# Texas CARES 5E Lesson
## Grades 9-12



UTHealth
**The University of Texas**
Health Science Center at Houston
**School of Public Health**

TEXASCARES
Texas Coronavirus
Antibody Response Survey

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# Teacher Background Information

## What is Texas CARES?

The Texas Coronavirus Antibody REsponse Survey (Texas CARES) measures the percentage of participants who have antibodies to SARS-CoV-2 virus in their blood (this measurement is called "seroprevalence"). All Texans 5-80 years of age can participate in the survey. Volunteers complete an informed consent, fill out a questionnaire, and then receive a blood draw at three time points (each three months apart) to determine if they have SARS-CoV-2 antibodies.

Texas CARES is not just *about* the Texas population. It's also *for* the Texas population.

Texas CARES is sharing information with the public, so that anybody – from public health officials to schoolchildren – can learn more about this project and the antibody response to COVID-19 across Texas! The Texas CARES dashboard presents the data from the participants updated weekly. Please download the Dashboard Guide for how to navigate the dashboard and more details about what the data represents

People learn can more about Texas CARES and enroll at www.TexasCARESproject.org.

## What are the survey's goals?

- Estimate how many people in Texas have been infected with SARS-CoV-2.
- Estimate how many people have been vaccinated for SARS-CoV-2 and develop antibodies.
- Learn how long COVID-19 antibodies last in someone's system.
- Identify the characteristics of people who develop COVID-19 antibodies.
- Identify the characteristics of people who never develop COVID-19 antibodies.

## Interviews

Dr. Eric Boerwinkle shares pertinent information that will set the stage for a successful teaching and learning experience in this 20-minute interview. Dr. Eric Boerwinkle is dean and M. David Low Chair of Public Health at The University of Texas Health Science Center at Houston (UTHealth) School of Public Health.

ABC13 coverage of Texas CARES: "More than 20 percent of Texans may have COVID-19 antibodies, study shows" by Marla Carter from March 15, 2021.

# Texas CARES 5E Lesson for Grades 9-12

## Learning Targets
- I can describe the characteristics of viruses.
- I can explain how my immune system fights viruses.
- I can explain how researchers investigate questions to new health problems, like the COVID-19 pandemic.
- I can explain how the COVID-19 vaccines work.

## Key Vocabulary

**Antibody:** protein found in the blood that is produced in response to foreign substances (e.g. bacteria or viruses) invading the body. Antibodies protect the body from disease by binding to these organisms and destroying them.

**Asymptomatic**: a person who has an infectious disease but shows no symptoms

**Blood:** fluid that transports oxygen and nutrients to the cells and carries away carbon dioxide and other waste products.

**Coronavirus:** coronaviruses are a type of virus that are named for the crown-like spikes on their surface. Human coronaviruses include SARS-CoV-2, SARS-CoV and MERS-CoV.

**COVID-19:** a newly-discovered infectious disease caused by a coronavirus

**Data:** All of the pieces of information that researchers collect or measure

**Immune system:** The complex system in the body responsible for fighting disease. Its primary function is to identify foreign substances in the body and develop a defense against them. This defense is known as the immune response. It involves production of protein molecules called antibodies to eliminate foreign organisms that invade the body.

**Pathogens:** Organisms (e.g. bacteria, viruses, parasites and fungi) that cause disease in human beings.

**RNA (ribonucleic acid):** biological macromolecule that functions to convert the genetic information of DNA into protein

**SARS-CoV-2:** SARS-CoV-2 stands for severe acute respiratory syndrome coronavirus 2. It is a virus that causes respiratory illness in humans. It was first known to infect humans in 2019

**Seroprevalence:** "Sero-" refers to the blood serum, where antibodies are found, and "-prevalence" is the proportion of individuals in a population who are positive for a measure of interest. Seroprevalence is the percentage of participating individuals who test positive for SARS-CoV-2

**Spike protein:** spikes made out of proteins that protrude from the outside of coronaviruses and help them infect cells

**Vaccine:** a vaccine gives your body directions to make the antibodies that fight pathogens like the coronavirus so you don't get sick (the COVID-19 vaccines available in the US are mRNA vaccines that contain the code that results in the production of antibodies to spike proteins)

**Virus:** non-living germ that multiplies within cells and causes disease such as chickenpox, measles, mumps, rubella, pertussis and hepatitis.

