Teacher Resources

Viruses and Vaccines

Communities for Immunity support provided by the Institute of Museum and Library Services (IMLS) and the Centers for Disease Control and Prevention (CDC)

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Antigen Builder

Grades 5–8

Objective:

- To model how vaccines provide your cells with the genetic code to make a specific protein called an antigen.

Materials, per pair of students:

- Lego blocks
- Antigen cards
- Small plastic bags

Procedure:

1. Before the activity, prepare enough sets of blocks and antigen cards for the class. Each pair will need one bag of blocks and one antigen card. Each bag should have the same blocks required to make the image on the card.
    - If you do not have blocks that match the provided antigen cards, you can make your own cards that reflect the blocks you have available.
2. One person will be the cell and they must build the correct antigen to match the virus. They will need the bag of blocks.
3. The other person will be the vaccine and they must communicate how to build the correct antigen to the cell. They will need the antigen card.
4. The 'vaccine' should provide verbal instructions to the cell on how to build the correct antigen. The more detail that is provided, the more accurate the cell will be able to build.
5. The 'vaccine' should keep instructing the cell until the final antigen matches the card. Once it matches, your body will now start making antibodies to protect you from the virus.

Science Concepts:

Antigens are like flags on the surface of biological things, like viruses and cells. Different antigens have different shapes. The antigens of your own cells have a different shape than the antigens of foreign invaders, like bacteria or viruses. Your immune system uses these flags to recognize what should and should not be part of your body.

Vaccines, including those for COVID-19, provide an instruction manual in the form of genetic code for your own cells to make antigens. These antigens, which are normally found on the outside of a specific virus, trigger your immune system into making virus-fighting proteins called antibodies. Your immune system responds as if you are being attacked by a virus, without the virus actually making you sick.

Antibodies are large Y-shaped proteins used by the immune system to identify and neutralize foreign objects. Antibodies travel through the bloodstream and connect to foreign antigens. Antibodies that match a specific virus's antigens protect you from that virus. When antibodies stick to the antigens of the virus, they block the virus from being able to attach to and infect cells. Antibodies also act as a signal to other cells in the immune system to come destroy the virus.

Antigen Builder (Continued)

Grades 5–8

Curriculum Connections:

Next Generation Science Standards

- MS-LS1-2 Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their functions depends on the relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.

References:

