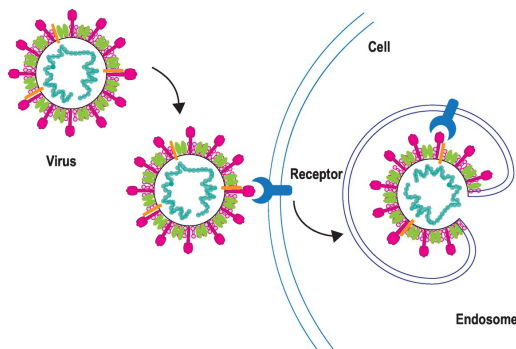
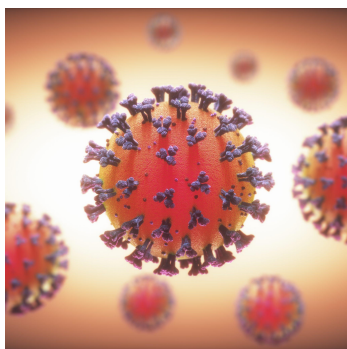


## How Vaccines Can Slow the Spread of Diseases

### LaCuKnoS Language Booster

A **virus**, like COVID-19 or the flu, makes you sick by tricking your cells into letting it pass through your **cell membranes**. Once a virus gets into your cells, it creates copies of itself, and those copies can invade other cells to spread the infection. The membranes around your cells are designed to keep harmful things out. They only let in things with a shape they recognize. But some viruses, like coronaviruses, can get past your cells' defenses with a trick like a key for a lock. These viruses have a structure called a **spike protein** that the cell recognizes as something it should let in. When a spike protein comes in contact with a cell membrane, the cell membrane lets the virus pass through into the cell.



**Vaccines** work by helping our **immune system** learn about viruses before they attack us. A vaccine teaches the body to make structures like the spike proteins on a coronavirus' surface that help them trick our cells. Once immune cells in our blood learn to recognize these structures as harmful, they start to detect particles that have that shape. In this way, the immune cells learn to identify and destroy viruses before they can enter any cells and reproduce to make you sick.

Vaccines can use different methods to teach your immune cells to recognize and fight harmful viruses. Some vaccines use a weakened or dead version of the actual virus to teach your cells. Other vaccines use a harmless virus that can look like the harmful virus. Several of the new COVID-19 vaccines -- called mRNA vaccines -- use instructions that teach the body to recognize shapes like spike proteins without being exposed to an actual virus at all.

**Talk with a partner, then write your answer:**

1. Write a sentence and draw a picture that you could use to explain to someone in your family how the COVID-19 virus tricks your cells into letting it pass inside.

## Vaccines, “Herd Immunity,” & Protecting our Communities LaCuKnoS Science Investigation

In the following investigation you will observe and analyze a computer simulation of how the COVID-19 virus spreads under different conditions with different percentages of people vaccinated. You will also discuss a diagram that models how different public health measures can work together to protect our communities from infectious diseases like COVID-19.



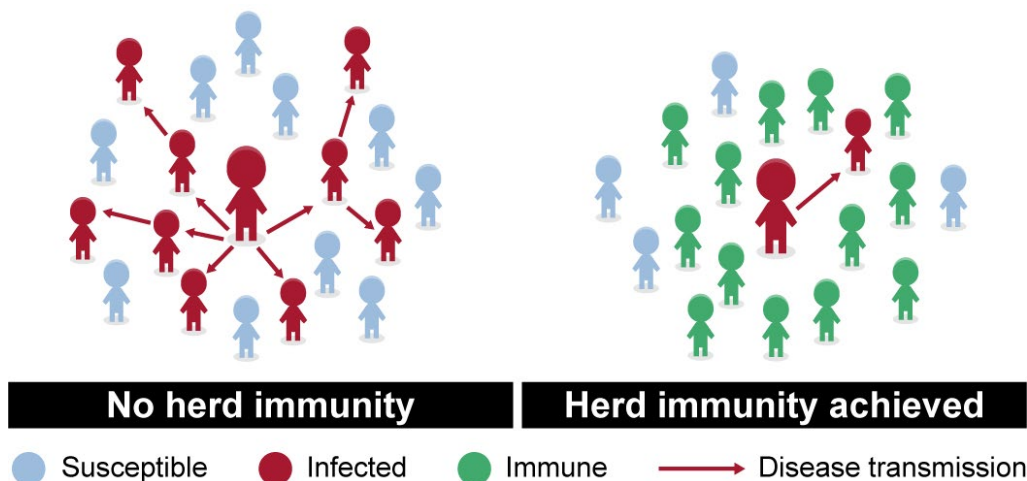
### Model #1: Simulation of How Herd Immunity Works

