Elementary

Lesson 5

How Can We Apply
What We Have Learned?

Hilleman & Vaccines

OVERVIEW & PURPOSE

Students will be introduced to the concept of Growth Mindset and how it plays a role in thinking like a scientist. They will have a brief introduction to Covid-19, with the opportunity to analyze some graphs from the pandemic. Hilleman also invented animal vaccines, including the first vaccine to cure cancer...in poultry. Most ranchers routinely vaccinate their cattle, what if they didn't? Students will relate why vaccinations are so important in cattle AND humans. Could anyone become a famous scientist? Students can reflect on where Maurice Hilleman came from, what he accomplished, and then visualize themselves in this important career.

MONTANA EDUCATION STANDARDS

C.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.

CCSS.MATH.CONTENT.3.NF.A.1Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.

CCSS.MATH.CONTENT.3.NBT.A.3 Multiply one-digit whole numbers by multiples of 10 in the range 10-90 (e.g., 9×80, 5×60) using strategies based on place value and properties of operations.

CCSS.ELA.RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

CCSS.ELA-LITERACY.RL.3.3 Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events

OBJECTIVES

Students will

1. Identify the attributes of a Growth Mindset.
2. Activate prior knowledge about viruses, and specifically about the coronavirus.
3. Use critical thinking skills to identify and connect facts about the coronavirus.
4. Evaluate what will happen if there are unvaccinated cattle in their herd.
5. Synthesize the information learned in the Hilleman unit to create a autobiography of themselves as a famous scientist.

LESSON INSTRUCTIONS
Lesson 5: How Can We Apply What We Have Learned?

MATERIALS

- Copies of Graph of the Week - upper elementary students (pages 132-133)
- Copies of "BRSV cattle" worksheets (bar graph (optional) (pages 136-138)
- "A Famous Scientist" worksheet (page 139)

VERIFICATION

Ask these questions at the end of the lesson to check for student understanding:

1. What are some qualities that help you become successful?

2. Do only people need vaccines? What might happen if ranchers don't use vaccines?

3. Can you see yourself as a scientist?

ACTIVITY INSTRUCTIONS
Lesson 5: How Can We Apply What We Have Learned?

ENGAGEMENT

Use the following dialogue example to introduce the lesson through a class discussion:
Tell students: Close your eyes. Visualize a scientist (maybe you?!) in a white coat in a laboratory.
Ask: How did they get there? Where did they grow up? What was their childhood like?

Review Maurice Hilleman's life and accomplishments. Use "Who Was Maurice Hilleman" information from Lesson 3.

Talk about Growth Mindset. Show Episode 1-5 from Class Dojo on Growth Mindset. (There are several excellent Growth Mindset videos available for deeper exploration). This is available on YouTube (2:35): https://youtu.be/2zrtHt3bBmQ

(If you are unfamiliar with Growth Mindset, there is some background information at this link: https://www.teachthought.com/pedagogy/5-strategies-creating-genius-mindset-students/)

EXPLORATION

CORONAVIRUS:

We need people interested in science more than ever! Can you think of what is going on in the world today that makes it important for us to understand about diseases, vaccines, and people like Dr. Hilleman? (Students will probably bring up Covid-19).

Watch the video Coronavirus: How to Teach Kids About COVID-19 | BrainPOP on YouTube (4:32): https://youtu.be/GoXxmzKdick

Upper elementary students might also want to look at these two Graph of the Week activities; (pages 132-133)

The February 2020 graph compares the Wuhan coronavirus to other major viruses. (Be aware that this was before the United States had many cases). Students analyze the data and reflect on what they think the graph is communicating. The January 2021 graphs are bar graphs representing the willingness of Americans to be vaccinated against Covid-19. (Be aware that this data was collected before the Covid-19 vaccine was available.) Students are to analyze the graphs and reflect on what they think the graph is communicating. This can be done as a group or individually.

Note: If you are unable to access YouTube in your classroom, you can embed the videos in a slideshow prior to class or visit https://vaccinemakers.org/resources/videos-animations *for other resources*

ACTIVITY INSTRUCTIONS
Lesson 5: How Can We Apply What We Have Learned?

ANIMAL VACCINES:
Dr. Hilleman used eggs to develop most of his vaccines. He had been raised on a farm and had cared for chickens most of his childhood. Dr. Hilleman created the first licensed vaccine against any viral cancer. He developed a vaccine to prevent Marek's disease, a lymphoma cancer of chickens caused by a member of the herpes virus family. Preventing the disease helped revolutionize the economics of the poultry industry. Chickens were no longer a rare treat, but became common meals.