## TEKS Alignment

| | |
|---|---|
| **Health TEKS** | Health I, Grades 9-12:<br>1.D develop and analyze strategies related to the prevention of communicable and non-communicable diseases<br>6.A examine the effects of health behaviors on body systems<br>6.B relate the importance of early detection and warning signs that prompt individuals of all ages to seek health care<br>12.B research various school and community health services for people of all ages such as vision and hearing screenings and immunization programs<br>18.A research information about a personal health concern.<br>18.B demonstrate knowledge about personal and family health concerns; and<br>18.C develop strategies to evaluate information relating to a variety of critical health issues. |
| **Science TEKS** | Biology:<br>2.E plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;<br>2.G analyze, evaluate, make inferences, and predict trends from data; and<br>2.H communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports<br>3.A analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student<br>4.C compare the structures of viruses to cells, describe viral reproduction, and describe the role of viruses in causing diseases such as human immunodeficiency virus (HIV) and influenza<br>10.A describe the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals<br>11.A summarize the role of microorganisms in both maintaining and disrupting the health of both organisms and ecosystems; and<br><br>Anatomy and Physiology:<br>3.G analyze, evaluate, make inferences, and predict trends from data;<br>3.H communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports<br>4.B communicate and apply scientific information extracted from various sources such as accredited scientific journals, institutions of higher learning, current events, news reports, published journal articles, and marketing materials<br>10.A identify the effects of environmental factors such as climate, pollution, radioactivity, chemicals, electromagnetic fields, pathogens, carcinogens, and drugs on body systems<br>10.B explore measures to minimize harmful environmental factors on body systems<br>11.B evaluate the cause and effect of disease, trauma, and congenital defects on the structure and function of cells, tissues, organs, and systems<br><br>These activities are also aligned with many of the TEKS in Principles of Health Science, Medical Microbiology, World Health Research, and Pathophysiology |
| **Math TEKS** | Algebra I:<br>1.A apply mathematics to problems arising in everyday life, society, and the workplace<br>1.D communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate<br>1.E create and use representations to organize, record, and communicate mathematical ideas |

**The 5E Model:** Each part of the 5E is summarized below. The parts should be done in order, starting with Engage. The Explore and Explain can be done in a back-and-forth manner as students need information to complete and understand the Explore activity and communicate their findings from the data investigation.

| | |
|---|---|
| **Engage Teacher Directions and Key**<br><br>The purpose of the Engage activity is to get students interested and personally involved in the lesson and for the teacher to assess prior knowledge. | **Option 1: Coronavirus: Dead or Alive?** is an activity that will engage students in thinking about whether the virus that causes COVID-19 is living or nonliving. Have students work in pairs or groups to answer the question and justify their answer and then share as a class. Lead a discussion and come to a class consensus on the best answer and a reasonable justification. Tie in comparisons between viruses and bacteria in your discussion.<br><br>Key:<br>The correct answer is Jared and Ashley. A virus is not a cell or composed of cells and cannot reproduce on its own. These are two characteristics of all living things, so without them a virus is not considered a living thing.<br><br>**Option 2: Social Media Post**<br>Students create a social media post that will help their classmates remember how to stop a virus from spreading. Instruct students to draw an image and create a caption with hashtags. |
| **Explore Teacher Directions and Key**<br><br>The purpose for the Explore activity is for students to collaborate with other students to build knowledge of the topic by interacting with phenomena. | Read the Teacher Background Information on page 3 prior to doing this activity with your students. There are opportunities throughout the activity to discuss viral infection and prevention, immunity, antibodies, vaccination of adults and children, and how scientists with the Texas CARES project are answering important questions about the percentage of COVID-19 antibodies in the population. The teacher background information will help you prepare for these discussions.<br><br>Note that for Parts I and II, the data shown in the activities will be different than then continuously updated data in the Texas CARES dashboard. The dashboard guide can be used as a resource for Part III.<br><br>Background Information for Students: Show these slides to students and use the notes section of the slides to find opportunities for students to answer and ask questions.<br><br>Have students work in pairs or work with small groups of students.<br><br>Answer Key for **COVID-19 Attack**! Data Analysis, Part I:<br>A higher percentage of people ages 29 and under have antibodies in the blood of people than people ages 30-80. They may have been symptomatic or asymptomatic. People with asymptomatic infections can still infect others. |