When most people in a community are immune to a disease, it becomes much harder for that disease to spread quickly and infect new people. This is called **herd immunity** and is one of the goals for ending the COVID-19 pandemic. Over time, a disease that cannot spread quickly will start to fade away and eventually disappear. In the Spreading Infectious Diseases lesson we learned that this idea is related to the Reproduction Number. People can gain immunity to a disease through receiving a vaccine or through having and surviving the disease. In most cases, it is much safer to be vaccinated than to risk getting the disease and surviving it. For example, people who survive COVID-19 may have long term side effects such as difficulty breathing, fatigue and pain.

Herd immunity tells us that vaccines protect us individually but that they also protect people around us. We will look at a simulation to see how this works. The simulation shows how a

disease like COVID moves through communities differently depending on what percentage of the people in the community have immunity.

[Link to simulation is here <https://n.pr/3p6t5gu>](https://n.pr/3p6t5gu). This simulation was created by National Public Radio.



## Procedure

1. In the computer simulation, each community has four hundred people. The light gray shapes represent people who are healthy but unvaccinated, the dark gray shapes represent people who are vaccinated, and the red shapes represent people who have or had the disease.
2. Watch the simulation a few times. As you watch, consider the questions below. Discuss the questions with your group and then write your answers.

What did you notice about the simulation?

What did you notice about vaccinated people?

What did you notice about unvaccinated people?

Why do more unvaccinated people stay healthy when more people around them are vaccinated?

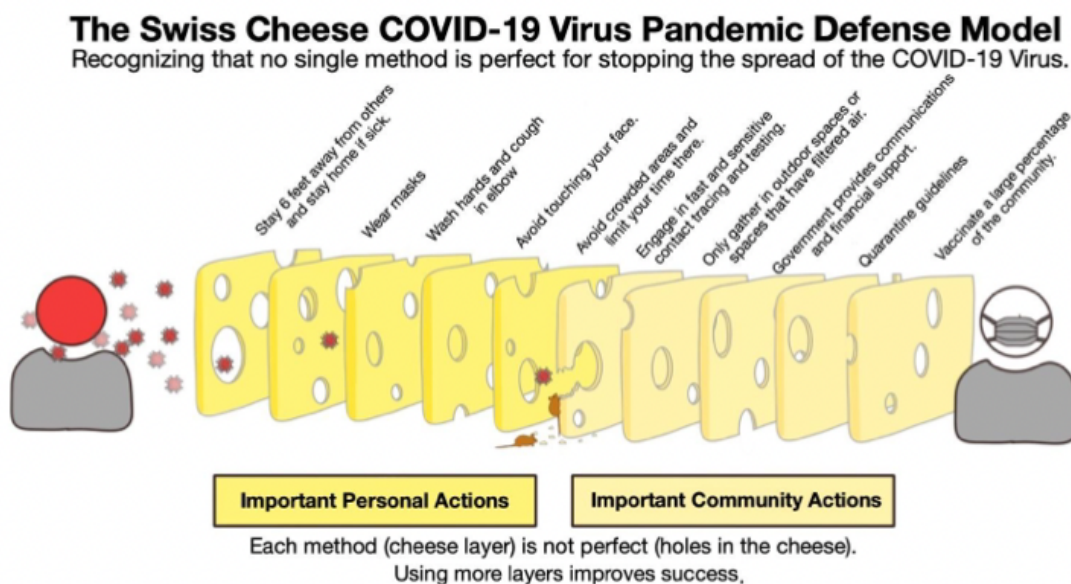
What new questions do you have after seeing this simulation?

