

HS-LS3-2

Students who demonstrate understanding can:

HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]

The performance expectation above was developed using the following elements from *A Framework for K-12 Science Education*:

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
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| <p>Engaging in Argument from Evidence Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.</p> <ul style="list-style-type: none"> Make and defend a claim based on evidence about the natural world that reflects scientific knowledge and student-generated evidence. | <p>LS3.B: Variation of Traits</p> <ul style="list-style-type: none"> In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. | <p>Cause and Effect</p> <ul style="list-style-type: none"> Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. |

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

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|---|--|---|---|--|--|--|---|--|---|--|---------------------------|--|---------------------------------------|---|---|
| 1 | Developing a claim | | | | | | | | | | | | | | |
| | <table border="1"> <tr> <td style="background-color: #e0e0e0;">a</td> <td>Students make a claim that includes the idea that inheritable genetic variations may result from:</td> </tr> <tr> <td></td> <td>i. New genetic combinations through meiosis;</td> </tr> <tr> <td></td> <td>ii. Viable errors occurring during replication; and</td> </tr> <tr> <td></td> <td>iii. Mutations caused by environmental factors.</td> </tr> </table> | a | Students make a claim that includes the idea that inheritable genetic variations may result from: | | i. New genetic combinations through meiosis; | | ii. Viable errors occurring during replication; and | | iii. Mutations caused by environmental factors. | | | | | | |
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| 2 | Identifying scientific evidence | | | | | | | | | | | | | | |
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| | b) environmental factors. | | | | | | | | | | | | | | |
| | iii. Genetic material is inheritable. | | | | | | | | | | | | | | |
| b | Students use scientific knowledge, literature, student-generated data, simulations and/or other sources for evidence. | | | | | | | | | | | | | | |
| 3 | Evaluating and critiquing evidence | | | | | | | | | | | | | | |
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| | | i. Types and numbers of sources; |
| | | ii. Sufficiency to make and defend the claim, and to distinguish between causal and correlational relationships; and |
| | | iii. Validity and reliability of the evidence. |
| 4 | Reasoning and synthesis | |
| | a | Students use reasoning to describe* links between the evidence and claim, such as: |
| | | i. Genetic mutations produce genetic variations between cells or organisms. |
| | | ii. Genetic variations produced by mutation and meiosis can be inherited. |
| | b | Students use reasoning and valid evidence to describe* that new combinations of DNA can arise from several sources, including meiosis, errors during replication, and mutations caused by environmental factors. |
| | c | Students defend a claim against counter-claims and critique by evaluating counter-claims and by describing* the connections between the relevant and appropriate evidence and the strongest claim. |