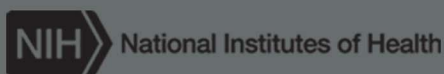


Our Cells our Selves

Lesson Plan



The Partnership in Education

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Our Cells our Selves

Lesson Plan - Defend Your Body

Grades: 8-10

Time : Two -45 minute lessons

Introduction

This lesson plan is designed to help students review their knowledge of the human immune system through an interactive game called *Defend Your Body*. Then, students will explore instances in which the immune system may malfunction.

The first lesson will review the main functions of the human immune system through an interactive game called *Defend Your Body*. After playing the game, students will engage in a class discussion about the similarities between the gameplay and the function of a real immune system.

During the second lesson, students will re-visit the simulation game; *Defend Your Body*, to recognize instances where the human immune system can deviate from its normal functions. Students will then research various diseases that affect the immune system and create a variation of the game *Defend Your Body* that simulates the effects of the disease.

Next Generation Science Standards:

For Middle School (Grade 8)

In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3)

For High School (Grades 9 and 10)

Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)

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AAAS Standards

By the end of grade 8, students should know

- 1.)Organs and organ systems are composed of cells and help to provide all cells with basic needs. 6C/M1
- 2.)Specialized cells and the molecules they produce identify and destroy microbes that get inside the body. 6C/M4

By the end of grade 10, students should know

- 1.)The immune system functions to protect against microscopic organisms and foreign substances that enter from outside the body and against some cancer cells that arise within. 6C/H1*
- 2.)The human body is a complex system of cells, most of which are grouped into organ systems that have specialized functions. These systems can best be understood in terms of the essential functions they serve for the organism: deriving energy from food, protection against injury, internal coordination, and reproduction. 6C/H6** (SFAA)

Day One

Objectives:

- 1.)Students will be able to recognize the components of the immune system and their functions.
- 2.)Students will be able to explain the importance of the immune system in sustaining the life of an organism.

Materials Provided in this Lesson Plan (Please see appendices at the end of this lesson plan):

- 1.) The Human Immune System Worksheet (Appendix 1A)
- 2.) Defend Your Body game cards (Appendix 1B)
- 3.) Defend Your Body game instruction manual (Appendix 1C)

Materials that are Not Provided in this Lesson Plan:

- 1.) Index cards (1 per student + a few extras)
- 2.) Scissors
- 3.) Glue

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Set Up



- 1.) Prior to the lesson, arrange the chairs in the classroom in a circle.
- 2.) Print enough copies of The Human Immune System worksheet for each student in the class. The handout is found in Appendix 1A.
- 3.) The game cards needed for the interactive game should be created prior to the lesson.
 - 3a.) To prepare the game cards, the cards for each character should be printed, cut out, and glued onto an index card (Appendix 1B). Follow the chart provided below to determine how many game cards for each character should be created according to the number of students in your class.

Total Number of players	Number of Doctor Cards	Number of Foreign Invader Cards	Number of Scribes	Number of White Blood Cell Cards
5	1	1	1	2
6-10	1	2	1	2-6
11-19	1	3	1	6-14
20-29	2	5	1	12-21
30-45	2	7	1	20-35

Pre-Activity (7 minutes)

- 1.) Pass out the worksheet *The Human Immune System* to all students.
- 2.) Instruct the students to fill out the first two columns and to leave the third one blank. Allow at least 5 minutes. In column one, students must write what they already know about the human immune system. In the second column, students should write down at least two things they want to learn about the immune system. The students should leave the last column blank until the end of the lesson.



- 3.) Once the students have completed the worksheet, conduct a class discussion to review the answers for each column. The discussion should review what students have previously learned. The main ideas that should be taken away from this discussion are

3a.) *The immune system protects the body from foreign invaders.*

3b.) *The white blood cells are the main components of the system which recognize and destroy foreign invaders.*

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Activity (30 minutes)

- 1.) Read the instructions of the game *Defend Your Body* to the students. The manual is found in Appendix 1C.
- 2.) For the first game the teacher should be the moderator.
- 3.) Play the game *Defend Your Body*.

