Activity 3: The Life Cycle of the Human Immunodeficiency Virus

Refer to Figure 1 on page 2 of this activity sheet and use resources suggested by your teacher to answer the 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?
Figure 1. The HIV Life Cycle (Image source: NIH)

The HIV Life Cycle

HIV medicines in six drug classes stop HIV at different stages in the HIV life cycle.

1. **Binding (also called Attachment):** HIV binds (attaches itself) to receptors on the surface of a CD4 cell. (CCRS Antagonist)

2. **Fusion:** The HIV envelope and the CD4 cell membrane fuse (join together), which allows HIV to enter the CD4 cell. (Fusion inhibitors)

3. **Reverse Transcription:** Inside the CD4 cell, HIV releases and uses reverse transcriptase (an HIV enzyme) to convert its genetic material—HIV RNA—into HIV DNA. The conversion of HIV RNA to HIV DNA allows HIV to enter the CD4 cell nucleus and combine with the cell’s genetic material—cell DNA.
   - Non-nucleoside reverse transcriptase inhibitors (NNRTIs)
   - Nucleoside reverse transcriptase inhibitors (NRTIs)

4. **Integration:** Inside the CD4 cell nucleus, HIV releases integrase (an HIV enzyme). HIV uses integrase to insert (integrate) its viral DNA into the DNA of the CD4 cell. (Integrase inhibitors)

5. **Replication:** Once integrated into the CD4 cell DNA, HIV begins to use the machinery of the CD4 cell to make long chains of HIV proteins. The protein chains are the building blocks for more HIV.

6. **Assembly:** New HIV proteins and HIV RNA move to the surface of the cell and assemble into immature (noninfectious) HIV.

7. **Budding:** Newly formed immature (noninfectious) HIV pushes itself out of the host CD4 cell. The new HIV requires protease (an HIV enzyme). Protease acts to break up the long protein chains that form the immature virus. The smaller HIV proteins combine to form mature (infectious) HIV.
   - Protease inhibitors (PIs)