Name: ________________________________ Class Period: ______

High School Science: Infectious Diseases and COVID-19 Continuing Learning

March 23 - April 3

Instructions: As we are out of school for the next two weeks, we would like to continue to provide science instruction remotely. In this packet you will find a number of activities that are designed to increase your understanding of science, epidemiology (the study of the spread of infectious diseases) and how societies are affected by diseases and how scientists can help.

YOU SHOULD BE PREPARED TO HAND IN THIS WORKBOOK WHEN WE RETURN TO CLASS.

Lesson	Activity	Lesson Date	Completed?
1	John Snow: The First Epidemiologist	Monday, March 23	
2	The Spread of Pathogens - POGIL	Tuesday, March 24	
3	Virus Explorer	Wednesday, March 25	
4	Viral Life Cycle HHMI	Thursday, March 26	
5	Microbe Multiplication Magic	Friday, March 27	
6	Identifying Patient Zero	Monday, March 30	
7	How Soap Works	Tuesday, March 31	
8	Herd Immunity	Wednesday, April 1	
9	Corona and Flu Data - CER	Thursday, April 2	
10	Graphs: COVID - 19 and Others	Friday, April 3	

If you need help, please reach out to the science teacher you currently have at your school. If you cannot reach them, please reach out to one of the following individuals.

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Stay safe and healthy! We can't wait to see you all!

John Snow: The World's First Epidemiologist

Finding the Real Cause of Cholera
Cholera (KOLL-er-uh) is a terrible disease. People who have been infected with cholera have diarrhea so badly that they get dehydrated. Within a short time—two or three days—nearly half the patients will die.

On the night of the 31st of August, 1854, cholera broke out in the Soho section of London. It was, according to a local doctor, "the most terrible outbreak of cholera which ever occurred in the kingdom." In a single night, doctors reported 56 new cases of cholera—all within a few blocks of each other. Before the outbreak was over, nearly 500 people had lost their lives.

In those days, people did not have running water in their homes. They carried in water from pumps located around the neighborhood.

At the time, most people—even the best scientists—thought that cholera was spread through the air. But one local doctor did not agree. His name was John Snow. He believed that cholera was caused by a microbe and was spread by contaminated water.

But at the time, no one knew how this terrible disease was spread. That's what you are going to do. In this activity, you will become "disease detectives," trying to figure out how cholera is spread so you can prevent infection in more people.

Glossary
Contaminated (cun-TAM-in-ay-tud): Polluted, poisoned.

Dehydrated (dee-HY-dray-tud): What happens when there's not enough water in your body. If people lose too much water, then can even die!

Part A: Pretend you are John Snow or a doctor who agrees with him. You want to prove that the cholera in your neighborhood is being caused by contaminated water. How would you prove that?

1. What are some things you would want to know about the people who got sick and died in the neighborhood?
    1.
    2.
    3.

2. What would you want to know about people who lived in the neighborhood who did not die?
    1.
    2.
    3.

What would you want to know about people who died and lived away from the neighborhood?
    1.
    2.

Figure out the information you might need to prove your case. Later, you will present your ideas before the class.

John Snow's Methods

Snow carefully mapped the location of each death. Nearly all lived close to the pump at the corner of Cambridge and Broad Streets. Two women who had died lived many miles away. But Snow learned they had drunk water from the pump.

Some people who lived in the area had not gotten sick. Snow learned that most of them drank water from other wells.

Snow presented the map to local authorities. This time, they paid attention. He asked them to take the handle off the pump, and eventually, they did. The number of new cases of cholera went down (although it had been declining already since so many people had left the area).

Later, people learned that the well below the pump was about 28 feet deep. But close by ran a sewer that was only 22 feet below ground level. A few days before people got sick, some people remembered a bad smell near the pump. The raw sewage had seeped through the ground and into the well. As more people got sick, the sewage contained more of the microbes that caused cholera. That made the water even more contaminated.

Today, John Snow is recognized as one of the first "disease detectives." His methods of gathering information are still used by epidemiologists. One of the first things epidemiologists do when they get to the site of an outbreak of a new disease is to map it. They figure out in detail where all the sick people live, work, and play. They also keep track of anyone with whom a sick person has had contact.

Disease-Causing Microbes

Microbe that Causes Disease	Environment in which the Microbe Thrives	How to Break the Environmental Chain and Control the Spread of the Disease
Salmonella—bacterium that causes salmonellosis	Intestines of people and animals—lives in raw eggs, poultry, and meat.	
Borrelia burgdorferi—bacterium that causes Lyme disease	Lives in deer ticks.	
Group A Streptococcus—bacterium that causes "strep" infections	Lives in the mucus from the nose or throat of an infected person.	
Giardia—protozoan that causes giardiasis	Lives in feces of infected people and animals. Spread by contact with contaminated water.	
Rabies virus	Lives in the saliva of infected animals. Spread when an infected animal bites another animal or person.	

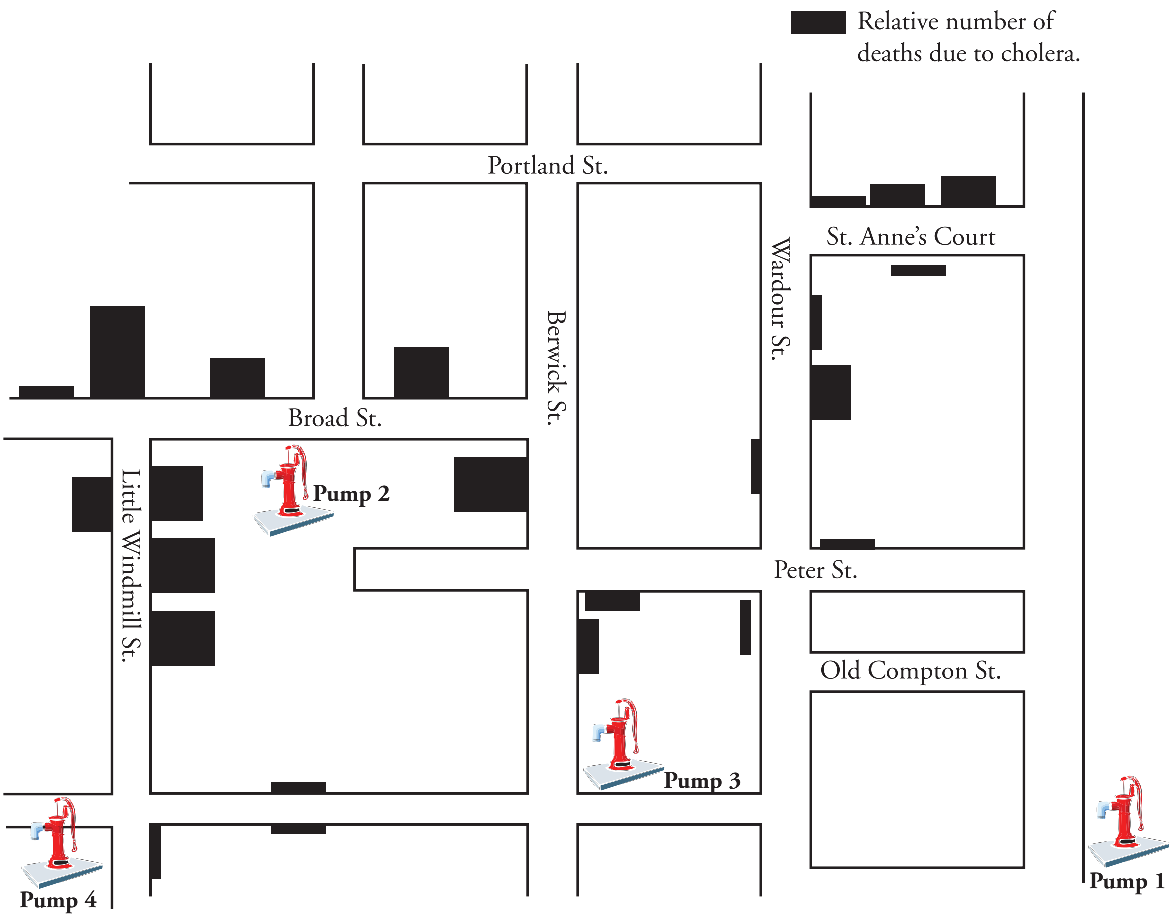
The Spread of Pathogens

How do we get sick?