Vaccines are very important in other agricultural fields. Cattle ranchers regularly immunize their calves. The "Math Lesson for Vaccinated and Unvaccinated Cattle" can be adapted for 3rd grade on up. Students raised in rural areas, especially where cattle ranching is a main source of income will relate to why vaccinations are so important.

BRSV IN CATTLE
The human virus RSV can cause severe problems for children under 10 months of age. Cattle can be infected with a similar virus called BRSV. There is a vaccination that many ranchers give to their cattle to prevent BRSV. What would happen if they didn't? (Activity on pages 134-138)

ELABORATION
GROWTH MINDSET
If you are interested in learning more about Hilleman and his mindset, this article speaks to some of Maurice Hilleman's personality traits that helped make him so successful: https://mag.uchicago.edu/science-medicine/man-who-developed-40-vaccines#

CORONAVIRUS:
Bringing current events into the classroom is always an engaging experience for students, but it can also cause teacher anxiety as you gauge the best practice to bring this information to your students without creating stress for them or upsetting parents. An important lesson to teach to your students is that many of the viruses can be killed by using soap and water. Practicing good hygiene can help reduce the risk of infection and better your chances of fighting it off, should you become infected.

EVALUATION
Have students bring together everything they have learned from the Maurice Hilleman unit. Complete the "Famous Scientist" worksheet. Tell students: Pretend you are a famous scientist. What contribution will you make to our effort to conquer disease? Will you discover a cure? Will you develop a vaccine?

Students will then draw a self portrait as a famous scientist. (page 139)

Graph of the Week
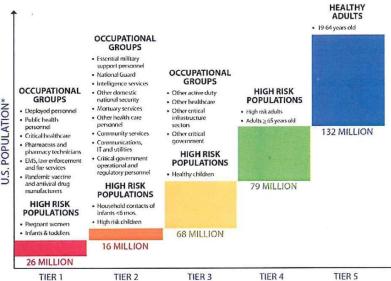
January _____, 2021

Name_____

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 are the topics of the graphs?
- 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 the next 10 years?

U.S. POPULATION*

HEALTHY ADULTS
- 19-64 years old

132 MILLION

TIER 5

OCCUPATIONAL GROUPS
- Essential military support personnel
- National Guard
- Intelligence services
- Other domestic national security
- Mortuary services
- Other health care personnel
- Community services
- Communications, IT and utilities
- Critical government operational and regulatory personnel

HIGH RISK POPULATIONS
- Household contacts of infants <6 mos.
- High risk children

68 MILLION

TIER 3

OCCUPATIONAL GROUPS
- Other active duty
- Other healthcare
- Other critical infrastructure sectors
- Other critical government

HIGH RISK POPULATIONS
- Healthy children

79 MILLION

TIER 4

HIGH RISK POPULATIONS
- High risk adults
- Adults ≥ 65 years old

OCCUPATIONAL GROUPS
- Deployed personnel
- Public health personnel
- Critical healthcare
- Pharmacists and pharmacy technicians
- EMS, law enforcement and fire services
- Pandemic vaccine and antiviral drug manufacturers

HIGH RISK POPULATIONS
- Pregnant women
- Infants & toddlers

26 MILLION

TIER 1

16 MILLION

TIER 2

A Third Of Americans Unwilling To Get Covid-19 Vaccine

Share of U.S. adults willing to get an FDA approved, no cost vaccine for Covid-19

■ Yes ■ No

	Yes	No
All Americans	65%	35%
Democrats	81%	19%
Independents	59%	41%
Republicans	47%	53%
18-29 years old	76%	24%
30-49 years old	64%	36%
50-64 years old	59%	41%
65+	70%	30%

n=7,632 (July 20-August 02, 2020)
Source: Gallup

statista ⚡

Graph of the Week

February _____, 2020

Name_____

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?

