

AP Chapter 18 Study Guide: The Genetics of Viruses and Bacteria

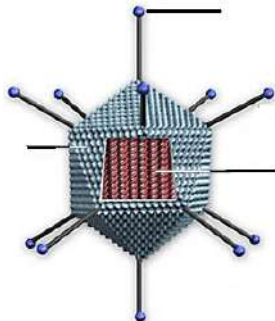
(Rob Hamilton)

Teacher's Note:

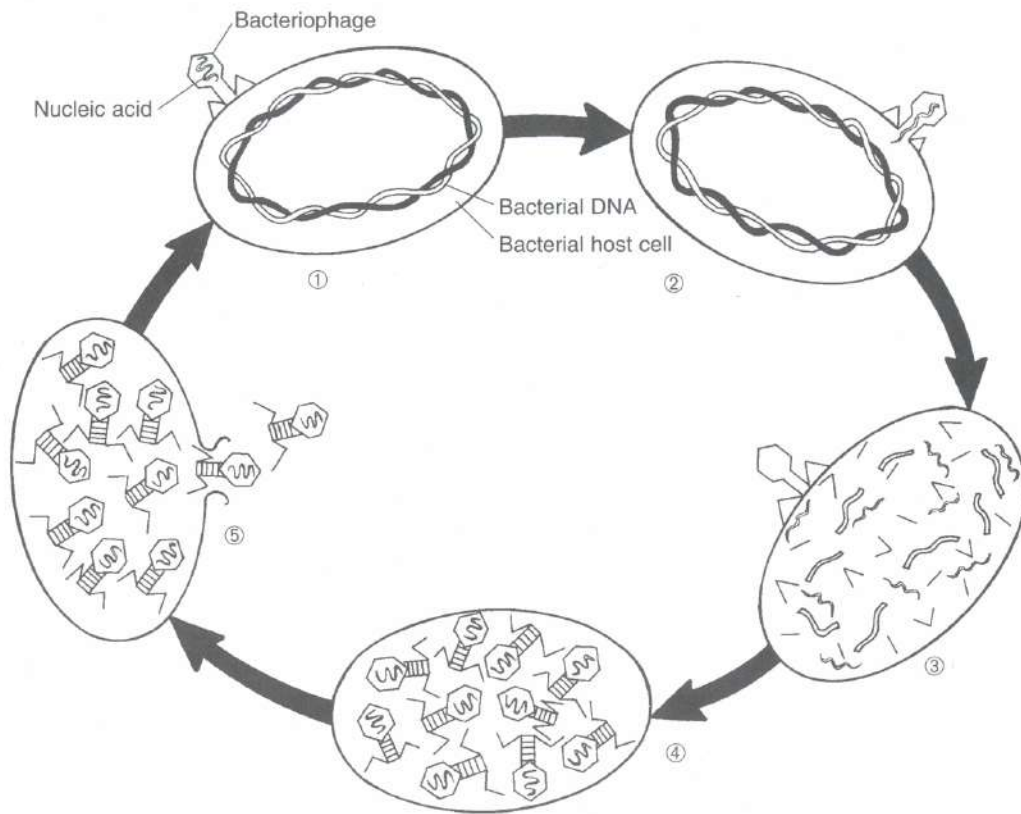
Microbial models were critical in helping early researchers work out fundamental mechanisms of DNA replication, transcription and translation. It is an expectation of College Board that you have an understanding of these organisms. Read pages 334-340 concerning viruses and their lifecycles.

1. Viruses are made of two materials: _____ and _____
2. Circle the characteristic which best describes a virus:
 - a) Viruses are **cellular** or **Non-cellular**
 - b) Viruses have **organelles** or **No organelles**
 - c) Viruses **may** or **may not** be crystallized
 - d) Viruses **grow** or **do not grow** in size
 - e) Viruses carry on **respiration** or **no respiration**
 - f) Viruses **reproduce** or **do not reproduce** outside a host cell
 - g) Viruses are **obligated parasites** or **free living**
 - h) Viruses **reproduce** or **do not reproduce** inside a host cell
 - i) Viruses contain **nucleic acids** or **no nucleic acids**
 - j) Viruses have **limited** or no **enzyme activity**
3. Based on the answers above, viruses considered **living** or **non living**
4. Can a bacteriophage infect a human? _____ Explain why or why not. _____