Why?

Communicable diseases are spread between individuals by different methods, but they are all caused by **pathogens**, which are commonly called "germs." Knowledge of pathogens and the ways in which they can be spread helps humans understand and prevent disease outbreaks.

Model 1 – The 1854 London Cholera Outbreak



1. Model 1 is a map of an area in London where a large number of cases of cholera occurred in 1854.
   a. How many water pumps are shown on the map?

   b. What do the black boxes represent on the map?

   c. What do the relative sizes of the boxes represent?

2. Is the concentration and size of boxes the same at all locations on the map? Explain your answer.

3. Where exactly on the map does the size and concentration of the boxes appear to be the highest?

4. Is there a relationship between the number of black boxes and any of the water pumps? Be specific and detailed in your answer.

5. Based on the information provided in the map, propose a way cholera may be transmitted.

6. Based on this information, what action would you have taken if you had been responsible for public health in London in 1854?

STOP

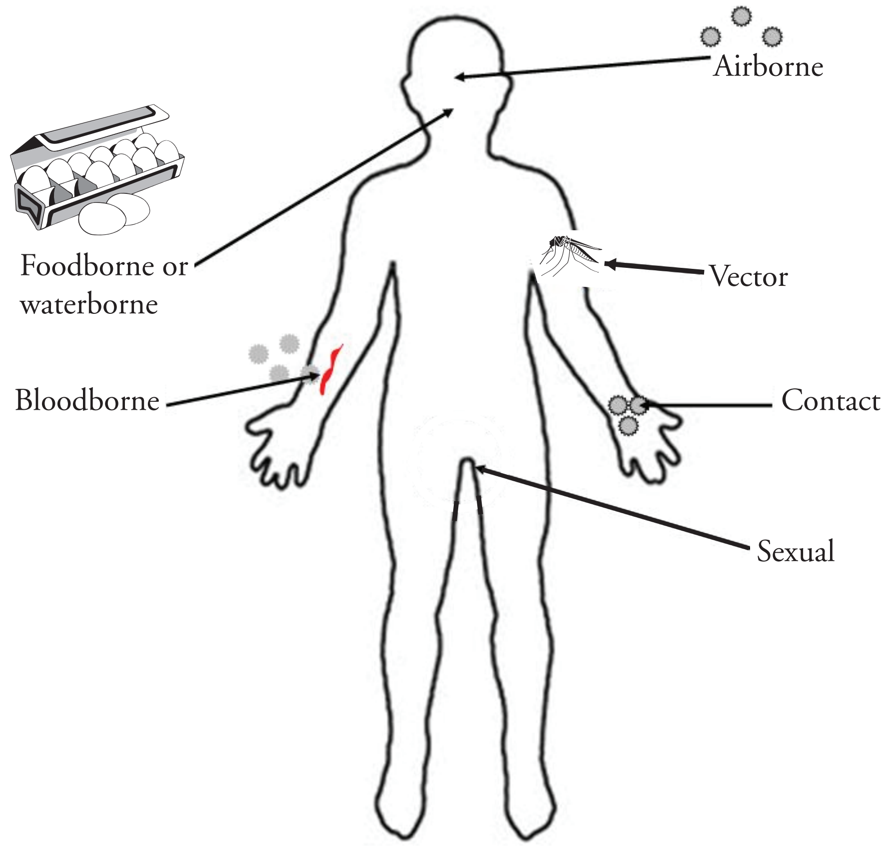
Read This!

Dr. John Snow is often referred to as the "father of epidemiology." **Epidemiology** is the study of the causes and spread of infectious diseases. Dr. Snow's study of the cholera outbreak of 1854 led to the discovery of the cause of this epidemic.

7. Cholera is caused by bacteria found in the fecal material of infected individuals. Brainstorm with your group the possible ways that cholera could have been transmitted from an infected individual into the water. Consider the distribution of deaths shown on the map as you develop your response.

STOP

Model 2 – Six Modes of Disease Transmission



8. Model 2 illustrates several methods by which diseases may be transmitted.
   a. List the six modes of disease transmission shown in Model 2.

   b. Which of these modes of transmission require a bodily opening, either natural or artificial?

9. An organism that is used by a pathogen to move from one person to another is called a vector.
   a. What vector is shown in Model 2?

   b. With your group, brainstorm a list of other organisms besides the one shown in the diagram that could be vectors for transmitting pathogens.

10. Considering all of the different ways disease may be transmitted, which modes are more likely to cause large numbers of individuals to get sick in the United States? Explain your reasoning.

11. Consider the information given below concerning several diseases. Identify the mode(s) of transmission from Model 2 that is most appropriate based on the description.

Name of Disease	Class of Pathogen	Scientific Name of Pathogen	Disease Transmission (How it is spread)	Mode of Transmission from Model 2
Cholera	Bacteria	*Vibrio cholerae*	Fecal contamination of water	
Syphilis	Bacteria	*Treponema pallidum*	Sexual contact with body fluids (can include saliva)	
Common cold	Virus	*Rhinovirus*	Touching contaminated objects and surfaces, and then touching eyes/nose; inhaling air contaminated from a cough or sneeze	
AIDS	Virus	Human immunodeficiency virus (HIV)	Body fluids, which include blood, semen, vaginal fluids, and breast milk	
Athlete's foot	Fungus	*Trichophyton sp.*	Moist areas where people walk barefoot	
Tuberculosis (TB)	Bacteria	*Mycobacterium tuberculosis*	Inhalation of respiratory secretions	
Malaria	Protist	*Plasmodium sp.*	Being bitten by certain mosquitoes	
Food poisoning	Primarily bacteria (and some viruses)	*Salmonella* is a common cause	Improperly handled food, fecal contamination of food.	
Lyme Disease	Bacteria	*Borrelia sp.*	Being bitten by deer ticks	

12. Below are several methods used by society to control disease. Under each method of control, list the diseases from Question 11 that could be prevented with that method. (You may list a disease under more than one category.)

    a. Preventing the contamination of food and water supplies.

    b. Hand washing and good personal hygiene.

    c. Avoiding contact with body fluids.

    d. Controlling insect populations.

13. Why might diseases transmitted by vectors be harder to control than those transmitted by other means?

14. In the 14th century in Europe, the bubonic plague killed approximately one third of the population. Bubonic plague is caused by the bacteria *Yersinia pestis,* which is spread by an insect vector carried by rats and other rodents. This disease can be spread to other animals besides humans. How is control of a disease such as bubonic plague complicated by the fact that it spreads across multiple animal species?

STOP

Extension Question

15. In a recent *Scientific American* article (February 2010), *The Art of Bacterial Warfare,* the authors state that 33% of humans are carrying the *Mycobacterium tuberculosis* bacteria—many without actually getting sick. In addition, 50% of the human population is carrying the bacteria *Helicobacter pylori* (which causes stomach ulcers), and 50% is carrying *Staphylococcus aureus* (which causes skin infections). Knowing that carriers are individuals who often do not show any visible signs of disease, what challenges can you think of for health care officials trying to control these types of communicable diseases?

