Acting Out the Immune Response

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Teacher Guide

I. Science Background

Humans are exposed to a large number of pathogens (disease causing organisms) every day, yet only a small number of those are successful in inducing infection and causing damage to host tissues. The human immune system is a complex collection of physical barriers, cells, and signaling systems that helps a human to respond to a pathogen invasion. The immune system can be thought of as two parts: the innate immune system that works nonspecifically against any invader, and the adaptive immune system that allows the human host to defend against specific pathogens. Sometimes, the immune system mounts a response to a foreign substance that is not a pathogen and is not really harmful. This type of a response to harmless environmental substances is called allergy. Recent scientific studies have shown that there has been an increasing incidence of allergy in developed nations such as the United States (Nova). Although the exact cause of the increase in allergy is not known, a number of suggestions have been proposed based on studies conducted by various scientists. One particular idea is called the Hygiene Hypothesis, and it is based on observations that individuals who are exposed

4. Cytokines are molecules secreted by immune cells that stimulate a response in other immune cells by binding to specific target receptors, resulting in a cascade of signaling

audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-LS1-3)

b. WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS1-1)

C. Recommended Course Placement

This curriculum can be adap

D. Day 4

1. Learn about allergy

7. Homework: Start planning Immune System analogy (See student section for handout.)

C. Day 3

1. Notes/lecture: Adaptive immunity
2. Act out innate and adaptive Immunity (Teacher selects version that is appropriate for class level.)
3. Homework: Finish planning immune system analogy.

D. Day 4

1. Peers edit immune system analogy idea. Students who have not done planning will work with the teacher to make a plan.
2. Notes/lecture: What happens when the immune system does not work correctly? Autoimmune disease and Allergy
3. Act out immune response to an allergen.
4. New roles: Allergen, IgE antibody
5. Homework: Write immune system analogy.

IX. Summative Assessment

A. Immune system Analogy

B. Vocabulary quiz

Student Section

I. Rationale

The Immune system is very complex, so most learners need to learn it in a variety of ways. Research shows that for a student to be a self-directed learner, they need to experience the content through several modalities (i.e. written, oral, physical). This activity will allow students to learn by hearing the content and also associating the content with body movement. Students are also better learners if they are aware of how they learn best. If you know that you like to learn by doing, then this activity will help you to learn a lot, but only if you are actively thinking about each step of the activity and paying attention.

II. Materials

A. For Disease spread simulation

One test tube that represents your body fluids, Goggles

B. For Acting out simulations

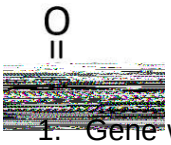
B. Methylation Script

(CH3 attaching to C nucleotides blocks gene)

1. Promoter and gene students arrange their nucleotide sequences with the promoter before the gene.
2. Promoter and gene students wrap their sequences very loosely around the histone students.
3. RNA polymerase arrives, attaches to the promoter and starts to make the mRNA by calling for the nucleotides that correspond to the gene sequence. Students holding the nucleotides bring them to the gene and the RNA polymerase assembles them into the mRNA
4. The person is now exposed to BPA (Bisphenol A). Methyl transferase methylates the C residues in the DNA
5. RNA polymerase tries to transcribe the gene, but the methyl groups get in the way. Transcription is blocked, the gene is off.

C. Acetylation Script

(Acetyl group binds to Lys in Histone, blocking + charge. This decreases the histone interaction with DNA negative charge. DNA wrapping around histone is loosened and Transcription can happen. Acetylation turns on gene).



1. Gene with Promoter wraps around the histones. The wrapping is tight for an “off” gene.
2. RNA polymerase tries to get to the promoter, but the wrapping is too tight, and the RNA polymerase cannot reach it. Gene is off, because transcription can’t happen.
3. Acetyl Transferase brings acetyl group and sticks them onto histones the + charges. The DNA wrapping loosens which allows the RNA polymerase access to the promoter.

D. Script for Acting Out the Immune System Response

Note to Teachers:

E. Roles

Pathogen: 2-3 students

External Barriers

- Host cells: 2-3 students
- Mucus with Cilia: 2-4 students
- Damaged cells:1-2 students

Innate immunity

- Macrophage: 1-2 students
- Mast cell: 1 student holding Histamine – 1 student
- Dendritic cell: 1-3 students

Adaptive immunity

- Bone

Immune System Analogy Scoring Rubric

	An analogy is made for every word/concept assigned and some extra Each word/concept analogy has a clear role in story which encompasses fine points of role in human body	An analogy is made for every word/concept assigned An analogy is made for each word/concept that shows good understanding of basic role in human body	An analogy is made for most of the words/concepts assigned An analogy is made for most words/concepts	An analogy is made for a few of the words/concepts assigned	Few to no analogies are made

V. Quiz Answer Key

Matching:

g	1. antibody	a. a disease causing organism
e	2. antigen	b. general immunity
i	3. macrophage	c. directs specific immunity
a	4. pathogen	d. makes antibodies
h	5. dendritic cell	e. part of the pathogen recognized as foreign
b	pnh	

Select one question to answer from Group 2.

Group 2

2.1. Explain why it is rare with some diseases (Ex. chicken pox) to suffer from the disease more than once, but with other diseases (Ex. flu, common cold, etc.), you can get sick over and over again. Use the following vocabulary: Antigen, Antibody, DNA, Memory B cell.

4 points maximum

2 points for correct use of all vocabulary words

1 point for diseases you only get once: DNA coding for the antigen does mutate/change

1 point for disease you get over and over: DNA coding for the antigen can mutate

2.2. Explain how a person's body recognizes that a foreign organism is present in the body. Use the following terms in your response: antigen, host, marker protein, pathogen.

4 points maximum

4= excellent overall understanding of the concept. All vocabulary used correctly.

3= may have left out or mis-used a vocab word or lacking some general understanding

2= has some understanding, but writing shows some major misconceptions

1= some but very little understanding, most vocabulary not used correctly

0= complete lack of understanding or not done

2.3 Your body is exposed to many potentially disease causing organisms each day, yet you only get sick once in a while. Explain why this happens.

4 points maximum

4= excellent general understanding of external barriers and innate and adaptive immunity. Good use of applicable vocabulary

3= Good general understanding of innate and adaptive immunity. Could use more specific vocabulary

2= some general understanding. Only a few applicable vocabulary words used

1= limited general understanding. Only a few applicable vocabulary words used