# 3-D Performance Assessment

Performance Expectation: **HS-LS2-8**
Grade Level: **High School**

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|---|---|---|---|
| Title | **Defending the Hive to Survive...To Bee Aggressive or not** | | |
| Designed by | **Patrick Bond, Sarah Conger, Travis Hall, Brie Stratton** | Course(s) | **Living Environment** |

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| Performance Expectation | **HS-LS2-8**: Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.<br><br>**Clarification Statement**: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.<br>**Assessment Boundary**: none |

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| Science and Engineering Practice | **Engaging in Argument from Evidence**<br>• Evaluate the evidence behind currently accepted explanations to determine the merits of arguments. |
| Disciplinary Core Ideas | **LS2.D: Social Interactions and Group Behavior**<br>• Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. |
| Crosscutting Concept | **Cause and Effect**<br>• Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. |

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| Student Performance | 1. Identifying the given explanation and the supporting evidence<br>2. Identifying any potential additional evidence that is relevant to the evaluation<br>3. Evaluating and critiquing |

# Performance Assessment

## Phenomenon

From spring through fall, a honeybee's main task is turning plant nectar into honey. The honey is stored and eaten over the winter, so it is vital for the colony's survival. Because honey is an energy-rich food source, hives are targets for break-ins from animals, like bears, skunks, and humans that want to steal the honey. Bees even have to fight off bees from other colonies that try to steal honey.

Beekeepers are wondering if they should stimulate their colonies to become more aggressive. Perhaps a more aggressive hive would produce more honey. As an animal behavior specialist the beekeepers have asked you to collect research to determine if there is a cause/effect relationship between aggression, honey production and colony survival.

| Queen # | Foster colony aggression level | Average offspring aggression score | Foster colony aggression level | Average offspring aggression score |
|---|---|---|---|---|
| 1 | Low | 7.1 | High | |
| 2 | Low | 6.6 | High | 7.2 |
| 3 | Low | 5.7 | High | 6.9 |
| 4 | Low | 6.9 | High | |
| 5 | Low | 4.6 | High | 7.2 |
| 6 | Low | | High | 6.6 |
| 7 | Low | 7.4 | High | 8.1 |
| 8 | Low | 5.1 | High | 6.1 |
| 9 | Low | 4.4 | High | 5.3 |
| 10 | Low | 4.1 | High | 4.3 |
| 11 | Low | 4.3 | High | 4.7 |
| 12 | Low | 5.4 | High | 6.4 |
| 13 | Low | 3.7 | High | 4.9 |
| 14 | Low | 6.0 | High | 8.1 |
| 15 | Low | 3.0 | High | 5.3 |
| 16 | Low | 2.9 | High | 5.3 |
| 17 | Low | 3.0 | High | 5.4 |
| 18 | Low | 6.4 | High | 5.8 |

| Low Average Aggression Score | | High Average Aggression Score | |
|---|---|---|---|

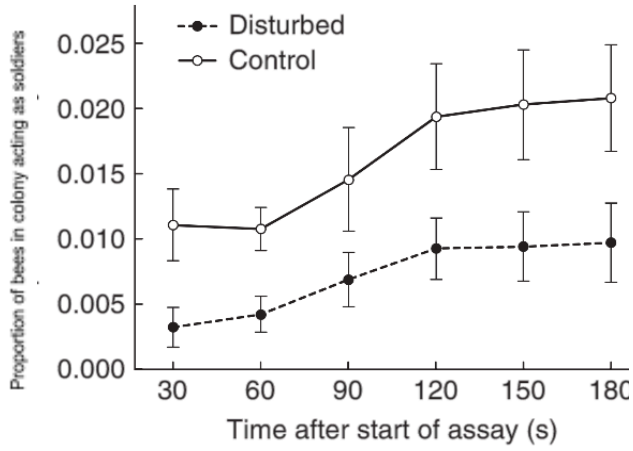
**Add caption**

http://datanuggets.org/wp-content/uploads/2017/06/Bee-aggressive_StudentC.pdf

Stimulus

Two groups of researchers conducted investigations to determine the effects that aggressive behavior have on colony success.