CDC on COVID-19 Reading
(adapted)

Background

CDC is responding to an outbreak of respiratory disease caused by a novel (new) coronavirus that was first detected in China and which has now been detected in more than 100 locations internationally, including in the United States. The virus has been named “SARS-CoV-2” and the disease it causes has been named “coronavirus disease 2019” (abbreviated “COVID-19”).

On January 30, 2020, the International Health Regulations Emergency Committee of the World Health Organization (WHO) declared the outbreak a “public health emergency of international concern” (PHEIC).

On January 31, Health and Human Services Secretary Alex M. Azar II declared a public health emergency (PHE) for the United States to aid the nation’s healthcare community in responding to COVID-19.

On March 11, the WHO characterized COVID-19 as a pandemic. On March 13, the President of the United States declared the COVID-19 outbreak a national emergency.

Source and Spread of the Virus

Coronaviruses are a large family of viruses that are common in people and many different species of animals, including camels, cattle, cats, and bats. Rarely, animal coronaviruses can infect people and then spread between people.

Early on, many of the patients at the epicenter of the outbreak in Wuhan, Hubei Province, China had some link to a large seafood and live animal market, suggesting animal-to-person spread. Later, a growing number of patients reportedly did not have exposure to animal markets, indicating person-to-person spread. Person-to-person spread was subsequently reported outside Hubei and in countries outside China, including in the United States. Some international destinations now have ongoing community spread with the virus that causes COVID-19, as do some parts of the United States. Community spread means some people have been infected and it is not known how or where they became exposed.

Severity

The complete clinical picture with regard to COVID-19 is not fully known. Reported illnesses have ranged from very mild (including some with no reported symptoms) to severe, including illness resulting in death. While information so far suggests that most COVID-19 illness is mild, a report out of China suggests serious illness occurs in 16% of cases. Older people and people of all ages with severe chronic medical conditions — like heart disease, lung disease and diabetes, for example — seem to be at higher risk of developing serious COVID-19 illness.

COVID-19 Now a Pandemic

A pandemic is a global outbreak of disease. Pandemics happen when a new virus emerges to infect people and can spread between people sustainably. Because there is little to no pre-existing immunity against the new virus, it spreads worldwide. The virus that causes COVID-19 is infecting people and spreading easily from person-to-person. Cases have been detected in most countries worldwide and community spread is being detected in a growing number of countries. On March 11, the COVID-19 outbreak was characterized as a pandemic by the WHO.

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This is the first pandemic known to be caused by the emergence of a new coronavirus. In the past century, there have been four pandemics caused by the emergence of novel influenza viruses. As a result, most research and guidance around pandemics is specific to influenza, but the same premises can be applied to the current COVID-19 pandemic. Pandemics of respiratory disease follow a certain progression outlined in a "Pandemic Intervals Framework." Pandemics begin with an investigation phase, followed by recognition, initiation, and acceleration phases. The peak of illnesses occurs at the end of the acceleration phase, which is followed by a deceleration phase, during which there is a decrease in illnesses.

Risk Assessment

Risk depends on characteristics of the virus, including how well it spreads between people; the severity of resulting illness; and the medical or other measures available to control the impact of the virus (for example, vaccines or medications that can treat the illness) and the relative success of these. In the absence of vaccine or treatment medications, nonpharmaceutical interventions become the most important response strategy. These are community interventions that can reduce the impact of disease.

The risk from COVID-19 to Americans can be broken down into risk of exposure versus risk of serious illness and death.

Risk of exposure:

- The immediate risk of being exposed to this virus is still low for most Americans, but as the outbreak expands, that risk will increase. Cases of COVID-19 and instances of community spread are being reported in a growing number of states.
- People in places where ongoing community spread of the virus that causes COVID-19 has been reported are at elevated risk of exposure, with the level of risk dependent on the location.
- Healthcare workers caring for patients with COVID-19 are at elevated risk of exposure.
- Close contacts of persons with COVID-19 also are at elevated risk of exposure.
- Travelers returning from affected international locations where community spread is occurring also are at elevated risk of exposure, with level of risk dependent on where they traveled.

Risk of Severe Illness:
Early information out of China, where COVID-19 first started, shows that some people are at higher risk of getting very sick from this illness. This includes:

- Older adults, with risk increasing by age.
- People who have serious chronic medical conditions like:
    - Heart disease
    - Diabetes
    - Lung disease

What May Happen

More cases of COVID-19 are likely to be identified in the United States in the coming days, including more instances of community spread. CDC expects that widespread transmission of COVID-19 in the United States will occur. In the coming months, most of the U.S. population will be exposed to this virus.

Widespread transmission of COVID-19 could translate into large numbers of people needing medical care at the same time. Schools, childcare centers, and workplaces, may experience more absenteeism. Mass gatherings may be sparsely attended or postponed. Public health and healthcare systems may become overloaded, with elevated rates of hospitalizations and deaths. Other critical infrastructure, such as law enforcement, emergency medical services, and sectors of the transportation industry may also be affected. Healthcare providers and hospitals may be overwhelmed. At this time, there is no vaccine to protect against COVID-19 and no medications approved to treat it. Nonpharmaceutical interventions will be the most important response strategy to try to delay the spread of the virus and reduce the impact of disease.

CDC Response

Global efforts at this time are focused concurrently on lessening the spread and impact of this virus. The federal government is working closely with state, local, tribal, and territorial partners, as well as public health partners, to respond to this public health threat.

CDC is implementing its pandemic preparedness and response plans, working on multiple fronts, including providing specific guidance on measures to prepare communities to respond to local spread of the virus that causes COVID-19. There is an abundance of pandemic guidance developed in anticipation of an influenza pandemic that is being adapted for a potential COVID-19 pandemic.

Reading Questions

Vocabulary:
Use context clues to determine the definition of each of the following words

1. Chronic

2. Non-Pharmaceutical Interventions

3. Pandemic

4. Infrastructure

Comprehension Questions

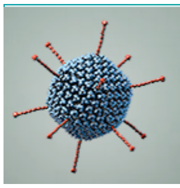
1. What is a “coronavirus”?

2. Which happened first:
    A. Health and Human Services Secretary Alex M. Azar II declared a public health emergency (PHE) for the United States to aid the nation’s healthcare community in responding to COVID-19.
    B. The President of the United States declared the COVID-19 outbreak a national emergency.
    C. The WHO characterized COVID-19 as a pandemic

3. Which is the correct order of the Pandemic Phases
    A. Investigation, initiation, recognition, acceleration, deceleration
    B. Acceleration, investigation, recognition, initiation, deceleration
    C. Investigation, recognition, initiation, acceleration, deceleration
    D. Acceleration, recognition, initiation, deceleration, investigation

4. Who are most at risk of severe illness from COVID - 19

Short Answer:
Using the information in this post write a tweet (140 characters or less) explaining what people should do to stop the spread of COVID-19.



Click and Learn
Virus Explorer

hhmi | BioInteractive

Student Handout

INTRODUCTION

This handout complements the Click and Learn “Virus Explorer” developed in conjunction with the 2016 documentary, *Spillover: Zika, Ebola & Beyond* (http://www.hhmi.org/biointeractive/virus-explorer).

PROCEDURE

Follow the instructions as you proceed through the Click and Learn, and answer the questions in the spaces provided.

1. Let’s review. Click on the “About” tab at the bottom. Read the information and list four (4) ways in which viruses can differ from each other.