Post-Activity Discussion (8 minutes)

- 1.) Hold a class discussion about the game and how it simulates the actual functions of the immune system. The discussion should lead the students to recognize that



1a.) White blood cells travel around the body through the blood and must identify invader cells. Identification of invader cells involve recognizing specific indicators on the cells. This is a very hard job.

1b.) Once the invader cell is recognized the white blood cells must communicate with each other and destroy the cell. Similar to the “awake phase” in the game when the players had to decide who to eliminate.

- 2.) The teacher should use the notes from the game to get students to remember what happened during the game.

- 3.) The discussion should then move on to the idea that

3a.) White blood cells sometimes make mistakes and kill off other white blood cells or body cells. The teacher can use an example from the game when a white blood cell was eliminated incorrectly. This idea will lead the next lesson.

- 4.) Instruct the students to complete the third column on their *The Human Immune System* worksheet. All the students must turn this in at the end of the lesson.

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Day 2

Objectives

- 1.) Students will be able to recognize various diseases caused by the immune system malfunctioning.
- 2.) Students will be able to research one disease that affects the human immune system using either online resources or resources in the school library.
- 3.) Students will be able to plan and create an edit to the game *Defend Your Body* to simulate the effects of the disease they researched.

Materials Provided in this Lesson Plan:

- 1.) The viewing guide for the video *Our Cells, Our Selves* provided at the end of this lesson plan. (Appendix 2A)
- 2.) The worksheet *Defend Your Body* against (Appendix 2B).
- 3.) The rubric for the post-activity final presentation (Appendix 2C).

Materials that are Not Provided in this Lesson Plan:

- 1.) The completed worksheets from day 1: The Human Immune System, for each student from the previous day.
- 2.) The video *Our Cells, Our Selves*. Available upon request from thepartnershipineducation.com.
- 3.) Scribe's notes from the game played during Day 1.
- 4.) A projector or screen for the students to watch *Our Cells, Our Selves*.

Our Cells our Selves

Set Up

- 1.) Set up the video *Our Cells, Our Selves* prior to the lesson.
- 2.) The students will have to conduct their own research either using the Internet or resources from the library. Prepare a method to allow students access to research resources.
- 3.) Print the handout in Appendix 2B for each student in the class.
- 4.) Print a copy of the instruction manual *Defend Your Body* for each student of the class.



Pre-Activity (5 minutes)

- 1.) Pass out the The Human Immune System worksheet from Day 1 and allow the students to refresh their memories about the main ideas discussed during the previous lesson. Remind the students about instances when the human immune system deviates from its usual role and attacks itself or the body instead.
- 2.) Pass out the viewing guide for *Our Cells, Our Selves*.
- 3.) Instruct students to complete the viewing guide as they watch the video *Our Cells, Our Selves* that illustrates an instance in which the immune system begins to damage the body cells.

Activity (20 minutes)

- 1.) Discuss the effects of diabetes on the human body. Remind students to use the answers from their viewing guide to enrich the discussion.
- 2.) Divide the students into groups of 4 or 5.
- 3.) Pass out the worksheet *Defend Your Body* against ... (found in Appendix 2B) to each student along with a copy of the rule sheet for the game *Defend Your Body*.
- 4.) Explain the instructions for this activity as found in the worksheet.

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Post-Activity (20 minutes)

- 1.) Pass out the rubric in appendix 2C to each student.
 - 2.) Instruct each group to make a poster to present their research to the class. The main topics of the poster should be the information gathered to answer the questions on the worksheet. Each group will then verbally present their poster to the rest of the class.
 - 3.) At the end of each presentation, each group will introduce their two new cards to the class.
- *** Remind students to use the rubric to guide them as they make the presentation.

Extension of the lesson

Use another class period to give the students a chance to play the game with the new rules and cards they created.

Assessments

- 1.) The Human Immune System Worksheet
- 2.) Final presentation
- 3.) The rubric found in Appendix 2B can be used to assess each group's performance.
- 4.) The teacher will make a formative evaluation on each group's presentation. The teacher should look for the use of good scientific resources used in research, the equal participation of each student during the group activity and presentation, successfully answering the research questions, and the ability of the group to successfully create a new role and the new role sheet.

