>Connections to other DCIs in this grade-band:</i> MS.LS2.A (MS-LS1-5);		
<i>Articulation to DCIs across grade-bands:</i> 3.LS1.B (MS-LS1-5); 3.LS3.A (MS-LS1-5); HS.LS2.A (MS-LS1-5)		
<i>Common Core State Standards Connections:</i>		
<i>ELA/Literacy –</i>		
RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-5)	
RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-5)	
WHST.6-8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-5)	
WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-5)	
<i>Mathematics –</i>		
6.SP.A.2	Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. (MS-LS1-5)	
6.SP.B.4	Summarize numerical data sets in relation to their context. (MS-LS1-5)	

Clarifying the standards

Prior learning

The following disciplinary core ideas are prior learning for the concepts in this unit of study. By the end of Grade 5, students should know that:

- Reproduction is essential to every kind of organism.
- Organisms have unique and diverse life cycles.
- Organisms have both internal and macroscopic structures that allow for growth, survival, behavior, and reproduction.

Progression of current learning

Driving question 1

How do characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively?

Concepts

- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.
 - There are a variety of ways that plants reproduce.
 - Specialized structures for plants affect their probability of successful reproduction.
 - Some characteristic animal behaviors affect the probability of successful reproduction in plants.
- Animals engage in characteristic behaviors that affect the probability of successful reproduction.
 - There are a variety of characteristic animal behaviors that affect their probability of successful reproduction.
 - There are a variety of animal behaviors that attract a mate.
- Successful reproduction of animals and plants may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability.

Practices

- Collect empirical evidence about animal behaviors that affect the animals' probability of successful reproduction and also affect the probability of plant reproduction.
- Collect empirical evidence about plant structures that are specialized for reproductive success.
- Use empirical evidence from experiments and other scientific reasoning to support oral and written arguments that explain the relationship among plant structure, animal behavior, and the reproductive success of plants.
- Identify and describe possible cause-and-effect relationships affecting the reproductive success of plants and animals using probability.
- Support or refute an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful plant reproduction using oral and written arguments.

Driving question 2

How do environmental and genetic factors influence the growth of organisms?

Concepts

- Genetic factors as well as local conditions affect the growth of organisms.
 - A variety of local environmental conditions affect the growth of organisms.
- Genetic factors affect the growth of organisms (plant and animal).
- The factors that influence the growth of organisms may have more than one cause.
- Some cause-and-effect relationships in plant and animal systems can only be described using probability.

Practices

- Conduct experiments, collect evidence, and analyze empirical data.
- Use evidence from experiments and other scientific reasoning to support oral and written explanations of how environmental and genetic factors influence the growth of organisms.
- Identify and describe possible causes and effects of local environmental conditions on the growth of organisms.
- Identify and describe possible causes and effects of genetic conditions on the growth of organisms.

Integration of content, practices, and crosscutting concepts

Instruction should result in students being able to use arguments based on empirical evidence and scientific reasoning to support an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants. Students may observe examples of plant structures that could affect the probability of plant reproduction, including bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract pollen-transferring insects, and hard shells on nuts that squirrels bury. Possible activities could include plant experiments (e.g., students could count the number of butterflies on brightly colored plants vs. the number of butterflies on other types of plants and record the data they collect in a table), using microscopes/magnifiers to view plant structures (e.g., dissecting a lily), going on field trips, both virtual and actual (e.g., butterfly garden/botanical garden).

Students may observe examples of animal behaviors that affect the probability of plant reproduction, which could include observing how animals can transfer pollen or seeds and how animals can create conditions for seed germination and growth (e.g., students may conduct an experiment using rapid cycling *Brassica rapa* [Fast Plant] and collect data on how many plants produce seeds with and without the aid of a pollinator).

Students could then observe examples of animal behaviors (using videos, Internet resources, books, etc.) that could affect the probability of successful animal reproduction. These behaviors could include nest building to protect young from cold, herding of animals to protect young from predators, and colorful plumage and vocalizations to attract mates for breeding.

Students may be able to identify and describe possible cause-and-effect relationships in factors that contribute to the reproductive success of plants and animals by using probability data from the rapid-cycling *Brassica rapa* (Fast Plant) experiments and drawing conclusions about one relationship between animals and plants.

At this point, students can present an oral and/or written argument supported by evidence and scientific reasoning that characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively. Students may use evidence from experiments or other sources to identify the role of pollinators in plant reproduction.

Instruction that results in students being able to construct an evidence-based scientific explanation for how environmental and genetic factors influence the growth of organisms could begin with students conducting

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experiments and collecting data on the environmental conditions that effect the growth of organisms (e.g., the effect of variables such as food, light, space, and water on plant growth).

Students could then examine genetic factors (inherited traits) that influence the growth of organisms, including parental traits and selective breeding. It is important to note that at this grade level, Mendelian genetics are not a part of student learning. Mendelian genetics will be covered in future grades.

This unit of study could end with students using an oral and/or written argument, supported by evidence and scientific reasoning from their experiments, to explain how environmental conditions and genetic factors affect the growth of an organism.

Integration of mathematics and/or English Language Arts/literacy

Mathematics

- Understand that a set of data collected to answer a statistical question about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively, has a distribution which can be described by its center (mean), spread (range), and overall shape (shape of the distribution of data).
- Summarize numerical data sets, collected to answer a statistical question about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively, that have a distribution that can be described by its center (mean), spread (range), and overall shape (shape of the distribution of data) in relation to their context.

English language arts/literacy

- Cite specific, empirical, textual evidence to support analysis of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively.
- Trace and evaluate the argument and specific claims in a text about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively. Distinguish claims that are supported by empirical evidence and scientific reasoning from claims that are not.
- Write an argument focused on how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively.

Future learning

- Systems of specialized cells within organisms help perform essential functions of life.
- Any one system in an organism is made up of numerous parts.
- Feedback mechanisms maintain an organism's internal condition within certain limits and mediate behaviors.
- Growth and division of cells in organisms occur by mitosis and differentiation for specific cell types.

Number of Instructional Days

Recommended number of instructional days: 24 (1 day = approximately 50 minutes)

Note—The recommended number of days is an estimate based on the information available at this time. Teachers are strongly encouraged to review the entire unit of study carefully and collaboratively to determine whether adjustments to this estimate need to be made.

