

## Unit 1: Lesson 2 –The Innate Immune System

### Activity 1: Castle of the Body

Like this castle, the body has different defense mechanisms to keep out invaders. The walls and moat protect the castle. Think of skin as the walls of your body, while the moat is like the mucous membranes that line your respiratory, digestive, and reproductive tracts. In this activity, you will simulate the many attacks by outside microbes made on the human body and simulate how the body defends against them. You may work individually, but the activity is better carried out working in a small group.



Figure 1. Herstmonceux Castle, near Wartling, East Sussex, Great Britain. (Courtesy of Geograph.org)

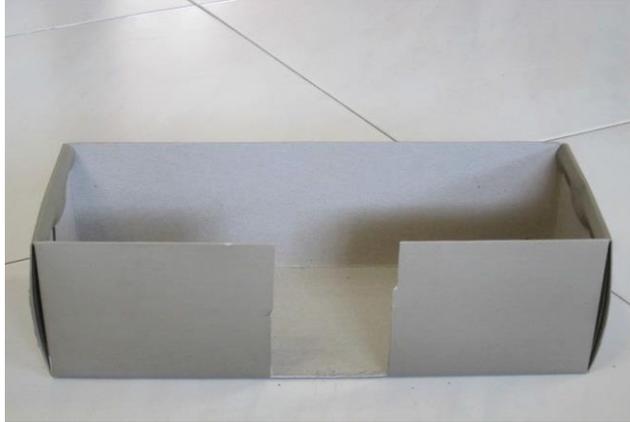
### Materials

Each group will need:

- Shoebox without lid
- Craft knife or scissors
- 10 ping pong balls
- 10 marbles
- 10 1½" foam balls
- Masking tape

## Procedure

1. Cut a hole in one side of the box, about two ping pong balls in width and height (see diagram). This will be your “castle.”



2. Place masking tape sticky side up in front of the castle opening. Use two smaller pieces at each end of the tape to keep it flat.
3. From a distance of one foot, gently roll the ping pong balls and tally the results in the worksheet data table. If a ball is stuck on the tape, tally a mark in the “Moat” column.
4. If the ball hits the wall of the box, tally in the “Walls” column. If the ball makes it into the shoebox, tally in the “Castle” column.
5. After rolling ten balls, total the results for Trial #1.
6. Clear away the ping pong balls and repeat Step 3, using the foam balls. Try to roll the balls the same speed that you used for the ping pong balls.
7. After ten rolls, total the results for Trial #2.
8. Clear away the foam balls and repeat Step 3, using the marbles. Again, roll the marble from the same distance and at the same speed you used for the other two trials.
9. After ten rolls, total the results for Trial #3.
10. Complete the table for the percentages of balls in each trial.
11. Answer the castle activity questions.

**Data table**

	Trapped in Moat	Hit Walls	Inside Castle
Trial #1 (ping pong balls)			
Trial #2 (foam balls)			
Trial #3 (marbles)			
Total number of items			
Average			

**Percentages**

Calculate the percentages and averages of balls in each trial.

	% Moat	% Walls	% Castle
Trial #1 (ping pong balls)			
Trial #2 (foam balls)			
Trial #3 (marbles)			
Total number of items			
Average			

### Activity 1 Questions

1. Describe the differences you observed between the results for each trial.
2. What is your hypothesis to explain the differences you observed between the results for each trial?
3. How does this activity represent the human body and the immune system?
4. Working in a small group, create a list of ways to get more of the balls or marbles into the box. Then create a list of ways to stop more of the balls or marbles getting into the box. If time allows, repeat the activity using different materials to represent various kinds of pathogens. Record your data and calculate percentages as before. Record the effectiveness of the technique and summarize your results and conclusions.
5. Within your group, discuss how your activity represents the immune system's interaction with pathogens to protect the body.