2. This interactive uses several abbreviations. Fill in what each abbreviation stands for in the table below.

Abbreviation	**Description**
nm	
bp	
ss	
ds	

3. Close the “About” window, and locate the **i** next to each viral characteristic tab across the top. Click on these icons and answer the questions below associated with each viral characteristic.

a. **Envelope:** Not all viruses have an envelope. If a virus has this outer layer, explain how it forms.

b. **Structure:** What determines the shape of the capsid, or core?

c. **Host(s):** From the virus' perspective, why is the host important?

d. **Genome Type:** Viral genomes may vary by four characteristics of their genetic information. What are they?

e. **Transmission:** Define the terms "vector" and "zoonotic."

f. **Vaccine:** What is one advantage of being vaccinated against a particular virus?

4. Virus Scavenger Hunt: Use the home page of the Virus Explorer and the various viral characteristic tabs across the top to answer the questions below.

a. What is one difference between the rabies virus and the influenza virus?

b. Of the nine viruses shown, which is the only one that infects plants?

c. What are three characteristics that adenoviruses, T7 virus, and papillomaviruses have in common?

d. Recently, Zika virus has been in the news. Treatment of it is of particular concern. Why?

e. Which two viruses infect all the vertebrates included in the interactive?

f. Of the nine viruses shown, which is the only one that infects bacteria?

g. List four characteristics that human immunodeficiency virus (HIV) and Ebola virus have in common. (Be specific.)

h. List four characteristics that HIV and Ebola virus do not share. (Be specific.)

5. Locate the **+** next to each virus name. Click on these icons and answer the questions below associated with selected viruses.

a. Rabies virus: People often associate rabies virus with dogs. Why is this incomplete?

b. Influenza virus: Influenza virus has a segmented genome. Why is this an advantage for the virus?

c. HIV: HIV infects immune cells. Why is this a disadvantage to the infected person?

d. HIV: Where in the world is HIV most prevalent?

e. Adenovirus: Adenoviruses can cause many mild clinical conditions in humans. What are three?

f. Papillomavirus: What is the common name for papillomas?

g. Papillomavirus: What kind of symptoms do some human papillomaviruses cause?

h. Zika virus: Why is Zika virus of great concern to pregnant women?

i. Tobacco mosaic virus (TMV): Name one unique characteristic of the tobacco mosaic virus.

j. Ebola virus: What animal is associated with Ebola virus outbreaks?

EXTENSION ACTIVITY: SIZE, SCALE, AND PROPORTION: HOW BIG IS A VIRUS ANYWAY?

Instructions: Click on the "Show Relative Sizes of the Viruses" tab at the bottom of the interactive home page. Answer the questions below in the spaces provided. (You will need a calculator for some items.)

1. Using the white scale bar provided, approximately how long (tall) is TMV?

2. What is the approximate diameter of HIV?

3. What is the approximate diameter of Zika virus?

4. So, how big is a nanometer? Study the sample problem provided and then answer Questions 5–10, showing your work in the space provided for each.

Sample Problem

An average small paperclip measures 3.0 cm in length.

Calculate the length of the paperclip in millimeters, micrometers, and nanometers.

a. Millimeters (mm)? 30 mm

Since there are 10 mm in a centimeter, the calculation is completed in the following way:

3.0 cm x 10 mm/1 cm = 30/1 = 30 mm

b. Micrometers (µm)? 30,000 µm

Since there are 1000 µm in a millimeter, the calculation is completed in the following way:

30 mm x 1000 µm/1 mm = 30,000 µm

c. Nanometers (nm)? 30,000,000 nm

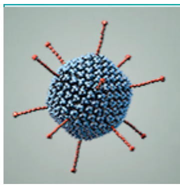
Since there are 1000 nm in a micrometer (µm), the calculation is completed in the following way: 30,000 µm x 1000 nm/1 µm = 30,000,000 nm

So, a small paperclip measures 3.0 cm in length, or you can say it measures 30,000,000 nm in length!

5. A single grain of salt measures 0.5 mm in width.

a. What is the width in micrometers (µm)? (Show your work.)

b. In nanometers (nm)? (Show your work.)



6. The average human skin cell measures 30 µm in diameter.

a. What is the diameter in millimeters (mm)? (Show your work.)

b. In nanometers (nm)? (Show your work.)

7. If you lined up human skin cells side-by-side, how many would fit along the length of the paperclip in the sample problem above? Justify your answer with math.

8. Using your response to item 1 above, if you lined up TMV particles end to end, how many would fit along the length of the same paperclip? Justify your answer with math.

9. Using your responses to item 6, if you lined up TMV particles end to end, how many would fit across the diameter of the average human skin cell? Justify your answer with math.

10. *Claim*: An individual virus docks on the surface of a cell, infects it, hijacks the cellular machinery inside, and replicates itself, sometimes thousands of times.

Justification: Based on what you learned about size, scale, and the component parts of a virus, justify with scientific reasoning how a virus is able to accomplish this.

VIRUSES AND THE CYCLE OF REPLICATION

Directions:

Read the passage below and answer all questions that follow.

Viruses cause damage when the viruses replicate inside the cells. The entry of the virus into the cell is not by itself harmful, but after the virus has replicated itself several hundred times and breaks out, the cell is destroyed. Organ damage in an organism can be severe if enough tissue is damaged by the virus. Any agent that causes disease is called a pathogen.

They cycle of viral infection, replication, and cell destruction is called the lytic cycle. After the viral genes have entered the cell, they use the host cell to replicate viral genes and to make viral proteins, such as capsids. The proteins are then assembled with the replicated viral genes to form complete viruses. The host cell is broken open and releases newly made viruses.

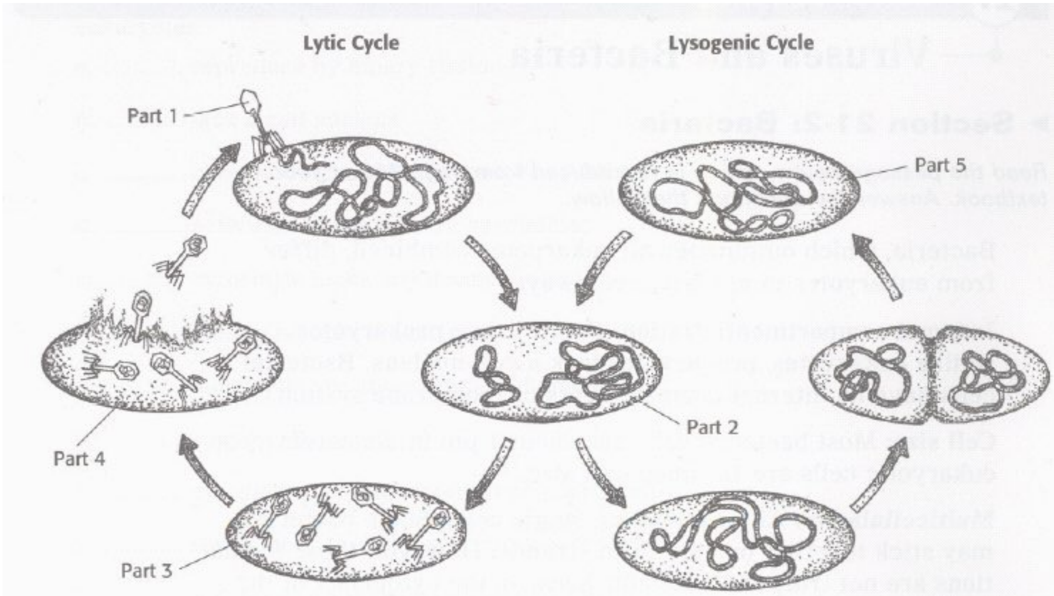
During an infection, some viruses stay inside the cells but do not make new viruses. Instead of producing virus particles, the viral gene is inserted into the host chromosome, and is called a provirus. Whenever the cell divides, the provirus also divides, resulting in two infected host cells. In this cycle, called the lysogenic cycle, the viral genome replicates without destroying the host cell.