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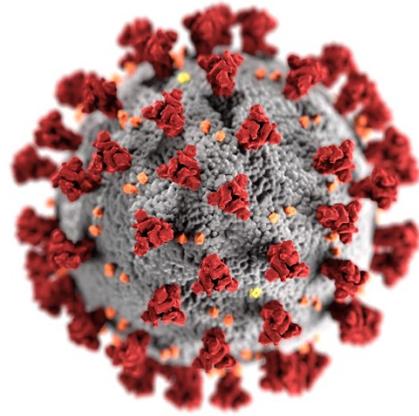*Texas Coronavirus
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|  | 1. No could be a reasonable answer because the more kids that are tested, it's possible they will find more kids who have never had COVID-19. When more people are vaccinated in a community, less virus circulates which could lead to less kids contracting COVID-19. Yes is a reasonable answer because the more kids that participate across all areas of Texas - and the more time goes on - it's possible researchers will see a higher seroprevalence in this age group.<br><br>Answer Key to Data Analysis, Part II:<br>1. 15%. Antibody presence may have waned over time to the point that they cannot be detected or the person was misdiagnosed or did not develop antibodies.<br>2. The vaccine will trigger the body's production of antibodies that are specific to the COVID-19 virus.<br><br>Teacher directions to Part III: Exploring the Texas CARES Dashboard:<br>Have students work in pairs. Explore the Texas CARES dashboard (https://sph.uth.edu/projects/texascares/dashboard) prior to teaching this part of the lesson. The Dashboard Guide is a helpful resource. Accept answers that are accurate and reasonable.<br><br>Answer Key, Conclusion:<br>Watch the 20-minute video interview with Dr. Eric Boerwinkle to get an overview of the purpose and goals for the Texas CARES Survey. The study is asking these questions: What is the frequency of individuals in our state who have been exposed to this virus? How long will the antibodies last? How many people in Texas have been infected with the virus? How many people have been vaccinated for SARS-CoV-2 and developed antibodies? How long do COVID-19 antibodies last in someone's system? What are the characteristics of people who never develop COVID-19 antibodies? Student answers will vary. |
| **Explain Teacher Directions and Key**<br><br>The purpose of the Explain activities is for students to build knowledge of the topic and use appropriate vocabulary as they communicate what they have learned. | Encourage students to reference the Background Information for Students to complete one or both of the explain activities.<br><br>**Virus and Antibody Diagram:** Label the diagram of the virus and antibody. In small groups, ask students to identify the similarities and differences between the virus in the diagram and a bacterial cell.<br><br>Use the **vocabulary activity** that is provided or use the vocabulary words and have students play Think and Throw defining the vocabulary words or drawing a picture as their response.<br><br>Answer Key:<br>The answers go in the blanks in this order: viruses, COVID-19, replicate, asymptomatic, immune system, antibodies, vaccine, survey, blood, data |