In addition to vaccinations, what other strategies have been used to slow the spread of COVID-19 or other infectious diseases?

## Model #2: The “Swiss Cheese” model of community protection

(Created by Ian MacKay).

### Swiss Cheese Model



Our first model showed us the important role that vaccines can play in slowing the spread of an infectious disease like COVID-19. But vaccines are not the only strategy we can use to help us slow the spread and protect our communities.

Talk with a partner about your answers to the final question above: In addition to vaccinations, what other strategies have been used to slow the spread of COVID-19 or other infectious diseases?

Our second model is called the Swiss Cheese Model. It highlights the importance of using multiple strategies to slow the spread of COVID-19. It is called the Swiss Cheese Model because Swiss cheese has holes in it and any single type of defense against COVID-19 will only be partly effective, like having holes in it.

### Materials

- Copy of the Swiss Cheese Model for each pair of students

### Procedure

1. With a partner, look at the Swiss Cheese model. Then work together to complete the “Notice and Wonder” two-column chart below.

2. Be prepared to share with the class one thing you noticed and one thing you wondered about the Swiss Cheese model.

What do you notice about the Swiss Cheese Model?	What do you wonder about the Swiss Cheese Model?

3. After each pair has shared one thing they noticed and wondered, conduct a whole class discussion of the following question: How does the swiss cheese model connect to the vaccine simulation we did first?
4. In the last part of this activity, you will work with a partner to create a concept map to show your understanding of the following topic: ***The Role of Vaccines in Slowing the Spread of Infectious Diseases.***
5. Your teacher will review with you an example of how to make a concept map.

***Step 1—Partner discussion.*** Start by discussing the following questions with your partner:

- What are the main ideas we should include in our concept map about The Role of Vaccines in Slowing the Spread of Infectious Diseases? List these main ideas below. The list already has a few concepts you may want to include. What other ones should you add?
- What are the relationships between these main ideas? How are they connected?

List of main ideas for our concept map	Notes on how these ideas are connected
<ul style="list-style-type: none"> <li>• Virus</li> <li>• Vaccine</li> <li>• Herd Immunity</li> <li>• Swiss Cheese Model</li> <li>• </li> </ul>	

**Step 2—Create your own individual concept map.** After your partner discussion, use a blank sheet of paper to create your own concept map. Be sure to include the main ideas you listed and how these ideas are connected to each other.

**Step 3—Share and discuss your concept maps with a partner.** After you finish your individual concept map, share and discuss your map with your partner or small group. Look for similarities and differences between your concept map and theirs. Why do you think your maps have the similarities and differences that they do? If you want to, you can use a second color to make changes or additions to your concept map.