1. How do viruses damage the cell?

2. What relationship exists between viruses and pathogens?

3. What sentence expresses main idea of the second paragraph?

4. The figure below shows the lytic and lysogenic cycles. In the spaces provided, describe what is occurring in each numbered part of the figure.



Part 1

Part 2

Part 3

Part 4

Part 5

Circle the letter of the phrase that best completes the statement.

Virus cause damage when they

a. invade cells
b. replicate inside cells.
c. remain inside a host cell.
d. Both (a) and (b).

Microbe Multiplication Magic

Ideal Conditions

Assume that you begin with 2 *E. coli* bacteria and they reproduce (split into two separate bacteria) every 15 minutes.

Time	:15	:30	:45	1 hr.	1:15	1:30	1:45	2 hr.	2:15	2:30	2:45	3 hrs	3:15	3:30	3:45	4 hrs
Number of *E. coli*																

Make your graph below: Make sure you include title, labeled axes and appropriate scales.

Less than Ideal Conditions

Assume that you begin with 2 *E. coli* bacteria and they reproduce (split into two separate bacteria) every hour.

Time	:15	:30	:45	1 hr.	1:15	1:30	1:45	2 hr.	2:15	2:30	2:45	3 hrs	3:15	3:30	3:45	4 hrs
Number of *E. coli*																

Make your graph below: Make sure you include title, labeled axes and appropriate scales.

Questions:

1. Compare and contrast the trends in both graphs.

2. What do you think would be a “non-ideal” condition for a bacteria?

3. How could you use your ideas for #2 to stop the spread of bacterial diseases?

Identifying Patient Zero Activity

Introduction

There has been an outbreak at Disney World causing a resort shut down. Millions of children are devastated as they have been looking forward to their trips for months! This new mysterious illness appears to be **communicable** and the **mode of transmission** appears to be through droplets (sneezing/coughing etc).

In this activity you will demonstrate the transmission of an unknown infectious agent from person to person as well as use deductive reasoning to determine "patient zero," the initial patient in the population to develop the infection and ultimately help reopen Disney World!

Procedure

Part 2: Contagion Activity

1. Epidemiologists have noticed that multiple Disney workers have down with a mysterious infection that causes coughing, fever, and difficult breathing. They believe the illness is **communicable** and the **mode of transmission** appears to be through droplets (sneezing/coughing etc). They have collected the last couple week's work schedule to assess which workers came into contact with each other.

Employee	Week 1	Week 2	Week 3
Cinderella	Soarin'	Castle	Space Mountain
Ariel	Astro Orbiter	Soarin'	Splash Mountain
Olaf	Soarin'	Astro Orbiter	Haunted Mansion
Simba	Splash Mountain	Splash Mountain	Soarin'
Mickey	Haunted Mansion	Castle	Splash Mountain
Anna	Splash Mountain	Haunted Mansion	Castle
Sneezy	Castle	Haunted Mansion	Haunted Mansion
Minnie	Castle	Astro Orbiter	Space Mountain
Belle	Astro Orbiter	Space Mountain	Astro Orbiter
Elsa	Space Mountain	Space Mountain	Soarin'
Beast	Haunted Mansion	Soarin'	Castle
Goofy	Space Mountain	Splash Mountain	Astro Orbiter

2. They also have tested each of the workers.

Employee	Test Result
Cinderella	-
Ariel	-
Olaf	+
Simba	+
Mickey	-
Anna	+
Sneezy	+
Minnie	-
Belle	+
Elsa	+
Beast	+
Goofy	+

3. Devise a way to determine *Patient Zero*. Determine your *Patient Zero options* by showing your work below (include image if you did this by hand):

4. Now that you have narrowed down your patient zero to 1 or a couple individuals, generate a list of 5 questions that you want to ask when you interview the workers. Your questions should be designed to help you identify who patient zero is, as well as learn more about how this new mysterious disease spreads.
    a.
    b.
    c.
    d.
    e.

5. *Why do you think the CDC (Center of Disease Control) attempts to determine patient zero when there is a disease outbreak?*

Name: ______________________________ Date: ____________

Article 6-Pack

Find at least two important pieces of information from the article and explain why they are so central to what the author is trying to say. **Determining Importance**	Write at least two connections between the article and your own experience. **Making Connections**
Select a sentence or passage from the article that made you think. Explain why it caught your attention and how it connected to the rest of the text. **Drawing Inferences**	Create an open-ended question about the article. **Questioning**
Identify some new or unfamiliar words or phrases you encountered. Explain the meaning of the words from the context. **Build Vocabulary**	Create a drawing or graphic that helps you understand or organize the ideas presented in the article. **Visualize**

Why Soap Works

At the molecular level, soap breaks things apart. At the level of society, it helps hold everything together.

By Ferris Jabr
March 13, 2020

It probably began with an accident thousands of years ago. According to one legend, rain washed the fat and ash from frequent animal sacrifices into a nearby river, where they formed a lather with a remarkable ability to clean skin and clothes. Perhaps the inspiration had a vegetal origin in the frothy solutions produced by boiling or mashing certain plants. However it happened, the ancient discovery of soap altered human history. Although our ancestors could not have foreseen it, soap would ultimately become one of our most effective defenses against invisible pathogens.