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Appendix 1A - The Human Immune System Handout

Name _____

Use the following words to guide your thinking.

- * Immunity
- * White blood cells
- * Defense
- * Diseases
- * Antibodies
- * Foreign Invaders cells
- * Auto-immune disease

Notes

What do I know about the Human Immune system?	What do I want to know about the human immune system?	What did I learn about the human immune system?	Questions I still have about the human immune system.

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Appendix 1B - Character Templates for the game *Defend Your Body*



FOREIGN INVADER

Open your eyes when the moderator gives you the instruction. Silently choose one player to eliminate and inform the moderator by pointing at the player.



DOCTOR

Open your eyes when the Moderator gives the instruction. Silently point at another player to find out if he/she is a Foreign Invader. If the Moderator shows a thumbs up the chosen player is a Foreign Invader. If it is a thumbs down the player is not.



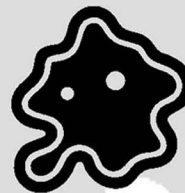
SCRIBE

Observe the game and write down what is happening throughout the course of the game. Carefully note the descriptions used by the Moderator during each round.



WHITE BLOOD CELL

Open your eyes when the Moderator gives the instruction. Discuss with the other players who the Foreign Invader/s is/are and try to eliminate them.



ROGUE CELL

You cannot be eliminated in this game. You will silently choose one player other than the player chosen by the Foreign Invaders to eliminate. Silently point to the player you have chosen after the Moderator instructs you to open your eyes.

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Appendix 1C - Instruction Manual for the game Defend Your Body

Defend Your Body Instruction Manual

This is an interactive game for your whole class. The main concept of this game is based on how white blood cells in the human body hunt out and eliminate foreign invaders that enter the body. This is a fun way for students to learn about the function of the immune system.

During the game all the students in the classroom will assume secretive roles as a white blood cell, a doctor, or a foreign invader. A moderator (usually the teacher) runs the game through a series of hours that imitate the body's response to a foreign invader.

Setup

*For your first game, use the following cards:

Total Number of players	Number of Doctor Cards	Number of Foreign Invader Cards	Number of Scribes	Number of White Blood Cell Cards
5	1	1	1	2
6-10	1	2	1	2-6
11-19	1	3	1	6-14
20-29	2	5	1	12-21
30-45	2	7	1	20-35

*The teacher should be the moderator for the first game. On subsequent rounds, if the students wish, they can select a classmate to be the moderator.

*All the players except the moderator will sit in a circle.

*The moderator will shuffle the cards and hand a card to each player face down. The moderator should be careful that no one other than the player the card is given to sees the card.

*The moderator will ask all the players to look at their cards in secret. At this point there should be no talking.

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How the game works

The First Half Hour After Infection - Round 1

During the first hour the moderator will get to know who the players are. Specifically the doctor and the invaders. During this hour each group of players will also get to see who their team members are.

In order to initiate the game, the moderator will ask all the players to close their eyes and put their heads down. “Everyone please close your eyes.”

Then to identify the Foreign Invaders the Moderator will say, “Invaders, please open your eyes and look for other Invaders.” All the Invaders will open their eyes to see who the other Invaders are. (Remember to do this quietly so that other classmates cannot hear you.) The Moderator should make a note of these players as well.

“Invaders close your eyes.” (Pause for 2 seconds) “Doctors open your eyes and look for other Doctors. Now indicate a player.” The Moderator will have to take note of who the Doctors are. When they Doctors point to a player, the Moderator has to give a thumbs up if the player is an Invader or a thumbs down if the player is not.

“Doctors, close your eyes.” (Pause) “Everyone open your eyes, Foreign invaders have attacked the body. It is up to you to find out who the Invaders are, and destroy them before too much damage is caused to the body.” All the players will open their eyes.

During the first conversation, all the players will introduce themselves by saying what type of White Blood Cell they are and which area of the body they happen to be moving around in at that moment. The trick is for the Invaders and the Doctors to pretend that they are also White Blood Cells and introduce themselves as one. Players can say anything they want during the introductions, but they must never show their card to anyone.

