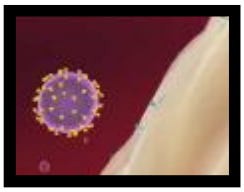

ANSWER KEY

How Do Antiretroviral Drugs Work?

HIV is a retrovirus. Retroviruses are a group of viruses that cause AIDS and some types of cancer. They carry their genetic information in the form of RNA and then copy it into DNA to be integrated into the cell's nucleus. Unfortunately, there is no cure for HIV at this time, only ways to control it and attempts to keep it from progressing into AIDS. In this activity, you will address the question below through a series of tasks.

HIV/AIDS is not curable at this point in time. Why is this the case based on current availability of drugs?

Part of your assignment will be to discover – the same way scientists do – how to treat and eventually cure HIV/AIDS. You will present your findings to the class through diagrams and descriptions and then have a chance to compare your deductions to those of actual scientists today.

PBS Video: HIV Immunity Questions

Watch the PBS video, *Surviving AIDS: HIV Immunity,* and respond to the questions below.

1. What is the benefit of studying the extreme situations in a viral infection?

By studying the extreme situations we can learn about how these cells differ from normal cells and can find ways to alter normal cells to eventually cure the disease.

2. How does HIV infect a cell?

HIV requires two receptors on the surface of the cell in order to bind. These are the CD4 and the CCR5 receptors. Once HIV binds to these receptors, it fuses with the cell's membrane and can enter the cell through endocytosis.

3. What are some possible ways people can be resistant to HIV?

People can lack one of the CCR5 receptors on the surface of the cell. Scientists also speculate there could be a genetic immunity.

4. What potential benefit does this knowledge of how people can become immune to HIV offer?

The hope is that this knowledge can help in developing a vaccine against AIDS.

Mystery of the Black Death: Clues and Evidence Questions

Read the *Clues and Evidence* article and respond to the following questions. (http://www.pbs.org/wnet/secrets/case_plague/clues.html)

1. How is studying a virus different from studying a bacteria?

Viruses require a host cell to survive and reproduce, therefore there must be some sort of host organism for them to invade and grow. Bacteria are self-contained and reproduce on their own as long as they have sufficient media to grow and survive.

2. What evidence is there that a relationship exists between individuals with ancestors who survived the plague and those resistant to HIV?

Both seem to have mutated CCR5 receptors (delta 32) on the surfaces of their cells, which prevent the invading organisms from being able to bind and invade.

3. What is a type of drug mentioned in the article that is used to inhibit HIV from affecting a cell? How does it work?

Fusion-Inhibitor drugs inhibit HIV from entering the cell by preventing the virus from binding to the cell.

Studying the Life Cycle of HIV

Using only the attached HIV lifecycle, determine at least three more stages in the lifecycle, in addition to the one identified in the article, where a drug can be developed to prevent HIV from spreading in the body. Draw and explain your group's response below by using a scientific approach – develop a hypothesis and discuss how you could test your hypothesis about how this "drug" would prevent the spread of HIV in an individual's body. In other words, what would you look for to indicate that the drug was effective in blocking the HIV lifecycle? You will share your findings with the class, so be sure to explain in a clear and well-supported manner.

Students should be able to identify drugs that stop the progression of HIV by inhibiting the effectiveness of HIV enzymes.

These stages are:

1. Stopping reverse transcriptase from being able to transcribe a DNA molecule from the virus' RNA
2. Stopping integrase from being able to integrate the transcribed DNA into the cell's own DNA
3. Protease-inhibitors that prevent the enzymes to be cleaved from the newly translated protein chain

***How do Antiretroviral Drugs Work* Video**

Watch the *How do Antiretroviral Drugs Work* video from the Koshland Science Museum Website. In your small group compare your deductions about how antiretroviral drugs can interrupt the life cycle of HIV to that of the video, then respond to the questions below.

1. How do your findings compare to those of scientists? How close were you in identifying stages in the infection pathway current drugs target?

These answers will vary depending on how close students were to the drugs discussed above.

2. Currently, what is the standard way to treat an HIV infection with medicine? Why is this the case?

The best method to treat HIV currently is to give infected individuals a cocktail of drugs that prevents HIV from spreading in their bodies at different stages of the process. This is important because of the high mutation rate of the virus; if the virus evolves resistance to one drug it will be stopped by another.

3. You have seen how people develop a natural immunity to certain infectious diseases through vaccines. As of yet, we do not have a vaccine for HIV. Why is this the case? Think about the reasons behind HIV's effective distribution methods within the body.

This is due to the high mutation rate of HIV. Because HIV mutates so frequently, every HIV virus in an infected individual is potentially different. Vaccines are only effective against certain strains of a virus, and so developing one for HIV where an individual may have tens of thousands of different strains in his/her body proves extremely difficult. Currently, antiretroviral therapy is the best and only way, aside from attempts to control the spread through prevention, to treat HIV/AIDS.