

3-D Performance Assessment

Performance Expectation: **HS-LS1-1**

Grade Level: **High School**

Title	Flesh Eating Bacteria		
Designed by	Samuel Washington, Elaine Solan, Michelle Watkins, Nicole Dixson NYS Teachers - Erin Garland, Carol Nicosia & Anya Swiss	Course(s)	Living Environment

Performance Expectation	<p>HS-LS1-1: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.</p> <p>Clarification Statement: none</p> <p>Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.</p>
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Science and Engineering Practice	<p>Construct Explanations</p> <ul style="list-style-type: none"> Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) 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.
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Disciplinary Core Ideas	<p>LS1.A: Structure and Function</p> <ul style="list-style-type: none"> Systems of specialized cells within organisms help them perform the essential functions of life. All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)
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Crosscutting Concept	<p>Structure and Function</p> <ul style="list-style-type: none"> Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem
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Student Performance	<ol style="list-style-type: none"> Articulating the explanation of phenomena Evidence Reasoning
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Performance Assessment

Phenomenon

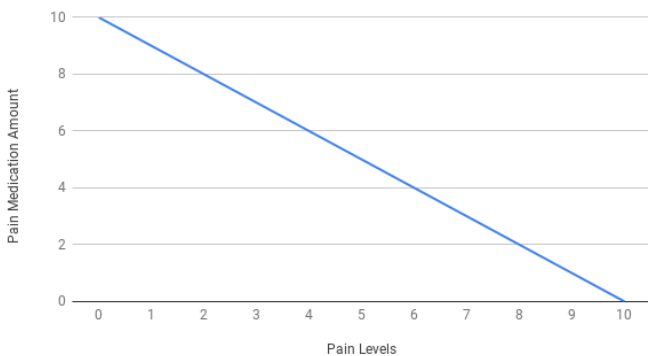
Background article: <https://www.medicalnewstoday.com/articles/321771.php>

The bacterium that is the main cause of necrotizing fasciitis, or flesh-eating disease, causes widespread, deadly infection by getting the nervous system to stop the immune system from attacking it.

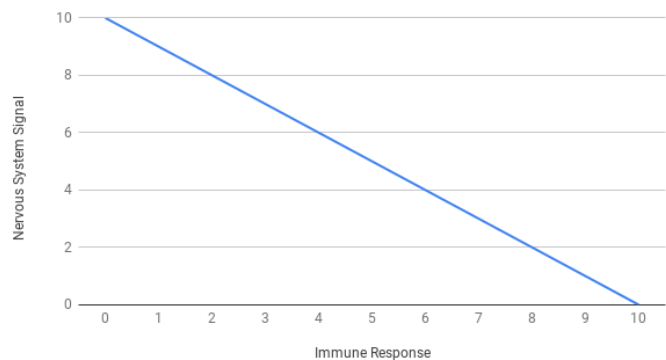
Stimulus

A recent study <https://www.medicalnewstoday.com/articles/321771.php> suggests that the bacteria secretes a toxin that triggers neurons to send a pain signal to the brain. It then triggers another signal which causes a secretion of a neurotransmitter which suppresses the immune system and disrupts homeostasis.