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After the players introduce themselves, the Moderator will explain how the group can accuse a player of being an Invader.

“To accuse a player of being an Invader you must point at another player and say ‘I accuse John.’ If another player seconds that accusation, then John gets a chance to defend himself. After his statement, all the players will vote whether to eliminate him or not. In order to vote FOR him you must put your thumb up, in order to keep him you point your thumb down. If a player is voted off, his role will be revealed and everyone will close their eyes again. If everyone votes for him to stay the discussions will continue until someone is accused again.”

If more than half the players vote up for a player then the player is eliminated and his/her role is revealed. Once a player is eliminated then the cell has forever been destroyed and he/she can no longer participate in the game. (But should still observe the game and have fun). The Moderator should have a time limit for the discussions to take place. Usually 5-10 minutes is enough. After this allocated time the cells (players) will fall asleep again and the next round begins.

Every Hour After Infection - Subsequent Rounds

For each hour after the first, the Moderator will call out the Invaders as he/she did the first hour. The Invaders will collectively decide on one player to eliminate. The Moderator will also call upon the Doctors who can silently ask if a player is an invader or not. A thumbs up for; yes the player is an invader. A thumbs down for; no the player is not an invader.

The Moderator will then tell the Doctors to close their eyes and all the players to open their eyes. He/she will inform the group about the player who the invaders eliminated. That player’s role will also be revealed. The Moderator can add to the story by narrating the effects of the invader cells on the body. For example, “the body temperature has begun to rise due to body cells being destroyed,” “the nerves in the leg cannot function anymore.”

All the players will then be asked to discuss who they should eliminate similar to the first hour after infection.

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Ending the Game

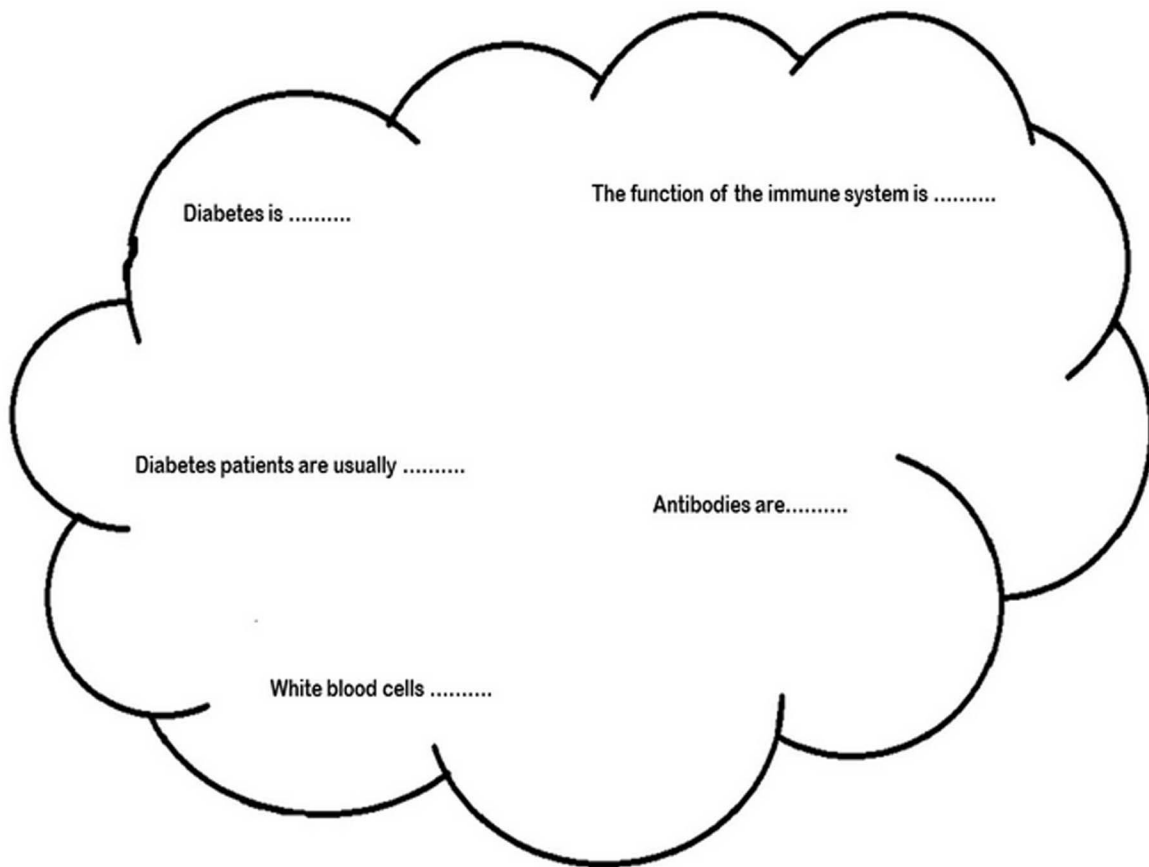
If the White Blood Cells manage to kill of all the invaders the game is over. If there is the same number of White Blood Cells to the number of Invaders, the Invaders win the game. The Moderator should keep track of the game and let players know when the game is over. At the end of the game all the remaining players must reveal their cards.

