

## MS-LS4-4 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

- MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]**

The performance expectation above was 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><b>Constructing Explanations and Designing Solutions</b></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 ideas, principles, and theories.</p> <ul style="list-style-type: none"> <li>Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena.</li> </ul>	<p><b>LS4.B: Natural Selection</b></p> <ul style="list-style-type: none"> <li>Natural selection leads to the predominance of certain traits in a population, and the suppression of others.</li> </ul>	<p><b>Cause and Effect</b></p> <ul style="list-style-type: none"> <li>Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.</li> </ul>

### Observable features of the student performance by the end of the course:

1	Articulating the explanation for phenomena										
	a Students articulate a statement that relates the given phenomenon to scientific ideas about the cause-and-effect relationship between the inheritance of traits increasing the chances of successful reproduction and natural selection.										
	b Students use evidence and reasoning to construct an explanation for the given phenomenon.										
2	Evidence										
	a Students identify and describe* given evidence (e.g., from students' own investigations, observations, reading materials, archived data) necessary for constructing the explanation, including: <table border="1" style="width: 100%; margin-left: 20px;"> <tbody> <tr> <td>i.</td> <td>Individuals in a species have genetic variation that can be passed on to their offspring.</td> </tr> <tr> <td>ii.</td> <td>The probability of a specific organism surviving and reproducing in a specific environment.</td> </tr> <tr> <td>iii.</td> <td>The traits (i.e., specific variations of a characteristic) and the cause-and-effect relationships between those traits and the probability of survival and reproduction of a given organism in a specific environment.</td> </tr> <tr> <td>iv.</td> <td>The particular genetic variations (associated with those traits) that are carried by that organism.</td> </tr> </tbody> </table>	i.	Individuals in a species have genetic variation that can be passed on to their offspring.	ii.	The probability of a specific organism surviving and reproducing in a specific environment.	iii.	The traits (i.e., specific variations of a characteristic) and the cause-and-effect relationships between those traits and the probability of survival and reproduction of a given organism in a specific environment.	iv.	The particular genetic variations (associated with those traits) that are carried by that organism.		
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3	Reasoning										
	a Students use reasoning to connect the evidence and support an explanation that describes* the relationship between genetic variation and the success of organisms in a specific environment. Students describe* a chain of reasoning that includes: <table border="1" style="width: 100%; margin-left: 20px;"> <tbody> <tr> <td>i.</td> <td>Any population in a given environment contains a variety of available, inheritable genetic traits.</td> </tr> <tr> <td>ii.</td> <td>For a specific environment (e.g., different environments may have limited food availability, predators, nesting site availability, light availability), some traits confer advantages that make it more probable that an organism will be able to survive and reproduce there.</td> </tr> <tr> <td>iii.</td> <td>In a population, there is a cause-and-effect relationship between the variation of traits and the probability that specific organisms will be able to survive and reproduce.</td> </tr> <tr> <td>iv.</td> <td>Variation of traits is a result of genetic variations occurring in the population.</td> </tr> <tr> <td>v.</td> <td>The proportion of individual organisms that have genetic variations and traits that are advantageous in a particular environment will increase from generation to generation due to</td> </tr> </tbody> </table>	i.	Any population in a given environment contains a variety of available, inheritable genetic traits.	ii.	For a specific environment (e.g., different environments may have limited food availability, predators, nesting site availability, light availability), some traits confer advantages that make it more probable that an organism will be able to survive and reproduce there.	iii.	In a population, there is a cause-and-effect relationship between the variation of traits and the probability that specific organisms will be able to survive and reproduce.	iv.	Variation of traits is a result of genetic variations occurring in the population.	v.	The proportion of individual organisms that have genetic variations and traits that are advantageous in a particular environment will increase from generation to generation due to
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v.	The proportion of individual organisms that have genetic variations and traits that are advantageous in a particular environment will increase from generation to generation due to										

	natural selection because the probability that those individuals will survive and reproduce is greater.
vi.	Similarly, the proportion of individual organisms that have genetic variations and traits that are disadvantageous in a particular environment will be less likely to survive, and the disadvantageous traits will decrease from generation to generation due to natural selection.