



INTRODUCTION

In this activity, you will analyze sequences of Ebola viruses isolated from patients in Sierra Leone during the Ebola outbreak of 2013–2016 to track the virus spread. Do you have what it takes to be a disease detective?

BACKGROUND INFORMATION

To prepare for this activity, you will first watch the 8-minute **video** *Think Like a Scientist: Natural Selection in an Outbreak* (<https://www.youtube.com/watch?v=Tq2GhPZvdkU>), featuring computational geneticist Pardis Sabeti and epidemiologist Lina Moses. Then, answer the following question:

1. Thinking about what you saw in the video and what Drs. Sabeti and Moses discussed, identify three factors that contributed to the number of individuals infected in the Ebola outbreak.

Read the background reading provided and answer the questions below.

2. Define the term “mutation.”
3. In your own words, why is it important to examine the sequence of the Ebola virus genome during an outbreak?

PROCEDURE

- Obtain a set of DNA sequences that includes the reference sample from Guinea and 15 Ebola DNA sequences from samples of patients in Sierra Leone.
- The shaded nucleotides in sequences 1–15 represent mutations that occurred in these different viruses compared to the reference sequence. (Remember that the reference sequence is from a virus that was present at the start of the outbreak.) Move the Ebola sequences 1–15 around to identify patterns in the mutations.
- Group sequences according to any patterns you see.
- Every sequence should be in a group, even if they are not identical. Use your groupings to answer the analysis questions.



Part 2

Broad scientists created the visual below. They grouped the sequences based on sets of shared identical mutations, or core mutations. Take your virus sequences and group them as illustrated in Figure 3.

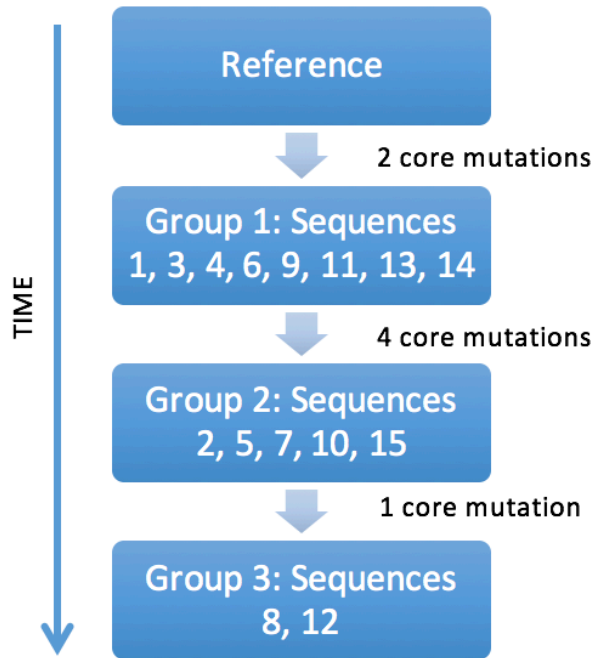


Figure 1. Groups of Ebola virus sequences. The sequences in each group have a set of shared core mutations. Within each group, some viruses may have additional mutations that are not shared by other viruses in the group.

1. Compare the groupings in Figure 1 to your groupings. What are the similarities and differences?
2. Using the grouping in Figure 1, list the core mutations that occurred between one group and the other. Core mutations are mutations shared by every virus in the group. Describe the mutation by indicating the nucleotide number in the sequence.
 - a. Differences between the reference sample and the Group 1 sequences:
 - b. Differences between groups 1 and 2:
 - c. Differences between groups 2 and 3:



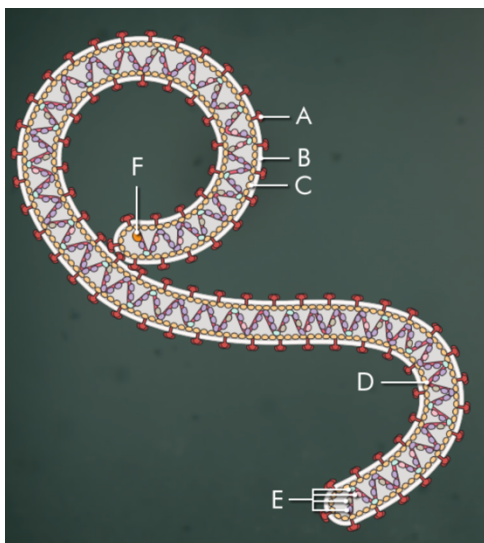
EXTENSION ACTIVITY

For more information on the Ebola virus, visit the Click and Learn interactive “Virus Explorer”

(<https://www.hhmi.org/biointeractive/virus-explorer>), click on Ebola, and complete the chart below. The host category has been completed for you as an example.

Categories of Exploration	Circle the correct choice(s) below	Notes
Host	Humans, Mammals, Birds, Reptiles, Plants, and Bacteria	Ebola can infect humans, other primates, and bats
Envelope	Enveloped or Naked	
Structure	Spherical, Helical, Isocohedral, or Conical	
Genome Type	ds DNA, ss + RNA, ss – RNA, Segmented, Linear, or Circular	
Transmission	Human-to-human, Zoonotic, Arthropod, Vector, Plant-to-plant, Bacterium-to-bacterium	
Vaccine	Vaccine Available or No Vaccine Available	

In the interactive, click on the cross section and write down the labels for Figure 2 below.



- A.
- B.
- C.
- D.
- E.
- F.

Figure 2. Cross section of Ebola virus.