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Appendix 2A - Viewing Guide for *Our Cells, Our Selves*

Before you view the video answer the following questions:

1. Using what you have learned before, make a few notes on the thinking cloud about diabetes and the immune system.



2. The immune system protects your body from “unknown particles.” Predict what would happen if a group of body cells is labeled as an unknown particle by the immune system.

Our Cells our Selves

As you watch the video answer the following questions:

1. Where was Sylvie the night before and why was she there?
2. According to the doctors, Sylvie has been diagnosed with diabetes and must make a few changes to her lifestyle. State one change she must make.
3. Where are Islets cells found, and what is their main function?
4. Draw a diagram to show how complex organisms are made from single cells.
5. Arrange the following statements in correct order.
 - a. Nutrients are distributed and absorbed by all cells in the body. ___
 - b. Food from the outside environment is swallowed. ___
 - c. Nutrients are used by cells to perform body functions ___
 - d. Food is broken down into simple molecules in one specialized part of the body. ___

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6. Explain the job of blood vessels in a complex organism.

7. Illustrate a T cell and a B cell, then write a sentence or 2 describing their similarities and differences.

8. If a person gets a disease like chickenpox, he or she may never get that disease again. Why is that? Explain the phenomena using the following terms; T cells, B cells, and immune system.

9. Identify the reason why Sylvie can no longer control her own blood sugar levels. Make a quick sketch of what is happening inside her body.

After viewing the video answer the following question:

