

# **Epidemiology, Viruses, and the Scientific Method: Independent Study Assignment**

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## **Introduction.**

In this assignment you will view part of a lecture on epidemiology that is part of the Howard Hughes Medical Institute Holiday Lectures on Science. This material will bring together material that you have been studying this year in Biology from topics of molecular genetics and viruses to demonstrate how epidemiologists use the scientific method to study the causes and spread of infectious diseases.

## **Instructions.**

Use the attached worksheet to answer the questions in the spaces provide as you view the lecture. You will need the “2000 and Beyond” DVD and access to the DVD player located in the Science Support Center or the DVD compatible computers in the CRC of the lower campus. Expect to spend 45 to 60 minutes with this assignment. You will need more than one class period to complete the work.

Obtain the DVD from your teacher and load the disk into the machine. Using the “top menu” button on the remote, select lecture one, chapter 8 and press the “play” button. You will play this lecture through chapter 30. You will know when you have reached the last chapter when the lecturer opens up the discussion for questions from the audience. Make frequent use of the “pause” button to stop the lecture when you need time to respond to the questions on the worksheet. I recommend that you read all of the questions before you start so that you will be able to anticipate those areas in the lecture that need your careful attention. The numbers in parentheses indicate the chapter of lecture one where you will find the answers to the questions.

(8-9) Q1: The lecturer, Donald Ganem, poses two questions that are central to the work of epidemiologists. What are those questions?

(10-11) Q2: What are the basic structural components common to most viruses?

Q3: What is the difference between the non-envelope and envelope viruses? Give an example of each.

Q4: Suggest a reason why the immune system has a difficult time detecting and destroying envelope viruses.

(12-13) Watch the animation of virus replication in a culture of cells.

Q5: Describe how the replication of the virus in this tissue culture is similar to the spread of an infectious disease in a population of humans.

(14) Q6: Dr. Ganem states that the replication of the virus must be “robust.” What does this mean and why must it be so?

(15-17) Dr. Ganem poses a “thought experiment” involving a group of people becoming ill at a picnic.

Q7: What is the critical question for an epidemiologist in a situation such as this?

Q8: What is “secondary transmission” mean and why is it a critical piece of evidence for the epidemiologist?

Q9: What is “epidemiology?”

Q10: What were some of the alternative hypotheses concerning the cause of AIDS?

Q11: What was the epidemiological evidence that lead to the conclusion that AIDS must be caused by an infectious agent?

(18-20) Q12: Once a disease is thought to be caused by an infectious agent from epidemiological data, what are the classical laboratory techniques that are used to determine how the agent is transmitted and replicates?

(21) Q13: How does the principle of the Watson-Crick base pairing in DNA make the technique of “molecular subtraction” possible?

Q14: How does the universal structure of DNA across species make “molecular subtraction” possible?

(22-23) Q14: Prior to the AIDS epidemic, what was the characteristic distribution of Kaposi’s sarcoma in terms of its geographical distribution the severity of the disease, and the typical victim of the disease?

Q15: How does AIDS change these characteristics of Kaposi’s sarcoma?

Q16: What was the evidence from AIDS patients that indicated that KS is a sexually transmitted disease?

(24-26) Q17: Briefly explain how molecular subtraction was used to demonstrate that KS was caused by a virus belonging to the herpes family.

Q18: What features of this virus’s life cycle permit it to go unnoticed long after the initial infection?

(27) Q19: What are Koch's postulates and why were they so difficult to use in the study of KS?

(28-30) Ganem shows two graphs from his studies on Kaposi's virus and the HIV. The first graph shows the risk of KS infection among various groups and their corresponding antibody response to exposure to KS.

Q20: From these data can you say there is any evidence that it is the KS virus rather than the HIV that causes AID? Explain.

Q21: What is the evidence from this graph that KS is sexually transmitted virus?

Q22: What is the evidence from this graph and the second graph that the presence of HIV infection is associated with the particularly virulent symptoms associated with Kaposi's sarcoma in gay men?

Essay: Write a one-page essay demonstrating how Dr. Ganem's work on the association of Kaposi's virus and the HIV is a good example of the Scientific Method. Be sure to support your theses with specific examples from his lecture. Turn this essay in on a separate page or saved on a disk.