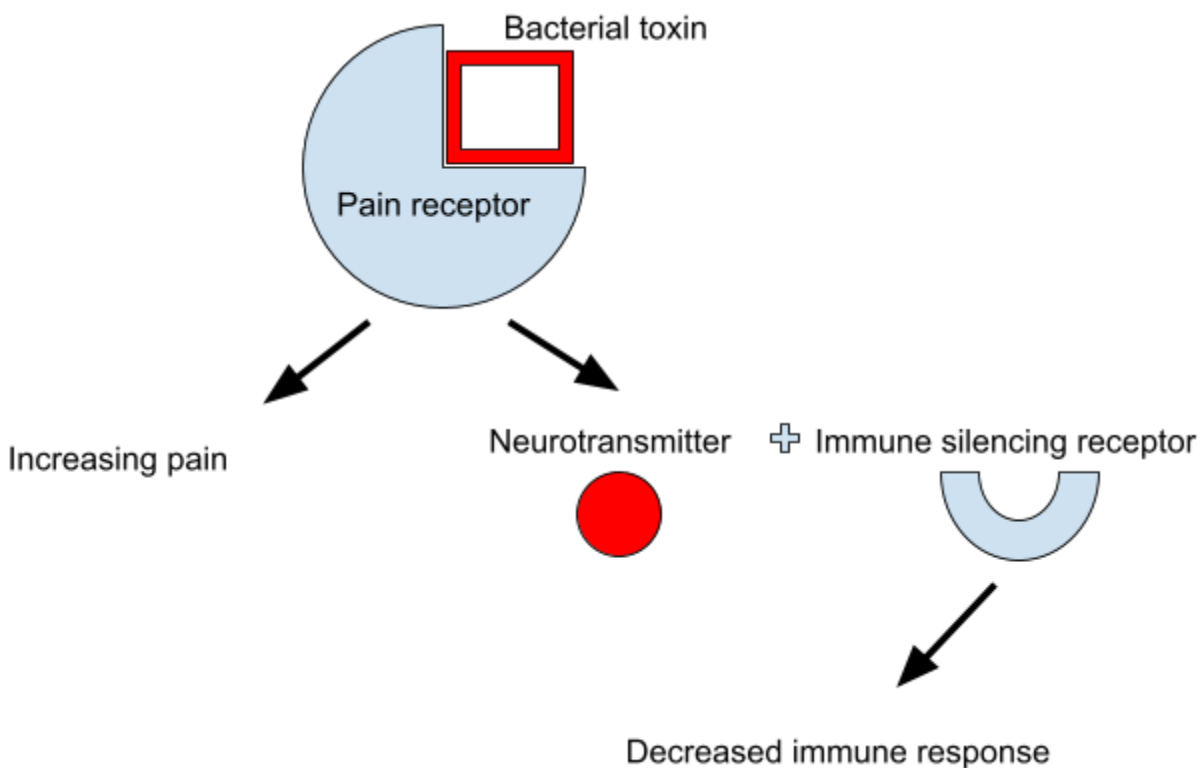
Pain Medication Amount vs. Pain Levels



Nervous System Signal vs. Immune Response



Immune Silencing Pathway



1. A microbiologist in the Wadsworth Lab is studying a recent outbreak of Flesh Eating Bacteria Necrotizing fasciitis in New York City. They claim that the link between pain and immune system may be key in treating the bacteria. The microbiologist wants to test the effects of pain medication on the reduction of tissue damage from the bacteria.

State the claim the microbiologist is investigating.

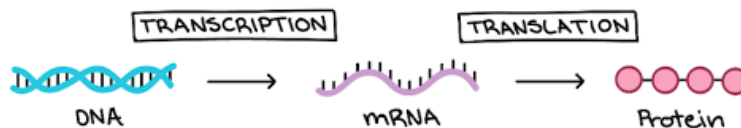
Exemplar: The “bacteria secretes a toxin that triggers neurons to send a pain signal to the brain. It also triggers another signal which causes a secretion of a neurotransmitter which suppresses the immune system.”

2. A. Describe how a healthy human immune system would typically respond to an invading bacteria in order to maintain homeostasis.

B. What is the essential function of an antibody?

Exemplar: increase of the number of white blood cells, increase in the number of antibodies, or any other acceptable response.

3.



-source: Khanacademy.org

Explain the role of genes in the production of the antibodies.

Exemplar: Genes are DNA which is used in the formation of proteins which are antibodies.

4. Design an experiment to test the claim that taking pain medications would allow the immune system to respond to the bacteria to restore homeostasis.
- A) Explain how the control group be treated differently than the experimental group.
 - B) Identify the data that you would collect
 - C) Describe results that would support your claim
 - D) Design the pain medication molecule that can be used on this pain receptor.
 - E) Draw a model of what the pain receptor and the pain medication would look like after the person was given the pain medication.
 - F) Describe the effect on the pathways function if the pain medication in part D binds successfully with the pain receptor and changes its structure.

A. Control Group:

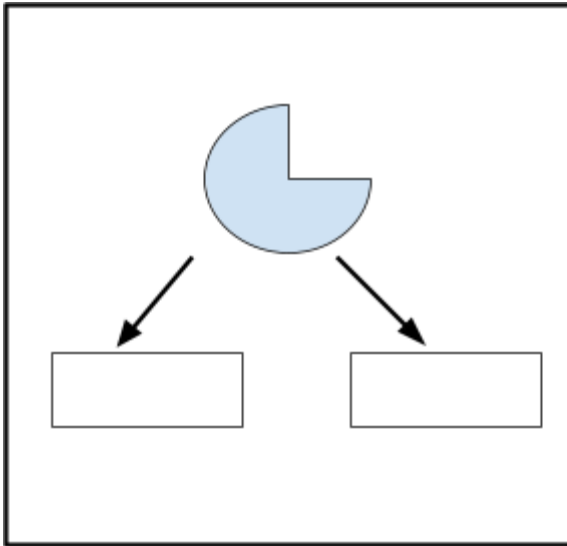
Experimental Group:

B. Data to be Collected:

C. Results (support your claim):

D. Design

E.



Key

F. Description:

Exemplar:

- A) The control group gets a placebo and the experimental group is given pain medication.
- B) The amount of tissue damage, and the size of the wound decrease after the prescribed time interval.
- C) Experimental group had less tissue damage and a smaller wound size after treatment, compared to the controlled group.
- D) The shape would fit in the pain receptor but differ from the bacterial toxin. The immune response would decrease pain and the neural pathway would increase.
- E) The bacterial toxin pathway would no longer function, and the body would return to homeostasis.

Assessment Rubric* - Question 1

	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				
Sample student responses				

Assessment Rubric* - Question 2

	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				
Sample student responses				

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

†Wiggins, G. P. (1993). *Assessing student performance*. San Francisco: Jossey-Bass Publishers.