

Unit 2: Lesson 2 – Case Studies: Influenza and HIV

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:
 - Agent Infection
 - Transcriber One
 - Translator
 - 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

Refer to Figure 1 at the end of this activity packet to assist with the following procedural steps 1-7.

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 AUCGGCUAA will have the complementary sequence UAGCCGAUU.) 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.
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 others, noting any differences between the amino sequences on the strips.
11. Review Figures 2 and 3 (illustrating antigenic drift and shift) at the end of this activity packet.

12. Complete the activity questions either as a group or individually, as indicated by your teacher.

Activity 1 Questions

Refer to Figures 1 to 3 in this activity packet to assist with answering the questions.

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.)

Figure 1. Antigenic Drift Activity Reference Diagram

Model of cycle of infection, transcription and translation used in this activity. (Figure shows only three codons.)

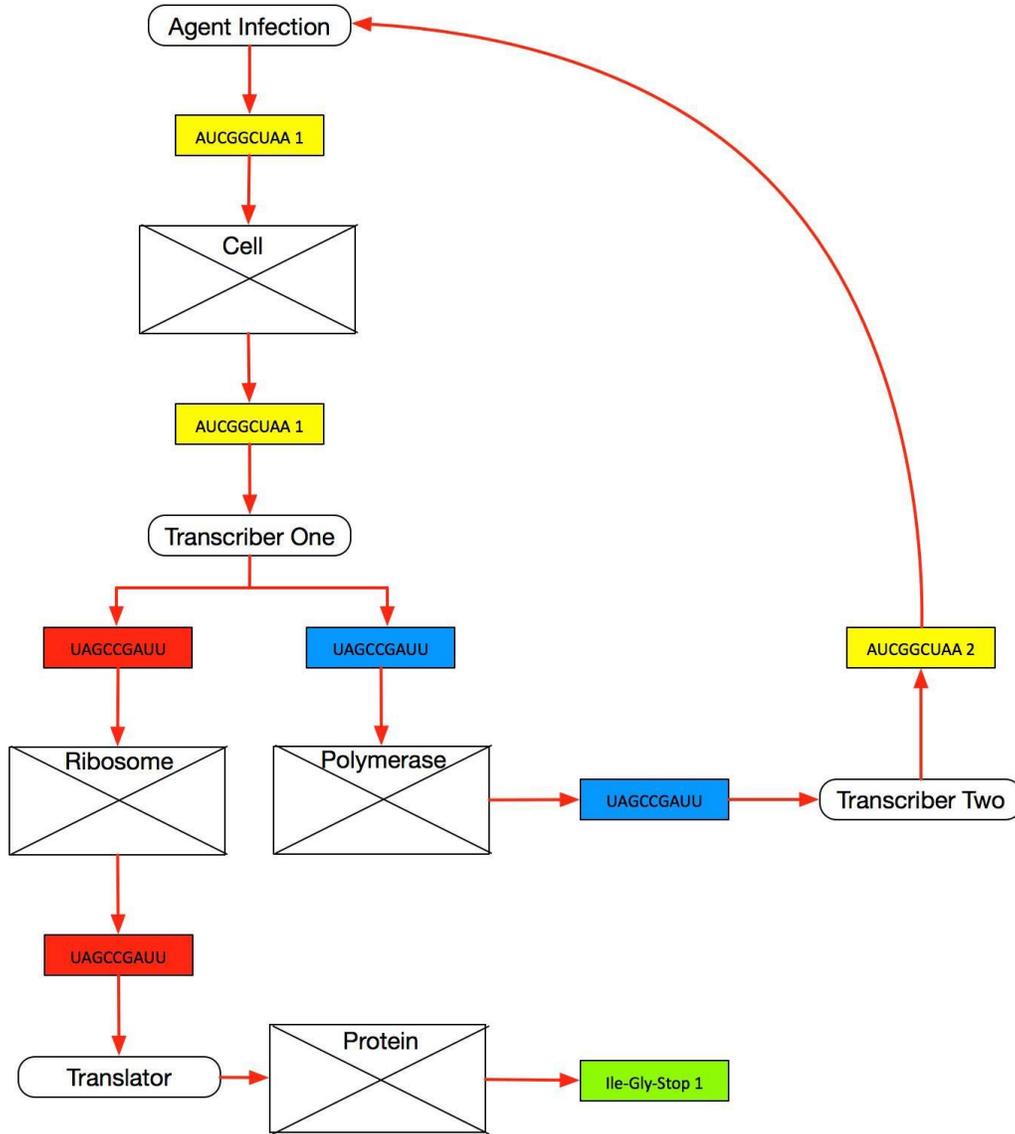


Figure 2. Antigenic Drift (Image source: NIAID)