| | |
|---|---|
| **Elaborate Teacher Directions and Key**<br><br>The purpose of the Elaborate activities is for students to use their new knowledge to further communicate understanding. | There are three options:  health activity, a data activity and science activities. You can assign one or more of these to students, or you can use this as a menu and have students choose one.<br><br>Students should be creative but also use accurate health and science information.<br><br>The poster, video, brochure and model projects should be shared with other students in class or on campus, as these are intended to serve as peers teaching peers. |
| **Evaluate Teacher Directions and Key**<br><br>The purpose of the evaluate activities is for students to demonstrate what they have learned. | There are two options: a short quiz (slides linked here) and a Claims-Evidence-Reasoning prompt. You may do one or both with your students.<br><br>For the CER, students make a claim that answers the question that is posed. They use evidence to back up the claim, then the student provides their reasoning behind the claim using a scientific principle, providing a justification for why the reasoning is important for the claim, or explaining how or why the data counts as evidence. A further step can be added -- peer review or rebuttal. In this fourth step, students examine each other's CERs and provide feedback. |

**The Each activity page can be found on the following pages or linked above.**
**The Student Background Information and Quiz slides are linked above.**

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# Engage Activity | Grades 9-12
# Coronavirus: Dead or Alive?

**Directions:** Read the scenario below, read the student responses, then answer the question and justify your decision.

Students are talking about whether or not the coronavirus that causes COVID-19 is living or nonliving.

**Didi** said it is a *living* thing since it infects humans and causes serious illness.

**Maya** said it is *nonliving* because it can only be viewed with a microscope.

**Jared** said it is *nonliving* because it is not composed of one or more cells.

**Sergio** said it is *living* because it contains genetic material.

**Ashley** said it is *nonliving* because it cannot make copies of itself on its own.

**Question 1:** Which student or students had correct explanations about the virus? Explain your reasoning.

**Question 2:** How are viruses different from bacteria?

# Engage Activity Option 2 | Grades 9-12
## Social Media Post

Use the box below to make a social media post that will help students, family members or the community know how to make healthy choices about COVID-19. Choose from one of these topics:

- Prevention strategies - how not to get infected with COVID-19 or infect others
- Importance of getting a COVID-19 vaccine when it is available to you

Be sure to use respectful communication and accurate information. Include a caption with hashtags for your post.