Wuhan coronavirus compared to other major viruses
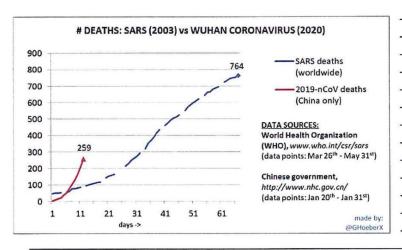
VIRUS	YEAR IDENTIFIED	CASES	DEATHS	FATALITY RATE	NUMBER OF COUNTRIES
Marberg	1967	466	373	80%	11
Ebola*	1976	33,577	13,562	40.40%	9
Hendra	1994	7	4	57%	1
H5N1 Bird Flu	1997	861	455	52.80%	18
Nipah	1998	513	398	77.60%	2
SARS	2002	8,096	774	9.60%	29
H1N1**	2009	>762,630,000	284,500	0.02%	214#
MERS***	2012	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

DEATHS: SARS (2003) vs WUHAN CORONAVIRUS (2020)

SARS deaths (worldwide)

2019-nCoV deaths (China only)

DATA SOURCES:
World Health Organization (WHO), www.who.int/csr/sars (data points: Mar 26th - May 31st)

Chinese government, http://www.nhc.gov.cn/ (data points: Jan 20th - Jan 31st)

made by: @GHoeberX

BOVINE RESPIRATORY SYNCYTIAL VIRUS (BRSV) MATH LESSON

EXPLANATION

BRSV in Cattle Activity: Background information on Hilleman and his development of animal vaccines and his relationship with the poultry industry:

https://www.nytimes.com/2005/04/12/us/maurice-hilleman-master-in-creating-vaccines-dies-at-85.html

Watch the video of this story (3:05). https://youtu.be/mQghyCeocP4

One of Dr. Hilleman's goals was to develop the first licensed vaccine against any viral cancer. He achieved it in the early 1970's, developing a vaccine to prevent Marek's disease, a lymphoma cancer of chickens caused by a member of the herpes virus family. Preventing the disease helped revolutionize the economics of the poultry industry. https://www.historyofvaccines.org/content/flock-chickens-changes-everything

Virologist Harry Rubin developed a method to detect a virus that caused leukemia in chickens. The test proved invaluable to researchers concerned about developing vaccines, including measles vaccine, in chick embryos that might contain a virus known to cause cancer in chickens. (It was later determined that the virus did not cause cancer in humans, but the researchers didn't know that at the time.) Maurice Hilleman, PhD, who was trying to use measles virus obtained from Enders to develop a vaccine for Merck, went in search of chickens known to be free of the leukemia virus for use in developing a measles vaccine. He eventually traveled to Kimber Farms in California, where the director of poultry research, W.F. Lamoreux, initially refused to sell the farm's flock of specially bred leukemia-free chickens.

Hilleman prepared to leave empty-handed, only to find that Lamoreux was happy to sell him the chickens when he realized that Hilleman, like Lamoreux, was a native of Montana. Hilleman bought the farm's entire flock of leukemia-free chickens for $1 each. The descendants of that original flock are still being used to create vaccines at Merck.

(Lamoreux recognized Hilleman's Montana accent!)

Note: If you are unable to access YouTube in your classroom, you can embed the videos in a slideshow prior to class or visit https://vaccinemakers.org/resources/videos-animations for other resources

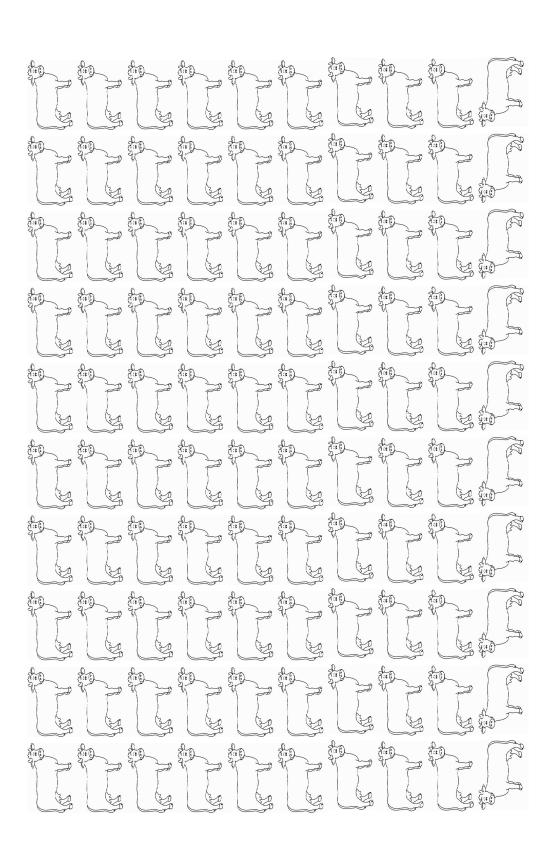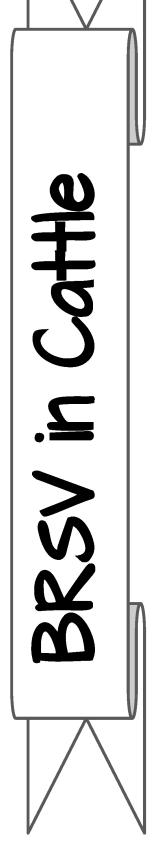## BOVINE RESPIRATORY SYNCYTIAL VIRUS (BRSV) MATH LESSON