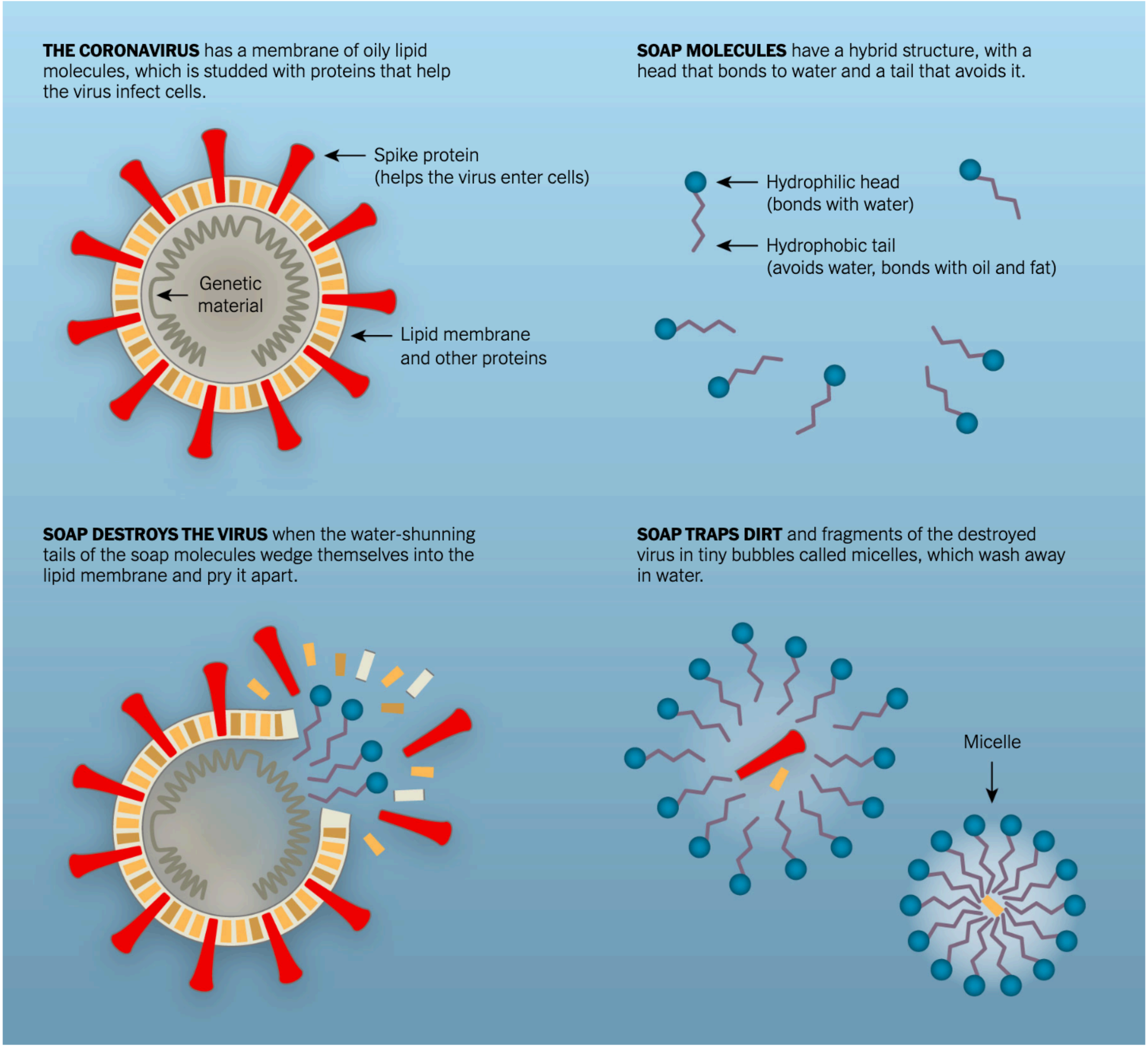
People typically think of soap as gentle and soothing, but from the perspective of microorganisms, it is often extremely destructive. A drop of ordinary soap diluted in water is sufficient to rupture and kill many types of bacteria and viruses, including the new coronavirus that is currently circling the globe. The secret to soap's impressive might is its hybrid structure.

Soap is made of pin-shaped molecules, each of which has a hydrophilic head — it readily bonds with water — and a hydrophobic tail, which shuns water and prefers to link up with oils and fats. These molecules, when suspended in water, alternately float about as solitary units, interact with other molecules in the solution and assemble themselves into little bubbles called micelles, with heads pointing outward and tails tucked inside.

Some bacteria and viruses have lipid membranes that resemble double-layered micelles with two bands of hydrophobic tails sandwiched between two rings of hydrophilic heads. These membranes are studded with important proteins that allow viruses to infect cells and perform vital tasks that keep bacteria alive. Pathogens wrapped in lipid membranes include coronaviruses, H.I.V., the viruses that cause hepatitis B and C, herpes, Ebola, Zika, dengue, and numerous bacteria that attack the intestines and respiratory tract.

When you wash your hands with soap and water, you surround any microorganisms on your skin with soap molecules. The hydrophobic tails of the free-floating soap molecules attempt to evade water; in the process, they wedge themselves into the lipid envelopes of certain microbes and viruses, prying them apart.

"They act like crowbars and destabilize the whole system," said Prof. Pall Thordarson, acting head of chemistry at the University of New South Wales. Essential proteins spill from the ruptured membranes into the surrounding water, killing the bacteria and rendering the viruses useless.



By Jonathan Corum and Ferris Jabr

In tandem, some soap molecules disrupt the chemical bonds that allow bacteria, viruses and grime to stick to surfaces, lifting them off the skin. Micelles can also form around particles of dirt and fragments of viruses and bacteria, suspending them in floating cages. When you rinse your hands, all the microorganisms that have been damaged, trapped and killed by soap molecules are washed away.

On the whole, hand sanitizers are not as reliable as soap. Sanitizers with at least 60 percent ethanol do act similarly, defeating bacteria and viruses by destabilizing their lipid membranes. But they cannot easily remove microorganisms from the skin. There are also viruses that do not depend on lipid membranes to infect cells, as well as bacteria that protect their delicate membranes with sturdy shields of protein and sugar. Examples include bacteria that can cause meningitis, pneumonia, diarrhea and skin infections, as well as the hepatitis A virus, poliovirus, rhinoviruses and adenoviruses (frequent causes of the common cold).

These more resilient microbes are generally less susceptible to the chemical onslaught of ethanol and soap. But vigorous scrubbing with soap and water can still expunge these microbes from the skin, which is partly why hand-washing is more effective than sanitizer. Alcohol-based sanitizer is a good backup when soap and water are not accessible.

In an age of robotic surgery and gene therapy, it is all the more wondrous that a bit of soap in water, an ancient and fundamentally unaltered recipe, remains one of our most valuable medical interventions. Throughout the course of a day, we pick up all sorts of viruses and microorganisms from the objects and people in the environment. When we absentmindedly touch our eyes, nose and mouth — a habit, one study suggests, that recurs as often as every two and a half minutes — we offer potentially dangerous microbes a portal to our internal organs.

As a foundation of everyday hygiene, hand-washing was broadly adopted relatively recently. In the 1840s Dr. Ignaz Semmelweis, a Hungarian physician, discovered that if doctors washed their hands, far fewer women died after childbirth. At the time, microbes were not widely recognized as vectors of disease, and many doctors ridiculed the notion that a lack of personal cleanliness could be responsible for their patients' deaths. Ostracized by his colleagues, Dr. Semmelweis was eventually committed to an asylum, where he was severely beaten by guards and died from infected wounds.

Florence Nightingale, the English nurse and statistician, also promoted hand-washing in the mid-1800s, but it was not until the 1980s that the Centers for Disease Control and Prevention issued the world's first nationally endorsed hand hygiene guidelines.

Washing with soap and water is one of the key public health practices that can significantly slow the rate of a pandemic and limit the number of infections, preventing a disastrous overburdening of hospitals and clinics. But the technique works only if everyone washes their hands frequently and thoroughly: Work up a good lather, scrub your palms and the back of your hands, interlace your fingers, rub your fingertips against your palms, and twist a soapy fist around your thumbs.

Or as the Canadian health officer Bonnie Henry said recently, "Wash your hands like you've been chopping jalapeños and you need to change your contacts." Even people who are relatively young and healthy should regularly wash their hands, especially during a pandemic, because they can spread the disease to those who are more vulnerable.

Soap is more than a personal protectant; when used properly, it becomes part of a communal safety net. At the molecular level, soap works by breaking things apart, but at the level of society, it helps hold everything together. Remember this the next time you have the impulse to bypass the sink: Other people's lives are in your hands.