_____

_____
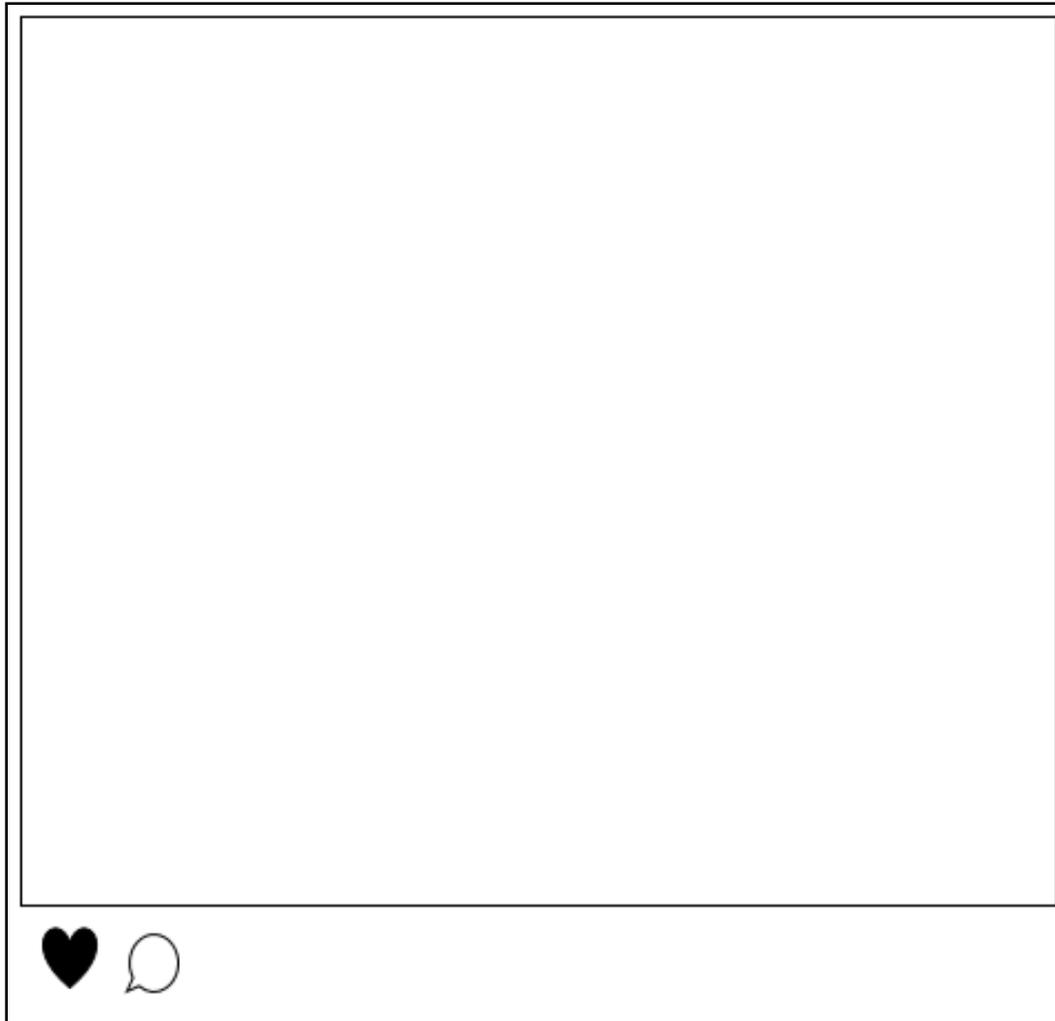
# Explore Activity | Grades 9-12
# COVID-19 Attack!

## Student Data Investigation Part 1: Antibodies in People 10-19 Years of Age

When people who are 10-19 years old had their blood tested by scientists with the Texas CARES Survey to see if they had antibodies for COVID-19, this is what they found:

32.48% of the 508 participants 10-19 years of age had COVID-19 antibodies in their blood.



Percentage and number of Texas CARES participants stratified by **Age groups**

**10-19**
508 (100.0%)
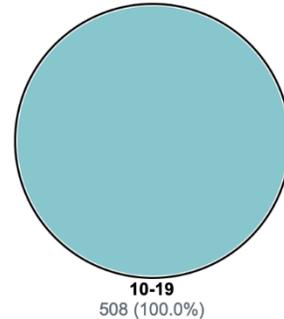
Seropositivity percentage distribution by **Age groups**

| 10-19 | 67.52% | 32.48% |
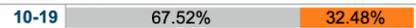
The chart below shows the seroprevalence (rounded to the nearest whole number) of COVID-19 antibodies in the blood for each age group Texas CARES researchers are looking at:

| Age Group | % of Age Group with COVID-19 Antibodies |
|-----------|------------------------------------------|
| Less than 10 | 33% |
| 10-19 | 32% |
| 20-29 | 38% |
| 30-39 | 23% |
| 40-49 | 26% |
| 50-59 | 26% |
| 60-69 | 24% |
| 70-79 | 26% |
| 80 and above | 17% |

## Data Analysis, Part I:

What are the researchers finding about the percentage of people with COVID-19 antibodies that are 29 and younger compared to the older age groups?
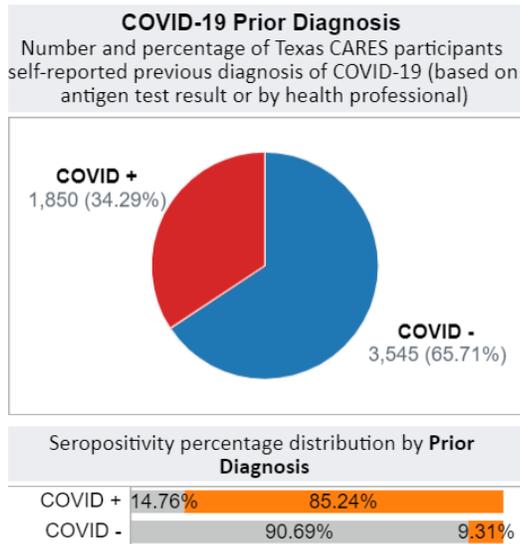
What could be some reasons for these differences?

