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.