Infection Prevention and You

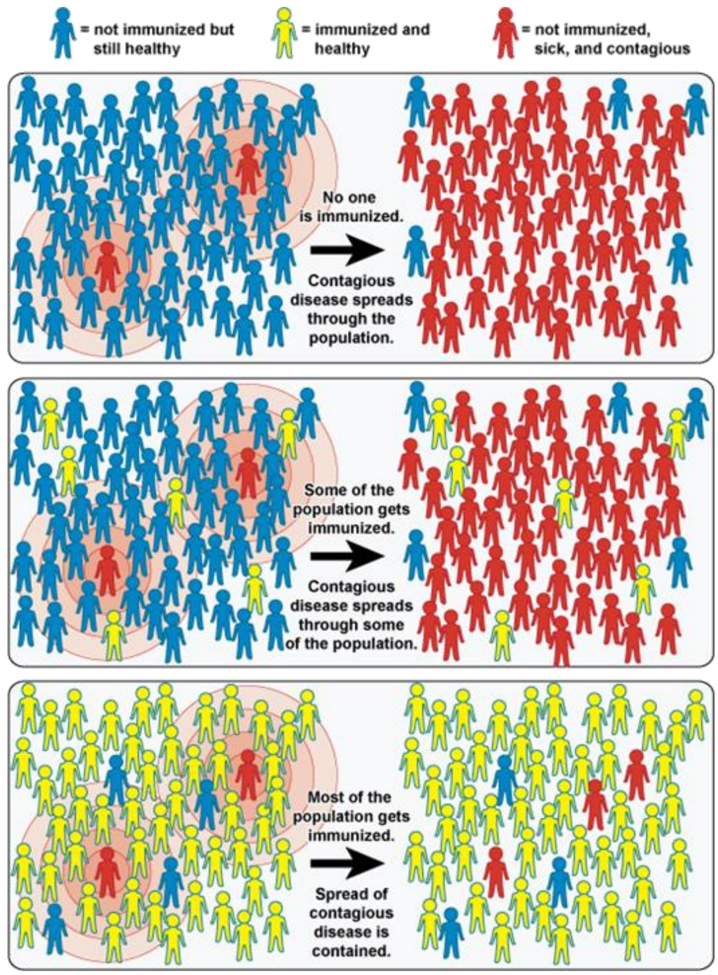
Herd immunity

What is herd immunity?

Herd immunity (or community immunity) occurs when a high percentage of the community is immune to a disease (through vaccination and/or prior illness), making the spread of this disease from person to person unlikely. Even individuals not vaccinated (such as newborns and the immunocompromised) are offered some protection because the disease has little opportunity to spread within the community.

Vaccines prevent many dangerous and deadly diseases. In the United States, smallpox and polio have both been stamped out because of vaccination. However, there are certain groups of people who cannot get vaccinated and are vulnerable to disease: babies, pregnant women, and immunocompromised people, such as those receiving chemotherapy or organ transplants. For example, the earliest a baby can receive their first pertussis or whooping cough vaccine is at two months, and the earliest a child can receive their first measles vaccine is at one year, making them vulnerable to these diseases.

Herd immunity protects the most vulnerable members of our population. If enough people are vaccinated against dangerous diseases, those who are susceptible and cannot get vaccinated are protected because the germ will not be able to “find” those susceptible individuals.



Credit: NIAID

Why are there still outbreaks of vaccine-preventable diseases?

Measles was declared eliminated in 2000. Yet in 2014, there were 668 cases reported. The disease was spread when infected people traveled to the United States. These infected people then exposed unprotected people to the disease. There are a number of reasons why people are unprotected: some protection from vaccines “wanes” or “fades” after a period of time. Some people don’t receive all of the shots that they should to be completely protected. For example you need two measles, mumps, and rubella (MMR) injections to be adequately protected. Some people may only receive one and mistakenly believe they are protected. Some people may object because of religious reasons, and others are fearful of potential side effects or are skeptical about the benefits of vaccines.

When doesn't herd immunity work?

One of the drawbacks of herd immunity is that people who have the same beliefs about vaccinations frequently live in the same neighborhood, go to the same school, or attend the same religious services, so there could be potentially large groups of unvaccinated people close together. Once the percentage of vaccinated individuals in a population drops below the herd immunity threshold, an exposure to a contagious disease could spread very quickly throughout the community.

What can you do?

Talk to your healthcare provider. Ask about your immunization status and if you and your family members are up-to-date on your shots. Staying on schedule with vaccinations not only keeps you safe, but also keeps your loved ones and your community safe.

Additional resources

Vaccination saves lives—APIC consumer alert http://www.apic.org/For-Consumers/Monthly-alerts-for-consumers/Article?id=vaccination-saves-lives
For parents: Vaccines for your children—CDC http://www.cdc.gov/vaccines/parents/index.html
Community immunity—Vaccines.gov http://www.vaccines.gov/basics/protection/
Measles death points to need for herd immunity—MedPage Today http://www.medpagetoday.com/InfectiousDisease/GeneralInfectiousDisease/52473
Community immunity—NIAID http://www.niaid.nih.gov/topics/pages/communityimmunity.aspx
Recommended immunizations for children from birth through 6 years old—CDC http://www.cdc.gov/vaccines/parents/downloads/parent-ver-sch-0-6yrs.pdf

Updated: 8/25/2015

Claims, Evidence, & Reasoning about the Coronavirus

Part 1: Coronavirus & the Flu

Comparison of the Flu and Coronavirus

	Flu	Coronavirus
Illnesses	34 million in US	100,000 worldwide
Deaths	20,000 in US	3,000 Worldwide
Death rate	0.1% in the U.S	2.3% in mainland China
Virus transmission R0	1.3	2.5

basic reproduction number," or R0 (pronounced R-nought). This is an estimate of the average number of people who catch the virus from a single infected person

BIG QUESTION: Is the Coronavirus *just* the flu?

Claim: *Answer the Big Question in a complete sentence.*

Evidence: *What data or text supports your claim?*

Reasoning: *Why does the evidence you chose support your claim? Explain Why!!*

Part 2: The *New* Coronavirus? *Read the article below and then fill out the CER.*

In recent weeks, a new coronavirus disease called COVID-19 has spread from where it was first detected in China to dozens of other countries. Now, several U.S. states have confirmed cases.

"Like any novel infection that's reported, it's certainly a public health concern," says Steven Gordon, MD, Chairman of the Department of Infectious Disease. And there is still much to learn about this new coronavirus disease.

As the situation continues to evolve, infectious disease specialist Frank Esper, MD, encourages people to stay informed and follow common-sense practices like proper hand-washing to reduce the spread of viruses.

Coronavirus is a family of viruses that are common in people and animals. They can cause a variety of illnesses, ranging from the common cold to severe pneumonia.

Coronaviruses spread from person to person through droplets released when people who are infected cough or sneeze. These infected droplets can land on people nearby, who can then become infected if the virus gets into their body through their eyes, nose or mouth.

So you could get COVID-19 from coming in close contact with an infected person who is coughing and sneezing, Dr. Gordon says. Experts also suspect that you can get it from touching a surface that has been contaminated with virus-containing droplets.

Because of this, the Centers for Disease Control and Prevention recommends that people who have or might have COVID-19, or anyone caring for someone who has it, wear face masks to prevent the spread. However, you do not need to wear a face mask if you are not sick.

Symptoms are what one would expect from a typical upper respiratory infection, including cough and fever. Some people also have other symptoms that mimic the flu, such as muscle aches and sore throat, Dr. Esper notes.

"Unfortunately there is no truly identifying feature of this coronavirus that separates it from other viruses out there," he says.

Most people who contract the virus will have mild symptoms and can recover on their own at home. But people over age 50 and people who have heart disease, lung disease or weakened immune systems seem to be more at risk for serious infections that could lead to pneumonia and difficulty breathing, Dr. Esper says.

The only way to confirm that someone has COVID-19 is through a swab test. Efforts are underway to make testing more widely available in U.S. hospitals and healthcare facilities. Because of this, Dr. Esper expects to see an uptick in the number of cases of COVID-19 being diagnosed and reported.

However, the CDC currently considers the immediate health risk to the American public to be low.

The priority: Prevention

While there is no specific treatment for COVID-19, the best way to protect against it and any other upper respiratory infection is to practice good cold and flu season hygiene, Dr. Gordon says.