**Step 4—Turn in your concept map to your teacher.**





# **The Role of Vaccines in Slowing the Spread of Infectious Diseases**

## **LaCuKnoS Concept Map Activity**



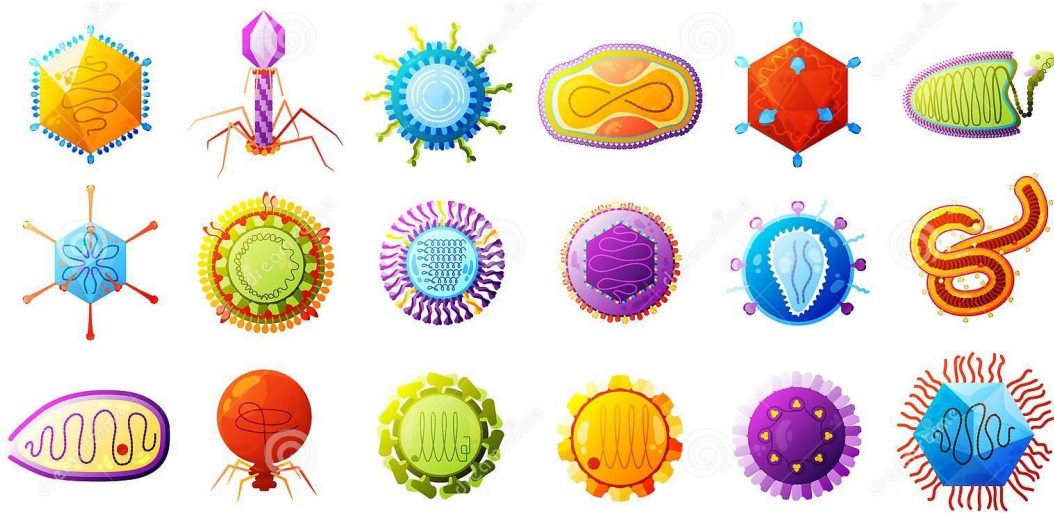
# Vaccines

## LaCuKnoS Concept Cards

# Virus/ Virus

A simple microscopic parasite that can only reproduce within living cells of another organism.

Un simple parásito microscópico que sólo puede reproducirse dentro de las células vivas de otro organismo.



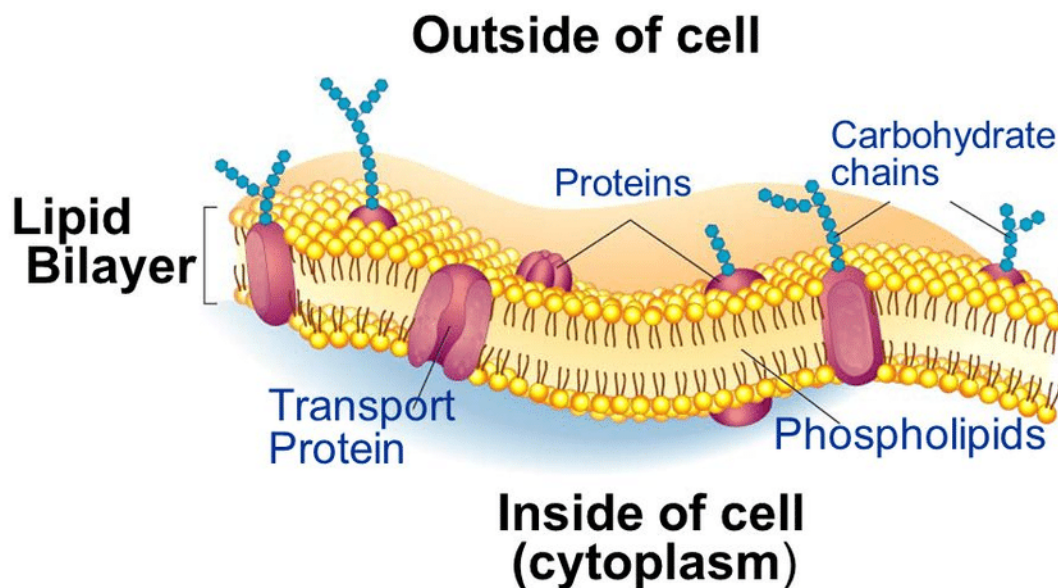
COVID-19 is a virus that spreads easily from person to person.

Concept Card

# Cell Membrane/ Membrana celular

The thin outside layer that surrounds a cell and controls the movement of materials into and out of the cell.

La fina capa exterior que rodea una célula y controla el movimiento de materiales dentro y fuera de la célula.

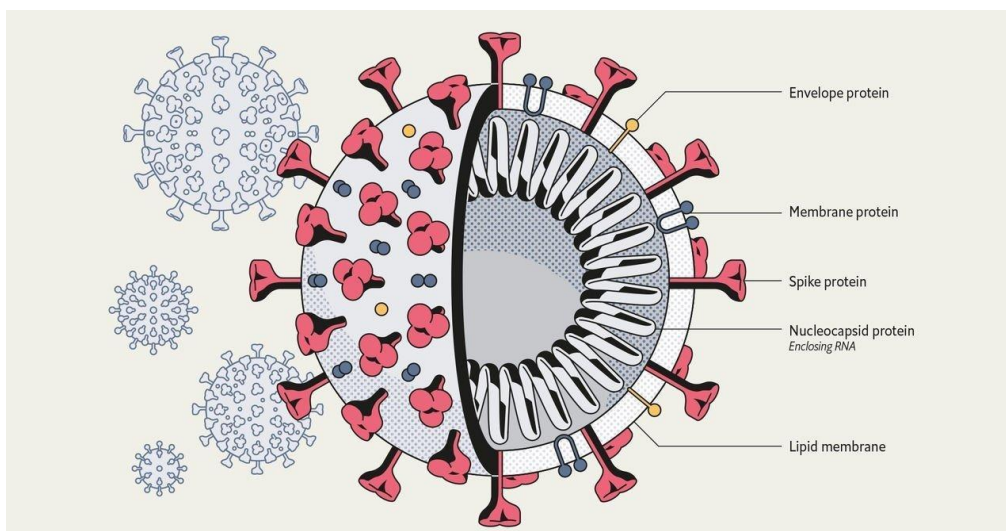


A spike protein can trick the cell membrane to let a virus pass into the cell.

# Spike Protein/ Proteína de Pico

The sharp bumps that stick out from some viruses, like coronaviruses, and act like a key to let the virus into a cell.

Las protuberancias afiladas que sobresalen de algunos virus, como los coronavirus, y actúan como una llave para permitir que el virus entre en una célula.



Spike proteins give coronaviruses their unique shape and name because they reminded scientists of a crown.

# Vaccine/ Vacuna

A substance that is injected to stimulate the body's immune response against a disease.

Una sustancia que se inyecta para estimular la respuesta inmunitaria del cuerpo contra una enfermedad.



Getting the COVID-19 vaccine to more people is important to slow the spread of the disease.

# Immune System / Sistema inmune

A network of cells and proteins that defends the body against infection and other diseases.

Una red de células y proteínas que defiende al organismo contra infecciones y otras enfermedades.



White blood cells are an important part of our immune system.

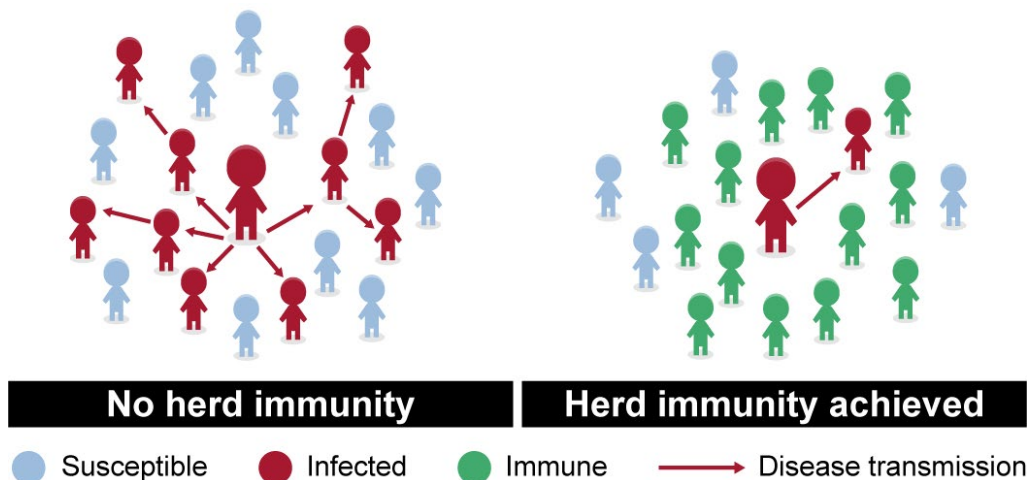
Concept Card



# Herd Immunity / Inmunidad de grupo

Resistance to the spread of an infectious disease based on existing immunity of a high percentage of individuals as a result of vaccination or previous infection.

Resistencia a la propagación de una enfermedad infecciosa basada en la inmunidad existente de un alto porcentaje de individuos como resultado de vacunación o infección previa.



It is safer to build herd immunity through vaccination than through previous infection.