



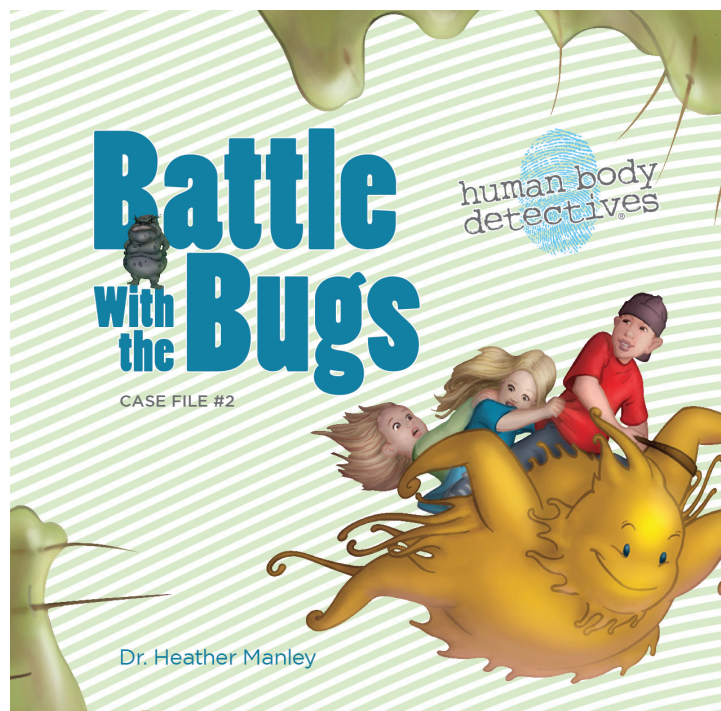
unit two

Human Body Detectives Go to School Elementary Curriculum

# The Immune System

Based on the second case in the HBD series, *Battle with the Bugs*

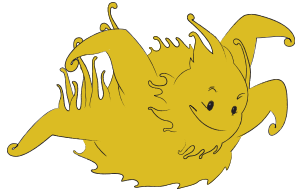




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# The Immune System

## INSTRUCTIONAL OBJECTIVES

The student will have an introductory working knowledge of the components and importance of the immune system.

## LONG RANGE OBJECTIVES

The student will:

- Have a basic understanding on how their immune system functions and how it works with the other systems of the body.
- Understand the important role nutrition plays in having a healthy immune system.

## SUGGESTED GRADES: 3 to 5

### MATERIALS

- HBD: *Battle with the Bugs* (book)
- Manila file folders (standard size)
- HBD downloadable stickers for this unit
- HBD downloadable worksheets for this unit
- Different colored Sharpie® pens
- OPTIONAL: Avery Labels #5164 and #5260
- Pre-cut paper from large roll, large enough to trace students' bodies OR a smaller 14" x 22" poster board
- Glue sticks
- Multi-colored construction paper
- Packets of yeast (enough for 1 packet per group of 3 to 4 students)

## OVERVIEW OF LESSONS

Lesson 1: Introduction; white blood cells and their importance

Lesson 2: The roles of different types of white blood cells antibodies; antigens

Lesson 3: Other immune system defenses

Lesson 4: Nutrition to support the immune system; conclusion

\*During each lesson in this unit, students will work on their own Immune System Self-Portrait Diagram. At the conclusion of lesson 4, the diagram will be complete and students will be able to take home their diagram.

## Unit 2:

# A Journey Through the Immune System

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### LESSON 1

#### THE IMMUNE SYSTEM

#### INSTRUCTIONAL OBJECTIVES

Students will demonstrate an introductory knowledge of what the immune system is, what it does, and why it is important.

#### MATERIALS

- Downloadable HBD “Know, Want to Know” about immune system worksheet
- HBD: *Battle with the Bugs* (book)
- Manila file folders (standard size)
- HBD downloadable stickers (Avery #5260) for this unit’s immune system case file
- Different colored Sharpie® pens
- Pre-cut paper from large roll, large enough to trace students’ bodies  
OR a smaller 14” x 22” poster board

#### OVERVIEW OF CONTENT

- Introduction to immune system
- Read HBD: *Battle with the Bugs* aloud to students
- Create Human Body Detectives Case File folders
- Discuss important components of immune system, specifically white blood cells
- Begin work on Immune System Self-Portrait diagram
- Review, Q&A, conclusion