Do you think these percentages will change as the researchers test more people? Explain your answer.

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## Part II: Prior COVID-19 Diagnosis and Antibodies

Look at the circle graph below. The red-shaded portion of the graph shows that 34% of the people in all age groups who participated in the survey reported that they had previously been diagnosed with COVID-19.

Researchers with Texas CARES have found that a little over 85% of these people who had COVID-19 in the past have antibodies in their blood.



**COVID-19 Prior Diagnosis**
Number and percentage of Texas CARES participants self-reported previous diagnosis of COVID-19 (based on antigen test result or by health professional)

COVID +
1,850 (34.29%)

COVID -
3,545 (65.71%)

Seropositivity percentage distribution by **Prior Diagnosis**

| | | |
|---|---|---|
| COVID + | 14.76% | 85.24% |
| COVID - | 90.69% | 9.31% |

## Data Questions, Part II:

1. If 85% of people who had COVID-19 in the past have antibodies in their blood, then 15% do not have antibodies in their blood. What might be some reasons for this?

2. How would getting vaccinated allow the immune systems of people in this group to develop antibodies against COVID-19?

**Part III: Exploring the Texas CARES Dashboard**
The Texas CARES researchers are studying the following demographic data from participants:
- Age
- Sex
- Ethnicity
- Race

Choose one of these to explore on the Texas CARES dashboard
(https://sph.uth.edu/projects/texascares/dashboard). What are two questions that you want to explore about the demographic that you chose? Write your findings in the chart below.

**Demographic I explored: _____**

| Questions | Findings in the data |
|---|---|
| 1. | |
| 2. | |

**Conclusion:**
Write a paragraph describing the importance of the Texas CARES study and what the data findings will do to help people understand the impact of COVID-19 in Texas.

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# Explain Activity Option 1 | Grades 9-12
# Virus and Antibody Diagram

Label the diagram below with the key terms in the word bank below.

**Word Bank:** lipid membrane, spike protein, genetic material, antibody
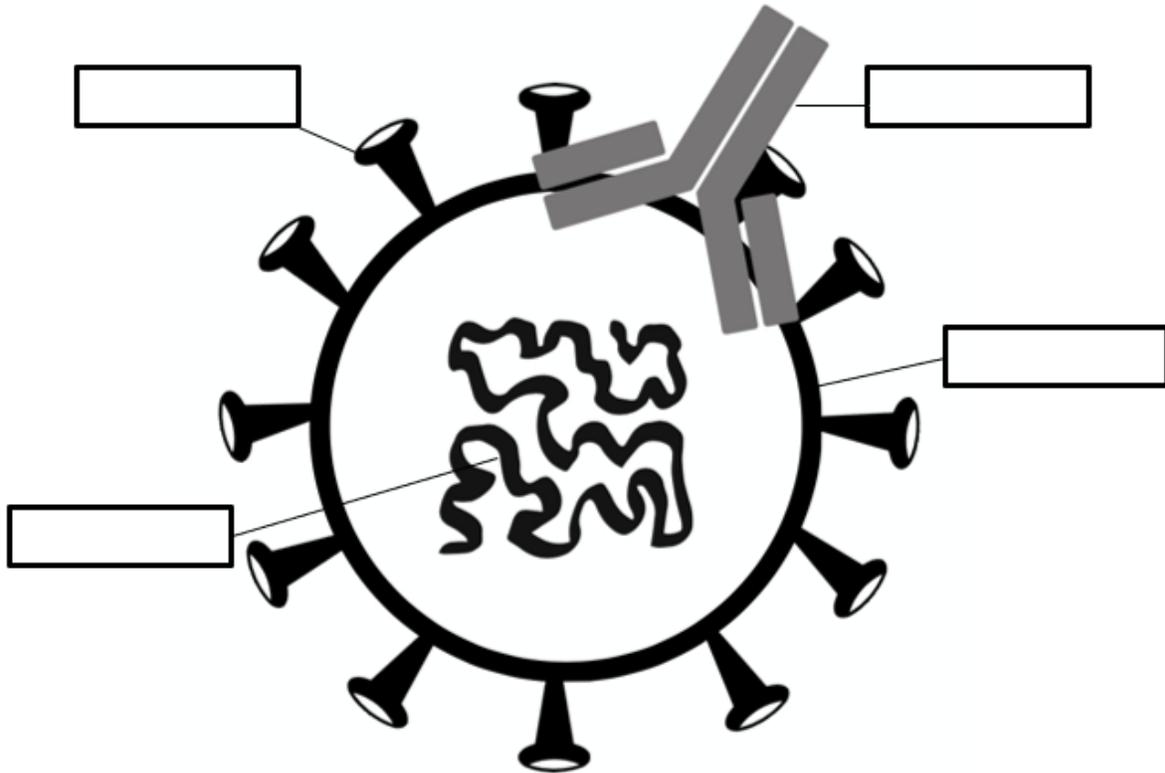
Compare the structures of the virus above to structures found in bacteria.