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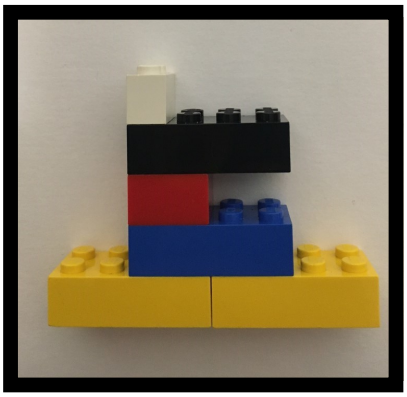
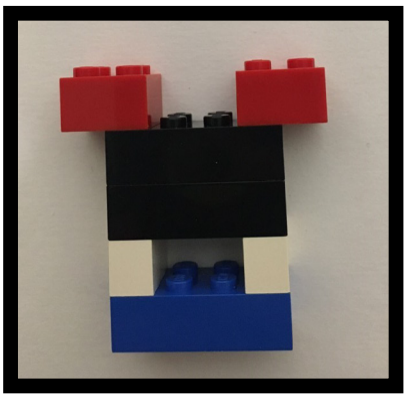
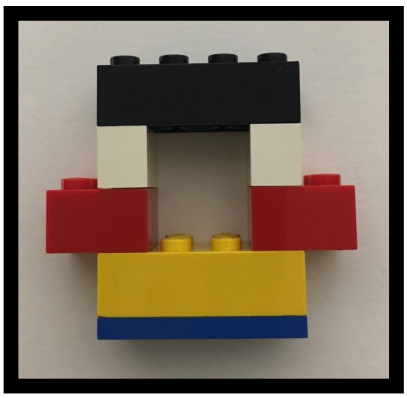
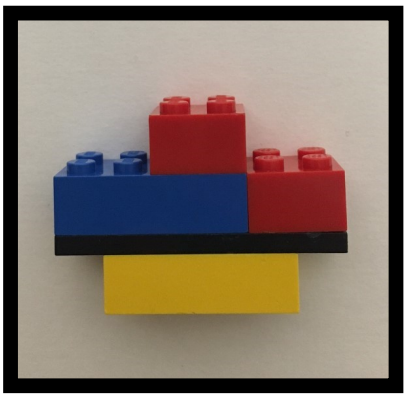
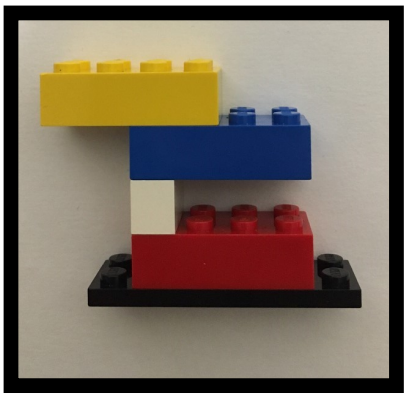
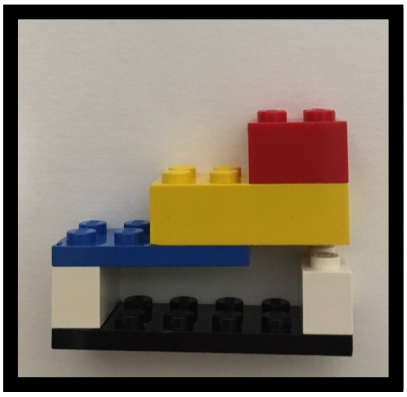
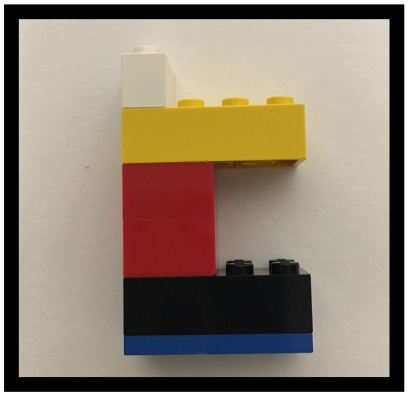
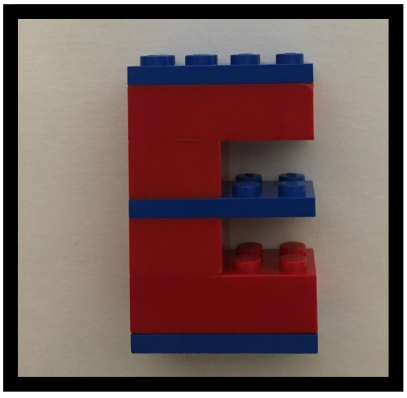
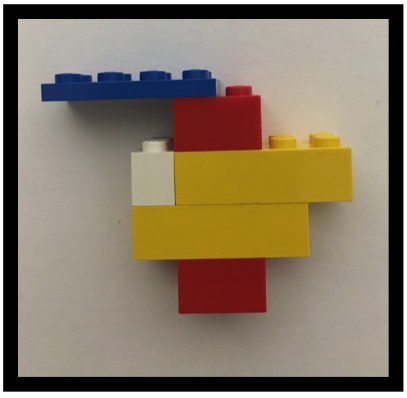
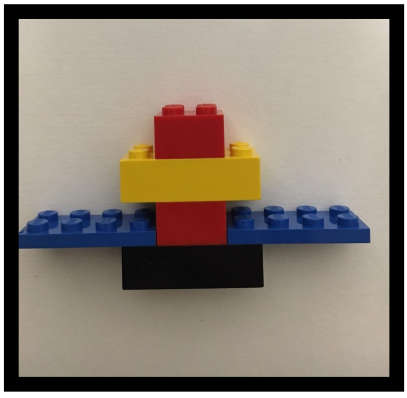

Antigen Cards

Prepare enough sets of Legos and antigen cards for the class. Each pair will need one bag of Legos and one antigen card. Each bag of Legos should have the same blocks required to make the image on the card.