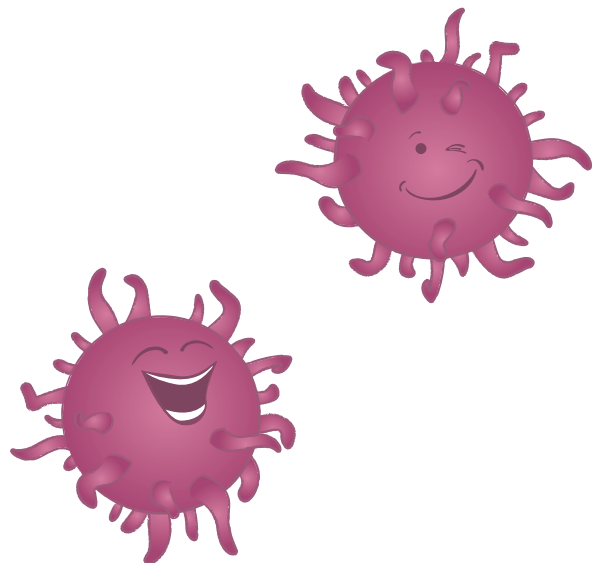
#### INSTRUCTIONS

1) **Have students fill out the Know, Want to Know page.** Encourage them to write down all they know about the immune system followed by what they want to know about it.

2) **Briefly introduce the immune system:** what it is, its role in the human body, and its components, specifically white blood cells and what they do (general at this point).

- The immune system defends and protects the body against millions of bacteria, viruses, toxins, and parasites every minute of the day. White blood cells, or leukocytes, circulate in the blood (and lymphatic tissue) in search of invaders. There are many different types of white blood cells, which will be discussed in detail later. The nutrients in food play an important role in fueling white blood cells, making them stronger, more powerful, and increase in number, all of which boost white blood cell fighting powers thus keeping YOU stronger.

- 3) **Announce that you will read *HBD: Battle with the Bugs*.** This time Merrin and Pearl enter someone's immune system. "Let's find out who it is and how the girls will help." Read *HBD: Battle with the Bugs* aloud. When finished, briefly discuss story. "What was the most exciting part for you?"
- 4) **Hand out a manila folder to each student.** Also hand out **Immune System Case File stickers** (Avery #5260) to label the file. Have students affix stickers to file tab and write their names in a corner on the folder front. Tell students that they are going to be Human Body Detectives like Merrin and Pearl and will fill their files with important information as they investigate the immune system.
- 5) **Have each student find a partner.** Hand each student the **large paper** and a darkcolored **Sharpie®**, or a 14 by 22 inch poster board, then have each student in each pair trace (or by themselves if using smaller poster board) the other's body on the paper. This will require enough room for half of all the students to lie down at the same time. They then can spend a few minutes drawing in their faces, hair, etc. (using other colored Sharpie's® ), creating their 'self-portrait.' Let them know that over the next few lessons, they will be adding elements of their immune system to their self-portraits.
- 6) **Conclusion:** Review general points about the immune system and why it is so important. Answer students' questions then let them know that next time they will be learning about white blood cells and the "bad bugs" they fight in more detail.



## Unit 2:

# A Journey Through the Immune System

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### LESSON 2:

#### INTRODUCTION TO DIFFERENT TYPES OF WHITE BLOOD CELLS, OR LEUKOCYTES

#### INSTRUCTIONAL OBJECTIVES

Students will know several different types of white blood cells, grasp what antigens and antibodies are, and know how the different white blood cells identify and attack the appropriate invader.

#### MATERIALS

- Students' own HBD case file folders
- Students' Immune System Self Portrait
- For *Battle with the Bugs* game: print names of different types of white blood cells in different shapes and sizes representing neutrophils, eosinophils, basophils, lymphocytes (with antibody—may use a post-it to remove and stick to antigen) and macrophages
- For *Battle with the Bugs* game: print names of viruses, bacteria, parasites, allergens, mosquito bites (with an antibody marking for tagging with a B-cell lymphocyte antibody)
- Downloadable HBD Code and Immune Mystery Story
- Glue sticks
- Optional: Avery Labels #5164

#### OVERVIEW OF CONTENT

- Introduction to different types of white blood cells, or leukocytes
- Discuss important components of immune system, specifically white blood cells
- Play *Battle with the Bugs* game
- Work on Immune System Self-Portrait
- Review, Q&A, conclusion


#### INSTRUCTIONS

- 1) **Introduce** how, in children, white blood cells are made in the spleen, then as children grow white blood cells are primarily made in the bone marrow—which is located inside the bone—and the thymus.
- 2) **Introduce the different types of white blood cells:**
  - **Neutrophils:** these scout for bacteria and fungi.
  - **Eosinophils:** these look out for parasites and also play a role for people who have allergies.
  - **Basophils:** these release a chemical called histamine and create inflammation. For example, when you get a mosquito bite and the area becomes itchy and red, your basophils are working!

