

Investigating Immunity

Everyone has innate (or natural) immunity. The innate immune system has a general response to foreign substances in the body. It recognizes that foreign things like *germs in the body are “bad” and attacks them. But the innate immune system doesn’t recognize specific KINDS of germs
*disease-causing bacteria and viruses

The adaptive (or acquired) immune system develops when we’re exposed to a germ or get a vaccination. The immune system learns how to recognize specific germs after the exposure. New kinds of protection develop against these germs. Next time the same germs invade the body, the immune response to those germs is faster and better.

In this activity we are using household materials to represent the immune system and germs.

- Dilute hydrogen peroxide represents innate immunity.
- 3% hydrogen peroxide represents adaptive immunity.
- Yeast represents a germ such as the novel coronavirus that causes COVID-19.

Materials:

- about 150 mL 3% hydrogen peroxide
note: This is the hydrogen peroxide sold over the counter at drug stores and grocery stores.
- about 2 cups tap water.
- 1 cup measure (1 cup measures about 237 mL.)
- 1 tablespoon measuring spoon (1 tablespoon measures 15 mL.)
- 1 packet dry active yeast for bread baking
Note: You can use regular active dry yeast OR types called instant, fast acting, rapid rise.
- 11 small cups (such as disposable bathroom cups)
- 1/8 teaspoon measuring spoon
Note: Use a 1/4 teaspoon measuring spoon if you don't have 1/8.
- paper towel to wipe up spills



Get Ready

Make the Dilute hydrogen peroxide solution

1. Measure 1 tablespoon 3% hydrogen peroxide into the 1 cup measure.
2. Add water to the 1 cup mark.



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3. Stir to mix this solution.

Investigation 1: Comparing the innate immune response to an acquired immune response.

Make Innate Immune System Cup

1. Label a cup "Innate."
2. Measure 1 tablespoon dilute hydrogen peroxide solution into a small cup.
3. Add 1 tablespoon of water to this cup. Stir.

Note: The dilute hydrogen peroxide solution represents a person's innate immune system.

Make Adaptive Immune System Cup

1. Label a cup "Adaptive."
2. Measure 1 tablespoon dilute hydrogen peroxide solution into a small cup.
3. Add 1 tablespoon 3% hydrogen peroxide (from the store bottle). Stir.