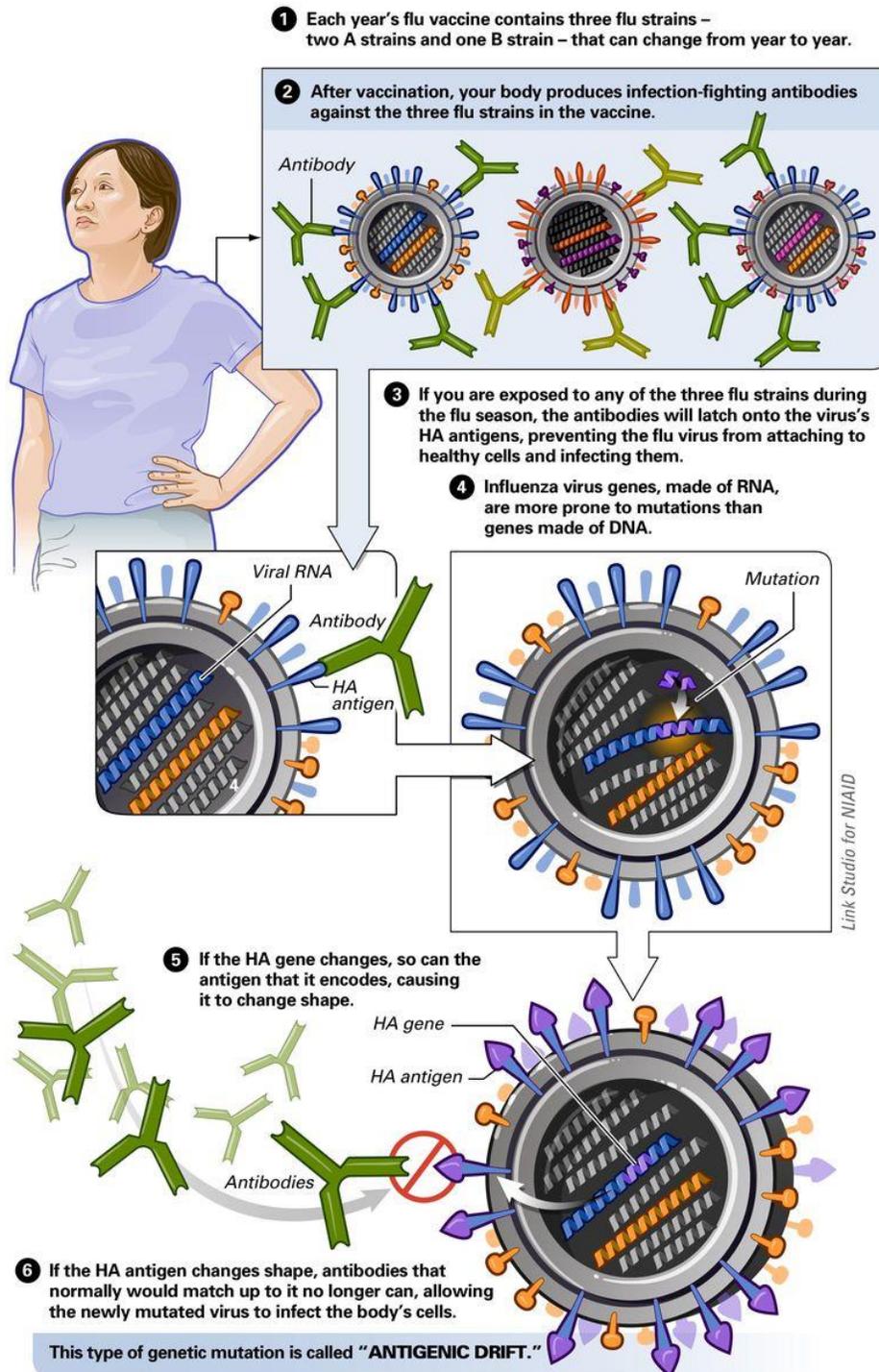


Figure 3. Antigenic Shift (Image source: NIAID)