- **Lymphocytes:** these work on killing both bacteria and viruses. There are 2 types: B and T cells. The B cells will tag germ invaders by secreting antibodies onto the germ's antigen site so other immune system cells will be able to identify them. The T cells will get the immune system team together by recruiting, activating and coordinating an attack. They also hunt for invaders that are hiding and look for cells that are different than healthy body cells.
- **Macrophages:** When in the bloodstream, macrophages are first monocytes, and once in the body tissues, they become macrophages. They attack invaders by a process called phagocytosis, in which they engulf and devour pathogens. They also stimulate lymphocytes to respond to a pathogen.

3) **Introduce antigens and antibodies:** An antibody is also known as an immunoglobulin. An antibody is secreted from lymphocyte B cells to identify and neutralize an invader, bacteria or virus. The B cell will seek out the part of the invader called an antigen and inject the antibody there. This process is similar to tagging and allows other white blood cells (the team members) to know it is an invader. If this is the first time this antigen has been tagged, it will go into the immune system memory so the right team member will attack it appropriately if it comes into the body again.

4) **Announce that you will now play the *Battle with the Bugs* game.** Randomly hand out different white blood cell cutouts that are labeled: eosinophils, neutrophils, basophils, macrophage, lymphocyte B cells with antibody and T cells, and invader cutouts that are labeled: bacteria, fungi, parasites, mosquito bites, allergens and viruses (some with an antigen and some without). Have the students appropriately match up with their pair (e.g. a eosinophil will find a parasite). Once all have been matched up, review and check that the appropriate white blood cell paired onto the appropriate invader.

 **Note to teacher:** Have the children draw their white blood cell or invader on the printable. The printables are sized for an Avery template but you may also print on paper and have the children cut them out.

5) Have the students take out their **case file folder** and work on the **HBD Code and Immune Mystery Story**. They can store this completed worksheet in their folder.

6) Have each student roll out their **Immune System Self-Portrait**. Use the **white blood cell stickers or cut-outs**, handing a few of each type to each student. These they can stick or affix with glue to the areas of the body where they were made (spleen, bone marrow and thymus).

7) **Conclusion:** Review the types of white blood cells, antibodies and antigens. Answer students' questions, then let them know that next time they will be learning about other larger parts of the body that help out the immune system.

## Unit 2:

### A Journey Through the Immune System

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#### LESSON 3:

#### INTRODUCTION TO OTHER IMMUNE SYSTEM DEFENSES

##### INSTRUCTIONAL OBJECTIVES

Students will become familiar with other systems of the body that aid the immune system function to achieve optimal defense against any foreign invaders.

##### MATERIALS

- Students' own HBD case file folders
- Downloadable Immune Cartoon
- Students' Immune System Self Portrait
- Different colored Sharpie® pens

##### OVERVIEW OF CONTENT

- Introduction to other immune system defenses
- Activity: Immune Cartoon
- Work on Immune System Self-Portrait diagram
- Review, Q&A, conclusion

##### INSTRUCTIONS

###### 1) Introduce the other immune system defenses:

- **Skin:** Many say that the skin is the first line of defense in your immune system. The skin has a thick layer of fat and dead skin, which repels invaders. Your skin glands secrete a chemical that is acidic and kills off invaders.
- **Nose, mouth and eyes:** The mucus found in your mouth, throat and nose acts as an initial barrier to invaders. The mucus has the ability to trap the invaders, and the body does its best to cough or sneeze it out. The saliva in your mouth contains a chemical enzyme called lysozyme, that kills bacteria. Your tears are acidic and break down and repel invaders.
- **Stomach:** If by some chance an invader makes its way to the stomach, it is in for a big surprise. The stomach is carefully lined to protect itself from the hydrochloric acid present here. This acid kills off most invaders who make it past the above defenses.
- **Lymphatic system:** The lymphatic system is very similar to the blood vessels but this system carries a substance called plasma that carries only white blood cells and not red blood cells. Its job is to help the white blood cells get where they need to be. The lymphatic system will also collect invaders in its lymph nodes (these are what sometimes become swollen when you are sick) and will filter them out and destroy them.