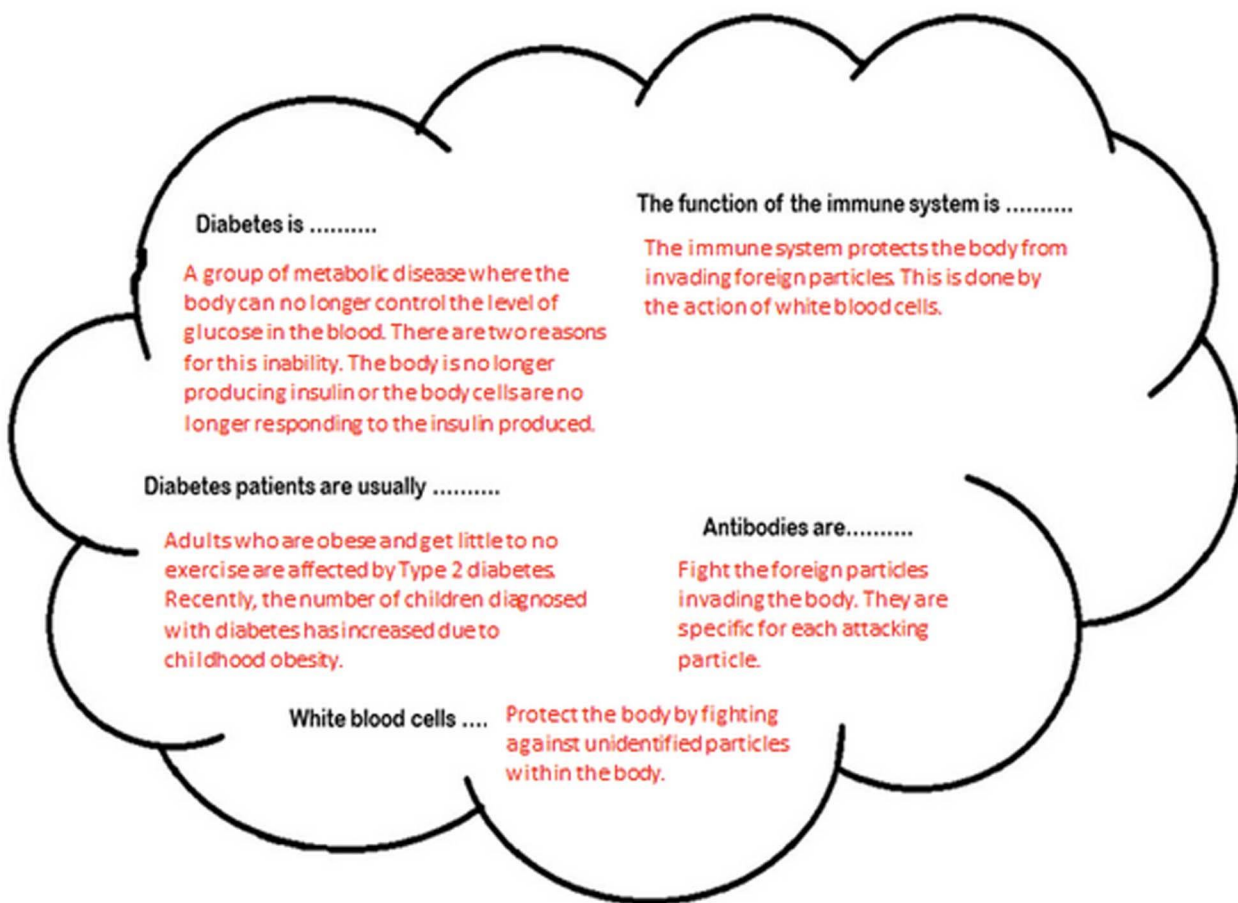
1. Take a look at your answer for the 2nd question, was your prediction correct? Explain why or why not.

Our Cells our Selves

ANSWER KEY

Pre-Viewing Questions

1. Using what you have learned before, make a few notes on the thinking cloud about diabetes and the immune system.



2. The immune system protects your body from “unknown particles.” Predict what would happen if a group of body cells is labeled as an unknown particle by the immune system.

Any particles labeled as an unknown particle, regardless of being a body cell, will be attacked by the white blood cells to protect the body.

Our Cells our Selves

ANSWER KEY

As you watch the video answer the following questions:

3. Where was Sylvie the night before and why was she there?

Sylvie was in the hospital because her doctor found out she has diabetes.

4. According to the doctors, Sylvie has been diagnosed with diabetes and must make a few changes to her lifestyle. State one change she must make.

- Keep a healthy diet with the correct amount of sugar.
- Keep taking insulin so the body can produce the correct amount of energy.

5. Where are Islets cells found, and what is their main function?

Islets cells are found in the pancreas.
Their main function is produce insulin.

6. Draw a diagram to show how complex organisms are made from single cells.

Students should draw a diagram to show the small individual cells coming together to form one large organism made up of many small cells.

7. Arrange the following statements in correct order.

- | | |
|--|---|
| Nutrients are distributed and absorbed by all cells in the body. | 3 |
| Food from the outside environment is swallowed. | 1 |
| Nutrients are used by cells to perform body functions. | 4 |
| Food is broken down into simple molecules in one specialized part of the body. | 2 |

8. Explain the job of blood vessels in a complex organism.

Blood vessels carry food and oxygen from the outside environment, and immune cells all to all the cells around the body.

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ANSWER KEY

9. Illustrate a T cell and a B cell, then write a sentence or 2 describing their similarities and differences.

Students should illustrate the following important points:

- T cells display the broken up pieces of the swallowed particles and are able to read and recognize those particles if they encounter it again.