Actions to prevent the spread of viruses include:

- **Washing your hands thoroughly with soap and water**, or using an alcohol-based hand sanitizer.
- **Properly covering your nose and mouth** with a tissue or your sleeve when you cough and sneeze.
- **Staying home from school or work** if you're not feeling well, whether you think you have something extremely contagious or not. Wear a mask if you are sick.
- **Disinfect surfaces** that are frequently touched, like doorknobs and handles.
- **Avoiding close contact** with people who are sick.
- **Avoid touching your face** to prevent the spread of viruses from your hands.
- **Follow travel guidelines** from the CDC.

If you think you may have been infected with the coronavirus, call your healthcare provider. They will ask about your symptoms and recent travel, and recommend what next steps you should take.

BIG QUESTION: Is the Coronavirus *new*? (Consider ways that it is and is not new, then state your claim!)

Claim: *Answer the Big Question in a complete sentence.*

Evidence: *What data or text supports your claim?*

Reasoning: *Why does the evidence you chose support your claim? Explain Why!!*

Graph of the Week **Name**____________________________________

February _______________, 2020

Analyze the graphs below and write a reflection on what you think the graphs are communicating to you. To guide you with your response, start with some observations.

- What is the topic of the graph?
- What quantities are being compared? (If there are x- and y- axes, what do they represent?)
- What are some observations that you can make based on the graphs?
- What do you foresee happening in this data 10 years from now?

Questions to ask when reading graphs:

- Is there an upward or downward trend?
- Are there any sudden spikes in the graph?
- What is being compared in the graph?
- What prediction can I make for the future?
- What inferences can I make about the graph?

Wuhan coronavirus compared to other major viruses

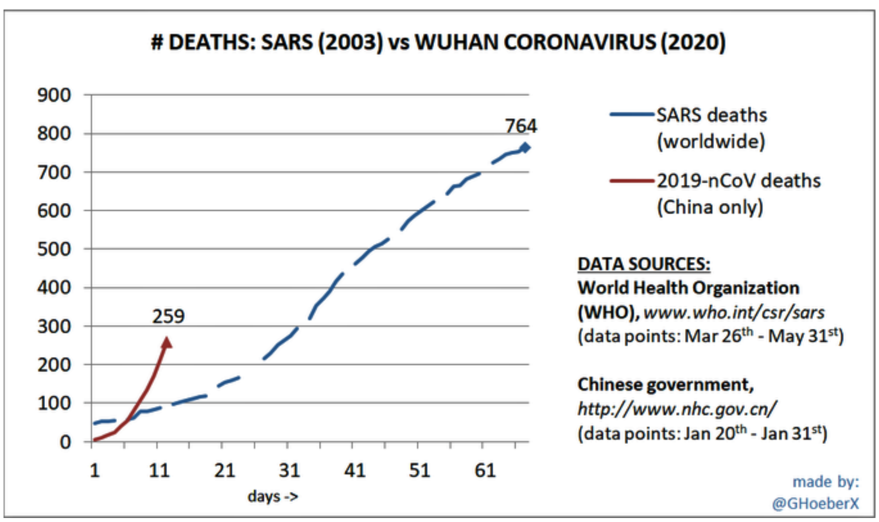
VIRUS	YEAR IDENTIFIED	CASES	DEATHS	FATALITY RATE	NUMBER OF COUNTRIES
Marberg	1967	466	373	80%	11
Ebola*	1976	33,577	13,562	40.40%	9
Hendra	1994	7	4	57%	1
H5N1 Bird Flu	1997	861	455	52.80%	18
Nipah	1998	513	398	77.60%	2
SARS	2002	8,096	774	9.60%	29
H1N1**	2009	>762,630,000	284,500	0.02%	214#
MERS***	2012	2,494	858	34.40%	28
H7N9 Bird Flu	2013	1,568	616	39.30%	3
2019-nCoV*	2020	11,871	259	2.2%	24

*As of January 31, 2020 **Between 2009 and 2010 ***As of November 2019

#Countries and overseas territories or communities

Sources: CDC; UN; WHO; New England Journal of Medicine; Malaysian Journal of Pathology; CGTN; Johns Hopkins University; The Lancet; Reuters, CIDRAP

BUSINESS INSIDER



Graph of the Week 3PA **Name**________________________________

Date______________________

Analyze the graphs below and write a reflection on what you think the graphs are communicating to you. To guide you with your response, start with some observations.

- What is the topic of the graph?
- What quantities are being compared? If there are x- and y- axes, what do they represent?
- What are some observations you can make based on the graph?

<u>Questions to ask when reading graphs:</u>

- Is there an upward or downward trend?
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- What prediction can I make for the future?
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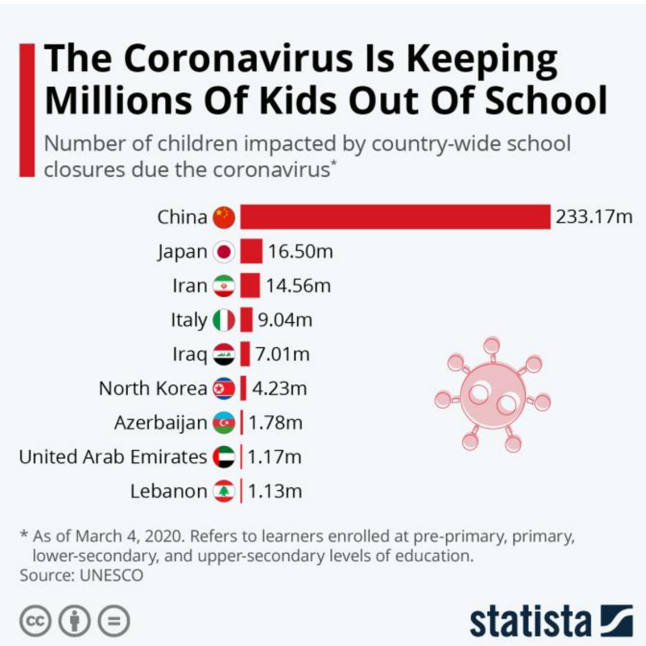

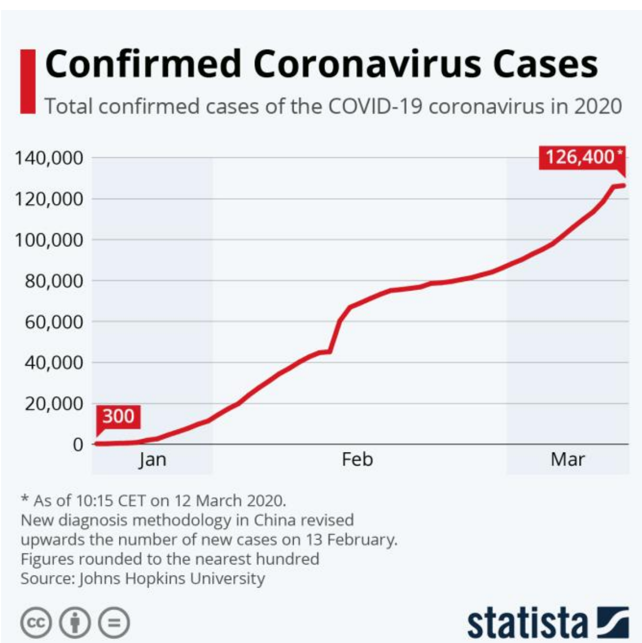

A. Analysis

B. What can you foresee happening in the near future?

C. Based on your response in part B, what solution(s) can you investigate or what other information/resources can you gather to strengthen your argument?

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Make an illustration or represent the data in your own way in the space below: