**Unit 2: Lesson 2 – Influenza and HIV**

**Vocabulary: Influenza and HIV**
Using resources suggested by your teacher, define the terms below.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>AIDS</td>
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<tr>
<td>Antigenic drift</td>
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<tr>
<td>Antigenic shift</td>
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<td>Budding</td>
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<td>Epidemic</td>
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<td>Genotypes</td>
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<td>Hemagglutinin</td>
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<td>HIV</td>
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<td>Messenger RNA (mRNA)</td>
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<tr>
<td>Neuraminidase</td>
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<td>Pandemic</td>
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<td>Point mutation</td>
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Refer to the online glossary and compare your definitions with those in the glossary. Make any necessary corrections to your definitions above.

Activity 1: Influenza – Antigenic Drift Materials

- 4 highlighter pens colored red, green, blue and yellow.
- Tape or glue
- Scissors
- Paper clips
- 2 sheets copier paper
- Timer or stopwatch
- 4 envelopes for each group

Instructions

- Work in pairs or small groups, ideally groups of four. If you have an odd number in your group, one or more of you will need to undertake more than one task.
- Ensure you have enough workspace to pass activity materials around to group members.
- Assign the following names to members of your group: o Agent Infection o Transcriber One o Translator o Transcriber Two

Set Up

1. Cut the copier paper into strips 8.5 inches long and half an inch wide, to make at least 40 strips.
2. Use a spreadsheet to generate random numbers from 1 to 4.
3. From the spreadsheet, write down a sequence of 30 random numbers from 1 to 4.
4. Assign each number a letter so that 1 = A, 2 = U, 3 = C and 4 = G.
5. Write these 30 letters on one of the paper strips, and highlight the set of letters with the yellow highlighter.
6. Label the four envelopes: “Cell”, “Polymerase”, “Ribosome” and “Protein”
Procedure

1. Agent Infection numbers the paper strip “1” and puts it into the “Cell” envelope.
2. Agent Infection passes the envelope to Transcriber One.
3. Transcriber One follows RNA base pairing rules to transcribe each letter on to a new paper strip and is allowed exactly 30 seconds to transcribe all 30 letters. (For example, the sequence AUCGCGUAA will have the complementary sequence UAGCCGAAU.) If the transcriber does not finish within 30 seconds he or she must finish as quickly as possible.
4. Transcriber One colors this strip red and puts the strip into the “Ribosome” envelope, passing it to the Translator.
5. The Translator takes the red strip from the “Ribosome” envelope. He or she uses the RNA codon table (genetic code) to determine the sequence of amino acids from the 10 codons (30 bases) in the bases on the red strip, writing the amino acid sequence on a strip of paper. He or she then colors this strip green and places it in the “Protein” envelope.
6. Meanwhile, Transcriber One repeats step 3, again being allowed 30 seconds to transcribe all 30 letters from the yellow strip. This time, the transcriber colors the strip blue and places it in the “Polymerase” envelope, passing it to Transcriber Two.
7. Transcriber Two takes the blue strip from the “Polymerase” envelope. He or she uses RNA base pairing rules to transcribe each letter on to a new paper strip, also being allowed exactly 30 seconds to transcribe all 30 letters. This paper strip is colored yellow and numbered “2” and then passed to Agent Infection.
8. Agent Infection places the #2 yellow strip into the “Cell” envelope, again passing it to Transcriber One so the cycle can continue as shown in Figure 1 of this lesson.
9. After 10 cycles, stop and count the number of strips in the “Protein” envelope. There should be 10 strips.
10. As a group compare each of the 10 “Protein” strips with the each other, noting any differences between the amino sequences on the strips.
11. Review Figures 1 and 2 (illustrating antigenic drift and shift) in the worksheet supplement.
12. Complete the activity questions either as a group or individually, as indicated by your teacher.
Figure 1. Cycle of infection, transcription and translation in the Antigenic Drift activity. (Figure shows only three codons.)
Activity 1 Questions: Antigenic Drift

Prior to answering these questions, refer to Figures 1 and 2 in the worksheet supplement.

1. What does the yellow strip of paper represent?

2. What does step 1 of this activity represent? Include the term “virion” in your answer.

3. When you compared the 10 green paper strips in the “Protein” envelope at the end of the activity, did the 10 strips have identical amino acid sequences? Quantify and explain your observations.

4. Explain how this activity models antigenic variation.

5. Do your observations during the activity model antigenic drift? Explain your answer.

6. Describe how the activity could be modified to model antigenic shift, including the basis for your modification. (If time allows, complete your modified activity.)

Activity 2: Causes and Consequences of an Influenza Pandemic

Watch the NOVA video segment about the influenza pandemic of 1918, known as the Spanish Flu: http://www.pbs.org/wgbh/nova/body/1918-flu.html.

As you watch the video clip, answer the following questions:

1. What example was used to illustrate that the 1918 influenza was the deadliest flu of all time?
2. What kind of virus caused the 1918 pandemic?

3. What made the 1918 flu virus so deadly?

4. How did scientists recover the 1918 flu virus for direct study?

5. What cells do flu viruses infect?

6. What protein is the “key” to accessing and infecting a cell?

7. What protein enables the flu virus get out of a cell?

8. What is the significance of the letters and numbers in flu strains identified by the letters H and N?

9. How did researchers change the seasonal flu virus to make it become more lethal?

10. What is the difference between a pandemic and an epidemic?
Activity 3: The Life Cycle of the Human Immunodeficiency Virus

If time allows, visit the NIH AIDS info page to learn more about the HIV life cycle: [https://aidsinfo.nih.gov/education-materials/fact-sheets/19/73/the-hiv-life-cycle](https://aidsinfo.nih.gov/education-materials/fact-sheets/19/73/the-hiv-life-cycle)

Then refer to Figure 3 in the worksheet supplement to answer the following questions:

1. In Step 1, virus attaches (binds) to the host cell surface. What is the significance of the CD4 receptor?

2. In Step 2 the virus envelope fuses with the host cell membrane. How could a fusion inhibitor drug prevent HIV infection of the host cell?

3. What is the role of the reverse transcriptase enzyme molecule?

4. Which molecule enables HIV to integrate its DNA into the host cell’s DNA?

5. In Step 5, what is the role of the host cell in allowing replication of HIV DNA?

6. Step 6 shows a process known as “assembly.” In what way is assembly similar to the process of fusion in Step 2?

7. When the HIV particle first leaves the cell, it is inactive and cannot reinfect another host cell. What final step allows the HIV particle to become infectious?