INSTRUCTIONS

Explain to students that Bovine Respiratory Syncytial Virus (BRSV) also has a human counterpart. The human RSV (much like there are many animal coronaviruses) causes severe problems for children under 10 months of age. However, there *is* a vaccine for cattle.

1. Have students work in groups of two and tell them each group has 90 heifers that are not vaccinated. They have just purchased 10 heifers at the sales barn and introduced them to the herd.

2. Teacher can assign one of the following fractions to each group: 1/100, 1/50, 1/25, 1/20, 1/10, 1/5, 1/2.

3. Tell each group that one of the new heifers had BRSV. Now, whatever fraction of the herd they had chosen, has died. Check their math. Let the students present their fraction and how many heifers died. You can choose to project the graph for the group.

4. Have each group brainstorm. Since this is a respiratory virus, in which ways can it spread and spread easily?

5. Next, have them make up a scenario where they describe how their new heifers were introduced and housed to cause the kind of disease spread they witnessed. Let them present their scenarios to the class.

6. Finally, tell them their herd is vaccinated, but that the vaccines had different efficacies. Talk about what that means. Now, there is one new heifer that has BRSV. Students can predict how many heifers were lost.

7. Calculate monetary losses.

BRSV in Cattle

BRSV in Cattle

The human virus RSV can cause severe problems for children under 10 months of age. Cattle can be infected with a similar virus called BRSV. There is a vaccination that many ranchers give to their cattle to prevent BRSV. What would happen if they didn't?

1. You own 90 heifers. They are NOT vaccinated for BRSV.
2. You bought 10 more heifers. How many do you have now?

   90+10=_____ heifers

3. Oh no! One of your new heifers has BRSV. You will receive a piece of paper from your teacher telling you the fraction of your cows that have died! Use the array of heifers on the other side of the paper to make groups to represent your fraction.
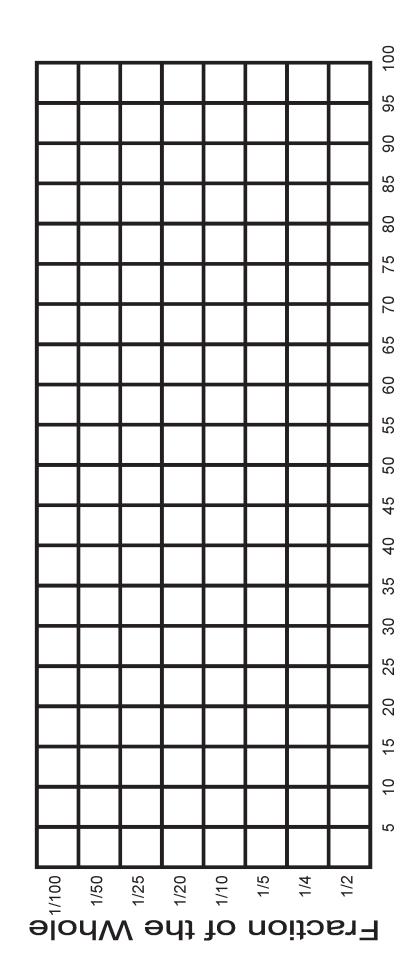
   _____ of 100=_____ dead heifers

4. Complete the bar graph on the board.

5. Since BRSV is a respiratory virus, how can it spread? _____

6. How could you prevent your heifers from catching BRSV from a contagious heifer?

   _____

7. If heifers were worth $500 apiece, how much money would you lose

   _____ dead heifers x $500 = $_____

Number Represented by a Fraction of a Group of 100
(horizontal bar graph)

Fraction of the Whole

| 1/100 | 1/50 | 1/25 | 1/20 | 1/10 | 1/5 | 1/4 | 1/2 |

Number out of 100

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

A Famous Scientist

Pretend you are a famous scientist.
What contribution will you make to our effort to conquer disease?
Will you discover a cure? Will you develop a vaccine?
Draw a picture of yourself and write your name underneath.