_____

_____

# Explain Activity Option 2 | Grades 9-12
## Vocabulary Activity

**Word Bank:**

**Antibodies    Blood    Viruses    Vaccine    Replicate    Data    Longitudinal**

**COVID-19    Immune System    Survey    Asymptomatic    Nervous System**

_____ are pathogens that can enter your body and make you sick. A new virus that has spread

around the world and has made many people sick is a coronavirus that causes _____. When a

person infected with COVID-19 breathes out air or coughs, the virus can enter your body through your

nose, mouth or eyes and enter the cells of your body to _____.  COVID-19 affects many body

systems, including the _____ with symptoms such as headaches, fatigue, fever and

chills, and loss of smell and taste. Some people get infected and don't show symptoms of COVD-19.

These people are called _____.


Your _____ protects your body from outside invaders like viruses. The immune system

creates attackers called _____ that will help fight off COVID-19 the next time you are

exposed to it. A person who has had COVID-19 or has received a COVID-19 _____ will

produce antibodies in their blood.


Scientists with the Texas CARES _____ are finding out more about who has antibodies to COVID-

19 by testing people's _____. They are conducting a _____ study which means they

will collect blood up to 3 times on the same participants to see if there have been any changes over

time. The _____ they are collecting will help them determine who has antibodies and how long

they last.

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# Elaborate Activities | Grades 9-12

## Option 1: Science Activities
### Antibody Attack!
Create a model showing how the virus that causes COVID-19 invades the body and how the body attacks the invading virus with antibodies. Describe system interactions that occur throughout the process of infection.

Be sure to label your poster or model using vocabulary such as coronavirus, respiratory system, lungs, circulatory system, blood, immune system, COVID-19 and antibodies.

Use your imagination and make this fun and creative while communicating accurate science information.

## Option 2: Data Activity: Dashboard Scavenger Hunt & Research Extension
Create your own data investigation. The activity is on page 17

## Option 3: Health Activity Stop the Spread!
Create a video, poster or brochure that helps students, family members or the community know how to make healthy choices about COVID-19. Choose from one of these topics:
- Prevention strategies - how not to get infected with COVID-19 or infect others
- Importance of getting a COVID-19 vaccine when it is available to you

Be sure to use respectful communication and accurate information.

# Elaborate Activities | Grades 9-12
## Dashboard Scavenger Hunt and Research Extension

Navigate the Texas CARES Interactive Dashboard to find the key items below.
https://sph.uth.edu/projects/texascares/dashboard
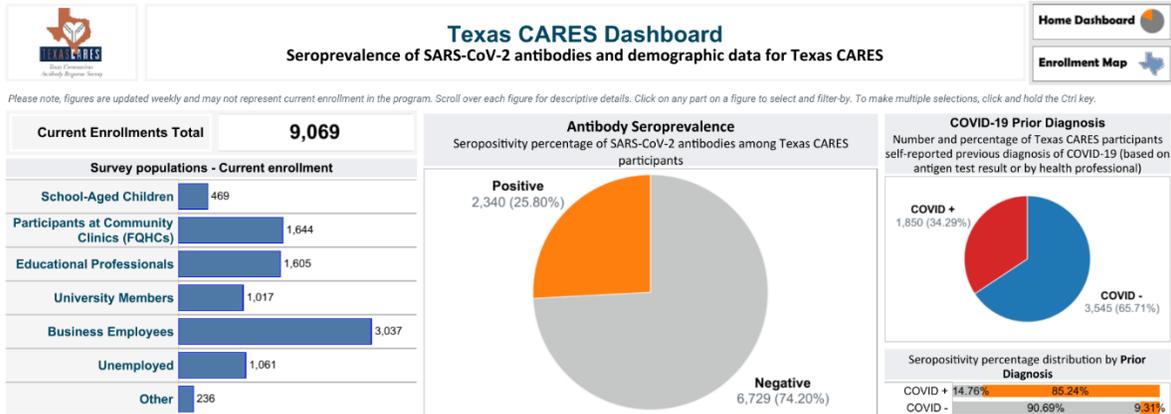


1. What percentage of females enrolled in the study are positive for SARS-CoV-2 antibodies?
   _____

2. What group under "current enrollment" has the greatest number of participants?
   _____

3. What is the total percentage of seropositive participants? _____

4. What is the number of participants who have had a past diagnosis of Covid-19?
   _____

5. Which age group has the greatest percentage of seropositive participants? _____

6. What group under "current enrollment" has the greatest number of people? _____

7. Looking at the dashboard, do you think that the current study participants are representative of the actual population of Texas? If not, what groups need better representation?

## *Now it's your turn to be a researcher!*

Brainstorm some scientific questions that researchers could study. *Example: How does the food that people eat affect their health? (You can also explore questions you had about the dashboard data.)*

## Designing a Study

1. Now that you know what scientific question you are going to research, it's time to design a study. Use the template below to plan your study design.

**Who will participate in your study?**

_____

_____

**How many people will you recruit for your study?**

_____

**What data will you collect?**

_____

_____

2. One study tool that can help you learn more about your participants is a survey. Use the template below to plan out your key survey questions.

**Survey Questions to Include:**
- _____
- _____
- _____
- _____

**What conclusions will you be able to make from your study?**

_____

_____

_____

_____

_____

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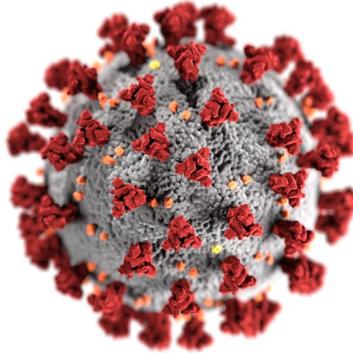
# Evaluate Activity | Grades 9-12
## Claim-Evidence-Reasoning: The Evidence is in the Blood



Watch the first video in the [ABC13 news story](#), "More Than 20 Percent of Texans May Have COVID-19 Antibodies, Study Shows," by Marla Carter.

In the video, Dr. Eric Boerwinkle, the dean of The University of Texas Health Science Center at Houston (UTHealth) School of Public Health, makes the claim that if you want to know what frequency of individuals have been infected with COVID-19, there is really only one way to find out—to look for antibodies in the blood.

Develop a Claims-Evidence-Reasoning using Dr. Boerwinkle's claim. Your evidence and reasoning should reflect what you have learned about COVID-19, antibodies and Texas CARES.

**Claim:**

**Evidence:**

**Reasoning:**