As you discuss these other defenses, mention the importance of healthy nutrition in keeping all these systems working properly. The next lesson will go into more detail but planting the seed and opening up a short discussion would be advantageous at this time.

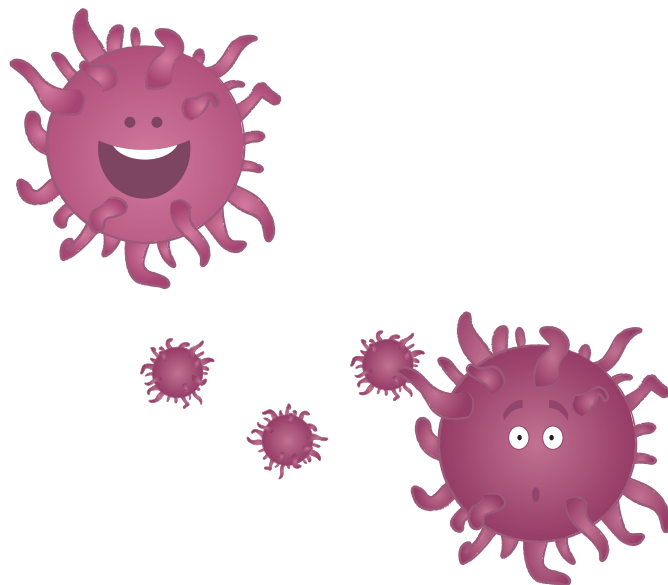
2) Discuss examples from the kids' everyday lives that shows how these other immune system defenses help out the immune system.

- When was the last time you sweat? Sweating is a good way to repel invaders.
- Sometimes a runny nose is a good thing. Do you remember the last time your nose was running? Were some of your classmates sick? When you sneeze, your nose is pushing the germs out! Be courteous and hygienic, and use a Kleenex.
- Can you think of other examples?

3) Have the students take out their **case file folder** and work on the **Immune Cartoon**. Make sure they add some color and some of their new vocabulary words.

4) Have each student roll out their **Immune System Self-Portrait**. With Sharpies®, students will draw on their other important immune defenses: (nose, mouth and eyes will already be done from first lesson, but do point them out again) skin, stomach and lymphatic system.

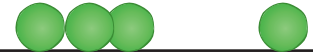
5) **Conclusion:** Review all the body's immune defenses. Answer students' questions, then let them know that next time they will be learning even more about how nutrition impacts the immune system.



## Unit 2:

# A Journey Through the Immune System

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### LESSON 4

#### Nutrition for your immune system

#### INSTRUCTIONAL OBJECTIVES

Students will understand the importance of eating whole colorful foods and that eating these foods will enhance immune system function.

#### MATERIALS

- Students' own HBD case file folders
- Students' Immune System Self Portrait
- Packets of yeast (enough for 2 tbs. packet per group of 3 to 4 students)
- Sugar
- Warm water (not hot)
- 2 small drinking glasses per group
- 2 Ziploc bags per group
- HBD downloadable stickers for this unit, Case Solved sticker
- Downloadable List Your Favorite Foods, Be in Tune, Stay Immune, and What I Learned about the Immune System worksheets, and Experiment Findings page.
- Different colored Sharpie® pens

#### OVERVIEW OF CONTENT

- Introduction to foods that are colorful and support the immune system
- Activity: feeding sugar to the "bad" bugs
- Worksheet activities
- Work on Immune System Self-Portrait
- Review, Q&A, conclusion

#### INSTRUCTIONS

1) **Announce that you will now do an experiment about feeding the bad bugs.** Divide the students into groups of three or four. Mention to the students how yeast is an important ingredient in making bread as it helps bread rise. Do you think yeast is similar to a germ invader in your body and likes to eat sugar? Be a good detective with this experiment and find out exactly why you should or shouldn't eat too much sugar!