- B cells acts like swallowing cells, but can only swallow one type of cell. If the unknown cell is labeled as harmful then the B cell activate to release antibodies to fight the unknown harmful cells.

10. If a person gets a disease like chickenpox, he or she may never get that disease again. Why is that? Explain the phenomena using the following terms; T cells, B cells, and immune system.

The first time a person gets chickenpox, the immune system is activated. The B cells swallow the particle, and release antibodies to fight the disease. The T cells will display the broken up particle and will also remember the particle. If the chicken pox particle invades the body again the T cell will recognize it and destroy it before it affects the other cells of the body.

11. Identify the reason why Sylvie can no longer control her own blood sugar levels. Make a quick sketch of what is happening inside her body.

The sketch should show Sylvie's Islet cells being attacked by the T and B cells. Thus, her body is unable to produce insulin which controls her blood sugar level.

After viewing the video answer the following question:

1. Take a look at your answer for the 2nd questions, was your prediction correct? Explain why or why not.

Students should first mention if their prediction was correct or incorrect, they explain their answer using examples from the video.

Name: _____

Defend Your Body Against...

This activity is made up of three parts.

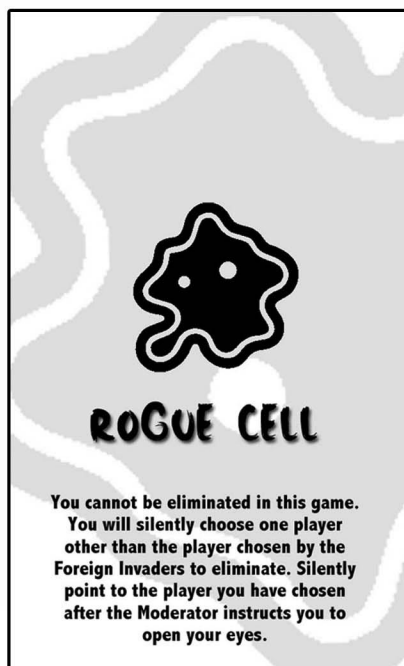
Part A: You and your group members will identify a disease that affects the human immune system causing it to malfunction. Specifically look into how the disease is caused and what occurs inside the body during and after infection. Use the following questions to guide your research.

- What is the name of the disease?
- Who is more likely to be diagnosed with this disease?
- How is the disease caused?
- What are the signs and symptoms of this disease?
- Can this disease be treated?
- Is there a way to prevent/control this disease?

Part B: Take a look at the rules and guidelines for the game *Defend Your Body* that you played during the previous lesson. Notice that there were the Foreign Invaders that alerted the immune system that it needed to defend the body, and the Doctor who was able to identify the Foreign Invaders and have it killed by guiding the White Blood Cells. The narrator in the game described the effects of the Foreign Invaders on the body each hour after infection. Your job is to:

1.) *Create a new role* (similar to either the Foreign Invaders or the Doctor roles) that is based on the disease you researched. Make sure you clearly describe what this new role entails.

For example: a new role for the disease Diabetes could be Rogue Cells. The rogue cells are body cells that attack and kill the pancreatic cells preventing the production of insulin.