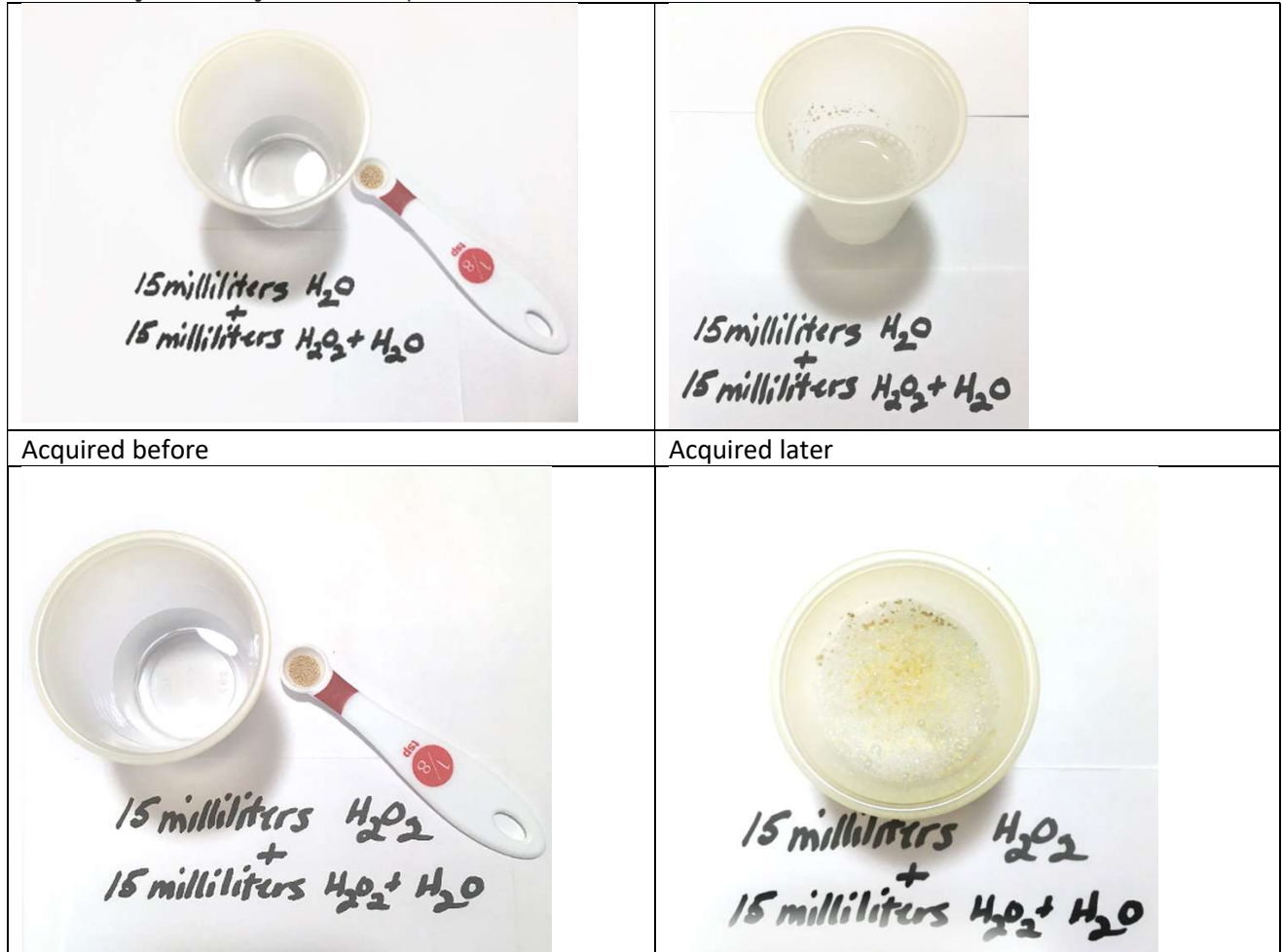
The dilute hydrogen peroxide solution represents a person's innate immune system. The added 3% hydrogen peroxide represents the ADDED protection from the adaptive immune system.

Compare Innate and Adaptive Immune Response

1. Put your 2 cups side by side.
2. Measure about 1/16 of a teaspoon of dry yeast into the smallest measuring spoon you have.
3. Sprinkle 1/16 teaspoon of dry active yeast onto the hydrogen peroxide in the two cups.
4. What differences do you observe? What does this activity show about the innate and adaptive immune responses?

Results:

Innate before	Innate later
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Modeling Herd immunity

Suppose that a vaccine is available for a specific disease. If almost everyone gets the vaccine, even people without the vaccine may be protected. That's because they are usually surrounded by vaccinated people who don't get sick and spread the disease to them. We call this effect "herd immunity. We can experiment with different levels of herd immunity.

Make Adaptive Immune System Cups

These cups represent people with vaccines.

1. Measure 1 tablespoon dilute hydrogen peroxide into each of 8 small cups.
2. Measure 1 tablespoon 3% hydrogen peroxide (from the store bottle) into each cup. Stir.

Make Innate Immune System Cup

This cup represents a person without a vaccine.

1. Measure 1 tablespoon dilute hydrogen peroxide into 1 small cup.
2. Measure 1 tablespoon water into this cup. Stir.

Viewing Herd Immunity

All of the cups have the same volume (2 tablespoon or 30 mL) and all the solution are colorless and transparent (clear). So, you cannot tell them apart visually. Can you tell them apart with their “immune” response to yeast?

1. Mix the cups up so you don’t know which is which.
2. Place them in a 3 by 3 grid.
3. Measure and sprinkle 1/16 teaspoon active yeast on each solution in the cups.
4. Can you tell which cup does not have the acquired immune response? How many vaccinated “people” are surrounding the unvaccinated “person”? What does this mean about how likely the unvaccinated person is to become sick from this disease?
5. (Optional) Retry the activity with different proportions of vaccinated and non-vaccinated “people.”

Cups before the reaction



Cups after the reaction

Arrangement 1	Arrangement 2
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