- Problem: Is yeast similar to a germ invader in your body; does it like to eat sugar?
- Hypothesis: Yeast likes to eat sugar and will produce carbon dioxide (air bubbles) after it has eaten.
- Control group: Yeast without sugar Variable: Yeast with 1 heaping tablespoon of sugar

- **Procedure:**

- Step 1: Fill a 16 oz glass with warm water
- Step 2: Add 1 packet of yeast into water, and gently stir to mix
- Step 3: Label Ziploc bags: one labeled "control" and one "variable"
- Step 4: With variable bag, add 1 heaping tablespoon of sugar
- Step 5: Pour 1 glass of yeast mixture into each Ziploc bag
- Step 6: Remove all air from bag and close tightly
- Step 7: Wait 1 to 1 ½ hours
- Step 8: Observe bags

3) **After an hour, discuss with the students what they observe.** Does one have more carbon dioxide bubbles than the other? If it is the Ziploc bag with sugar (variable), then we know that yeast, and other germs like bacteria, love to eat sugar and is not the best food choice during a sickness. Have the students write down their observations and conclusions on their **Experiment Finding page** and place in their case file folder.

4) **While the yeast is eating or not eating, introduce the idea of different colorful foods.** Briefly introduce the subject of whole versus processed foods.

5) **Create a class list of the different colored foods** (e.g. red: cherries, tomatoes).

- Discuss where these foods can be found: a store's produce section, on a farm, on a tree or bush.
- Discuss why these foods are extra important for the immune system (briefly talk about nutrients from the nutrition lesson plan)
- Sugar: Remind the students about the HBD *Battle with the Bugs* story and how the bugs loved to eat sugar. Sugar makes the bugs more powerful which makes our immune systems work even harder.
- Discuss how sugar should be eaten in moderation, and never eaten during a sickness.
- Ask the children what they had for breakfast or lunch today. Was there any (natural whole food) color?

6) Have the students take out their **case file folder** and work on **List Your Favorite Foods** (make a special note to list only whole colorful foods), **Be in Tune, Stay Immune** and have them finish the page **What I Learned about the Immune System**. Once the experiment is complete, insert their **Experiment Findings page** within.

7) Have each student roll out their **Immune System Self-Portrait**. Have them draw in their favorite colorful foods in areas of their body that they believe may need them.

8) **Conclusion:** Briefly review this lesson and check the experiment, then all aspects of all four lessons from the immune system unit. Answer students' questions. Hand out **Case Solved stickers** for them to affix to front of their case file folders. They can take these and their Immune System Self-Portraits home.

## Unit 2:

### A Journey Through the Immune System

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#### OVERVIEW OF LESSONS

Lesson 1: Introduction; white blood cells and their importance

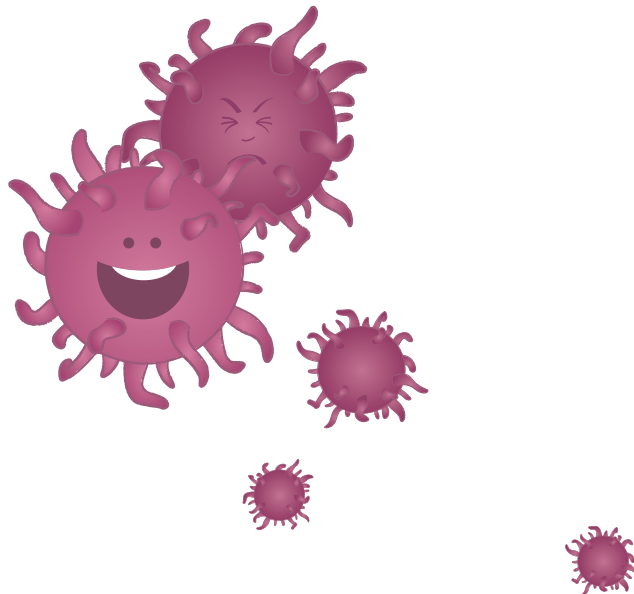
Lesson 2: The roles of different types of white blood cells antibodies; antigens

Lesson 3: Other immune system defenses

Lesson 4: Nutrition to support the immune system; conclusion

#### QUESTIONS TO ASK THE STUDENTS

1. Ask students what they ate today that made their immune systems strong.
2. Ask the students which is their favorite white blood cell and what it does in their body for them.
3. What is their favorite colorful food?





Dr. Heather is a practicing naturopathic physician who promotes wellness and naturopathic healthcare on her website [drheathernd.com](http://drheathernd.com). She is also the author of the award winning book series, *Human Body Detectives*. Dr. Heather lives on the Big Island of Hawaii with her husband and two daughters, and is currently at work on the next Human Body Detectives adventure.



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Visit the **Human Body Detectives** website for free downloads, to view the HBD book trailers, and to watch Human Body Detectives Merrin and Pearl in the kitchen and visiting exciting places!