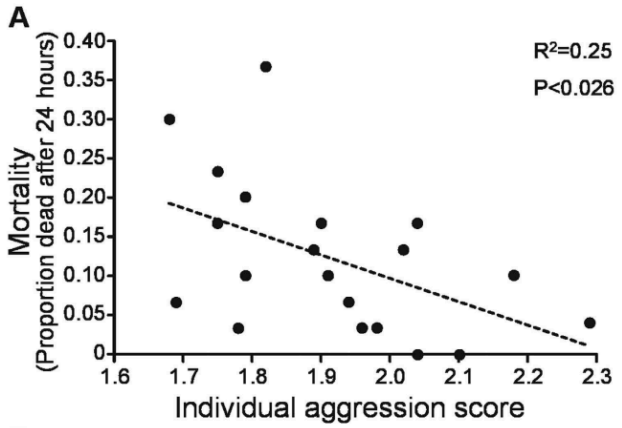
https://onlinelibrary.wiley.com/doi/epdf/10.1111/gbb.12087
In the first group the researchers mimicked predation events to keep some colonies chronically disturbed. Other colonies were left alone.



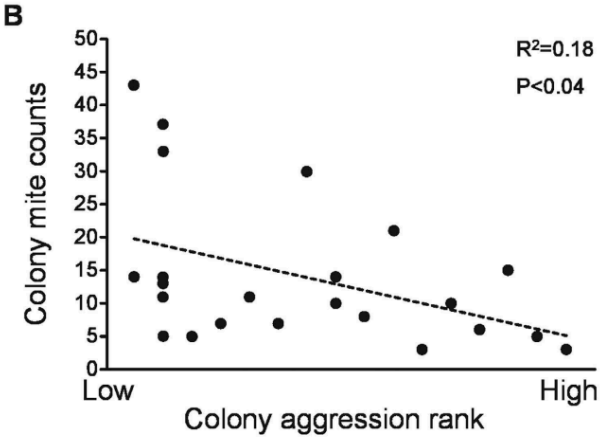

**Disturbed (less aggressive) colonies have fewer responding soldiers.**


**Disturbed (less aggressive) colonies have fewer foragers over time. Foragers produce honey.**

https://www.nature.com/articles/srep15572.pdf
The second group investigated the effects of aggression in bees on their immune system resilience.




**Aggressive bees are able to resist a harmful pesticide better, decreasing death.**




**Aggressive colonies have fewer mites found on individual bees. Mites are a harmful parasite.**

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| Prompt |
| 1. **Explain** how the chronic disturbance to the colony caused changes in the bee behavior over time.<br>2. Write a claim for whether or not the beekeepers should train their hives to become more or less aggressive based on the graphs above. Provide evidence to support your claim. Support your claim with scientific reasoning.<br>3. **Identify** potential additional evidence (in the form of data, information, or other appropriate forms) that was not provided but supports the claim that group behavior benefits the survival of the species. |

Rubric Construct: Student explains how the chronic disturbance to the colony caused changes in the bee behavior over time.

**Performance Expectation:**

**Alignment to PE Dimensions Assessed:**

**Alignment to Question in Performance Task:**

| Assessment Rubric* - Question 1 | | | | |
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| | Emerging | Developing | Approaching Proficiency | Excelling |
| Description of performance | Student identifies an irrelevant cause for change in bee behavior based on information in figures.<br>OR<br>No cause is identified. | Student identifies a relevant cause for change in bee behavior minimally supported by analysis of data (e.g. trends from figure) and limited to no cause-and effect reasoning.<br>OR<br>Student identifies relevant cause for change in bee behavior supported by inaccurate interpretation of data and/or limited to no cause-and-effect reasoning. | Student identifies a relevant cause for change in bee behavior supported by accurate analysis of data (e.g., numerical data and trends from figure) and general cause-and effect reasoning. | Student identifies a relevant cause for change in bee behavior supported by clearly connecting accurate analysis of data (e.g., numerical data and trends from figure) and explicit cause-and effect reasoning |
| Sample student responses | | | | |

| Assessment Rubric* - Question 2 | | | | |
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| | Emerging | Developing | Approaching Proficiency | Excelling |

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|---|---|---|---|---|
| Description of performance | | | | |
| Sample student responses | | | | |

| Assessment Rubric* - Question 3 | | | | |
|---|---|---|---|---|
| | Emerging | Developing | Approaching Proficiency | Excelling |
| Description of performance | | | | |
| Sample student responses | | | | |

Assessment rubric adapted from the Stanford NGSS Assessment Project http://snapgse.stanford.edu/

[1]Wiggins, G. P. (1993). Assessing student performance. San Francisco: Jossey-Bass Publishers.

4. **Explain** how the chronic disturbance to the colony caused changes in the bee behavior over time.
5. Write a claim for whether or not the beekeepers should train their hives to become more or less aggressive based on the graphs above. Provide evidence to support your claim. Support your claim with scientific reasoning.
6. **Identify** additional evidence (in the form of data, information, or other appropriate forms) that was not provided but supports the claim that group behavior benefits the survival of the species.