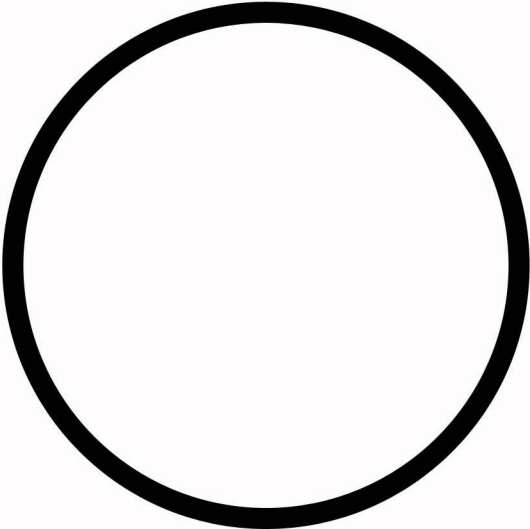
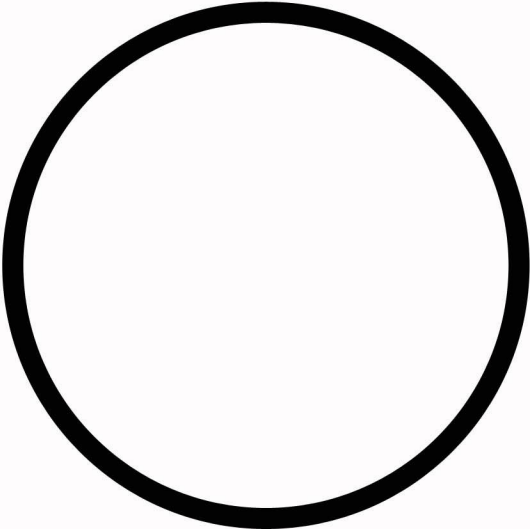


2.) *Alter the rule sheet and the narrator descriptions* to match the signs and symptoms of the disease you researched.

For example: the narrator role can describe the signs and symptoms of the disease after each round of the game.

Part C: In your groups, create a poster to illustrate your findings to your classmates. Use the rubric given below to guide this part of the activity. Each group will present the poster and explain to the class what new role they created and what changes they made to the game.

Blank Card Templates:

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Appendix 2C - Rubric for the Final Presentation

Name _____

CATEGORY	Excellent	Good	Adequate	Needs Improvement
Does the poster answer the required questions?	The poster includes answers to all the required questions as well as additional information.	The answers to all the required questions are included on the poster.	All but 2 or less of the required questions are included on the poster.	Answers to 3 or more questions are missing.
Attractiveness	The poster is exceptionally attractive in terms of design, layout, and neatness.	The poster is attractive in terms of design, layout and neatness.	The poster is acceptably attractive though it may be a bit messy.	The poster is distractingly messy or very poorly designed. It is not attractive.
Type of Sources used.	All research was gathered from credible sources. All sources are cited on the poster.	All research was gathered from credible sources. The sources are not cited/ are cited incorrectly.	Only some of the sources used to gather information were credible.	The sources used were not credible.
Oral Presentation	All members of the group presented. All members were very well prepared.	All members of the group presented. Only some members of the group were prepared.	Only some members of the group presented.	The group was not prepared to present their research.



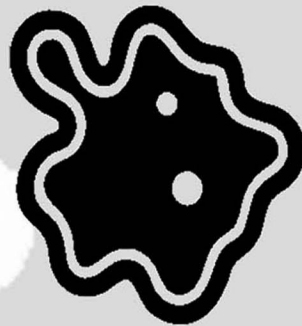
DOCTOR

Open your eyes when the Moderator gives the instruction. Silently point at another player to find out if he/she is a Foreign Invader. If the Moderator shows a thumbs up the chosen player is a Foreign Invader. If it is a thumbs down the player is not.



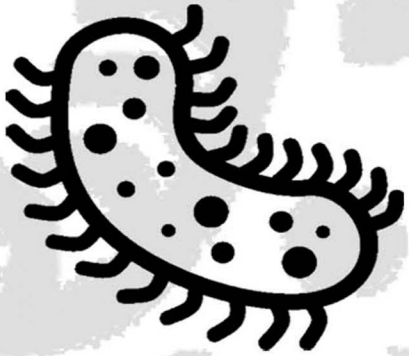
WHITE BLOOD CELL

Open your eyes when the Moderator gives the instruction. Discuss with the other players who the Foreign Invader/s is/are and try to eliminate them.



ROGUE CELL

You cannot be eliminated in this game. You will silently choose one player other than the player chosen by the Foreign Invaders to eliminate. Silently point to the player you have chosen after the Moderator instructs you to open your eyes.



FOREIGN INVADER

Open your eyes when the moderator gives you the instruction. Silently choose one player to eliminate and inform the moderator by pointing at the player.



SCRIBE

Observe the game and write down what is happening throughout the course of the game. Carefully note the descriptions used by the Moderator during each round.