Community Immunity

Grades 5–8

Objective:

- To model how vaccines provide protection against infection in a community.

Materials, group of 3-4 students:

- Three opaque containers with an opening such as coffee cans or tissue boxes
- 300 yellow beads or pom-poms
- 150 red beads or pom-poms
- Marker

For Extension:

- An additional opaque container

Procedure:

1. Before the activity, prepare the three containers. Label each container with a different virus: Measles, Influenza, COVID-19.
2. Fill each container with an assortment of beads or pom-poms according to the following percentages. The yellow items will represent vaccinated individuals and the red items will represent unvaccinated individuals.
    - Measles: 95% vaccinated, 5% unvaccinated (95 yellow, 5 red)
    - Influenza: 50% vaccinated, 50% unvaccinated (50 yellow, 50 red)
    - COVID-19: 70% vaccinated, 30% unvaccinated (70 yellow, 30 red)
3. Immunity refers to your body's ability to prevent infection. If your body knows how to eliminate a virus before it gets infected, you are immune to it. This most commonly occurs through vaccination.
4. Each container represents a population of people in a community. Everyone in the group will take a turn being an infectious virus – starting with the measles.
5. Each person should reach in and remove one handful of items from the measles container. This represents people exposed to the virus. Record the number of infected versus non-infected individuals.
    - Each red item is an unvaccinated individual that becomes infected
    - Each yellow item is a vaccinated individual that is immune to infection
6. Once everyone in the group has gone, tally up the total number of infected and non-infected individuals sampled from the population.
7. Repeat the procedure with the influenza container and the COVID-19 container, recording the numbers of infected and protected individuals for each.
8. Compare the results from all three viruses. How often did an unvaccinated individual get 'infected' from each virus? Does this reflect the percentages listed above?

Extension:

- Have your students look up the current COVID-19 vaccination rate for your school, county, or state. Make an additional container using this percentage and repeat the activity. How does this rate compare to the measles and influenza?

Science Concepts:

When many people are immune to a disease, usually due to vaccination, it's harder for that disease to spread in a community. When a large percentage of the population is immune to an infectious disease, we say that community has herd immunity. The more contagious a disease is, the more people need to be immune in a given population.

Community Immunity (Continued)

Grades 5-8

Science Concepts:

Measles is a highly contagious virus that requires around 95% of the population to be immune before herd immunity is reached. Most people receive an MMR (measles, mumps, and rubella) vaccine as a child and it provides good protection against illness. While there are still rare cases that break out among unvaccinated populations, this disease has been considered eliminated in the United States for over 20 years.

Influenza, the common flu, is a virus that mutates and changes rapidly. The antibodies initially produced by your body may not provide the same type of protection again, which is why we need flu vaccines annually. Because there are multiple strains and the virus mutates quickly, it's hard for scientists to determine how much of the population would have to be immune to the flu to stop the spread. It is estimated that only about 50% of the population gets a flu vaccine each year.

Scientist initially thought that some level of community protection would be achirved if 60% - 70% of the population was immune to the COVID-19 virus through infection or vaccination. However, similar to the flu, the COVID-19 virus has mutated and new variants have emerged. Scientists are still trying to determine what percentage of the population would need to be immune to attain herd immunity for COVID-19. Some new estimate that rate to be around 85% - 90% while others think it is possible that the virus may end up being treated like a recurrent seasonal infection.

Curriculum Connections:

Next Generation Science Standards

- MS-LS1-2 Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their functions depends on the relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.

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Community Immunity (Continued)

Grades 5-8

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