5. Most viruses generally have **a narrow** or **a broad** host range
6. Label the structures of the virus below: capsomere, DNA and glycoprotein



Examine the diagram of the lytic cycle below



7. Describe the events of each stage.

a) Stage #1 _____

a) Stage #2 _____

a) Stage #3 _____

a) Stage #4 _____

a) Stage #5 _____

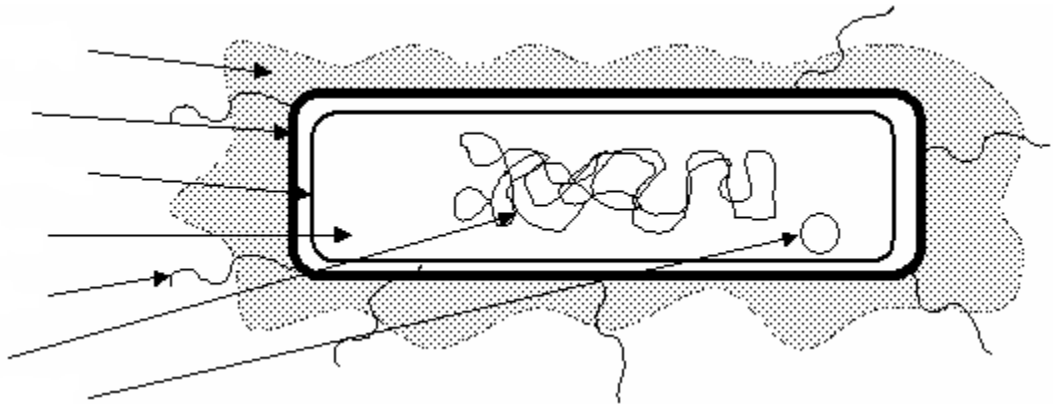
8. In what two fundamental ways does the lysogenic cycle differ from the lytic cycle? _____

Read pgs 346-352 and answer the following questions. Understanding the genetics of bacteria is important to the understanding of the most important lab we do all year. Lab #6. Make sure that you have a grasp of the structure of bacteria, and how they obtain new gene combinations

9. Bacteria are heterotrophic, and prokaryotic organisms. What do these two terms mean? _____

10. The bacterial genome is (circle one) **linear** or **circular**?

11. Label the bacterium below with the following structures: flagella, capsule, cell wall, cell membrane, cytoplasm, nucleoid and a plasmid.



12. Bacteria reproduce by (circle one) **sexual** or **asexual** reproduction

Evolutionarily speaking, asexual reproduction is usually a one way ticket to extinction. Yet bacteria have always been the dominant form of life on our planet.

13 List 3 ways bacteria get new genes and gene combinations and avoid extinction?

a) _____

b) _____

c) _____

14. What is transformation? _____

15. What must be present on the cell wall of a bacterium in order for it to be transformed? _____

16. What occurs during transduction? _____

17. What is conjugation? _____

18. Differentiate between a "F" plasmid and a "R" plasmid. _____

19. What is a transposon? _____

_____ Of what value is a transposon to a bacterium? _____

_____ How could a transposon be

harmful to a bacterium? _____

It is crucial for your own understanding of biology and your preparation for the AP exam to have total command of the inducible operon of E. coli., first described by Jacob and Monod. You may have to read pages 352-356 several times to grasp it. Come to class prepared!

20. If you have to be induced to get up in the morning, then describe yourself. _____

21. So if you were a gene and needed to be induced to transcribe then would your promoter be willing to bind with RNA polymerase at all times? _____

22. Would RNA polymerase be able to pass by the operator usually or only under special circumstances? _____

23. What are the circumstances in which RNA polymerase would transcribe your structural genes? _____

24. What does β -galactosidase do? _____

25. So why on earth would a bacterium want to do that? _____

26. So why would it be illogical for a bacterium to produce β -galactosidase if it were swimming in a sea of glucose? _____

27. What do regulatory genes do? _____

28. So then what are the components of an operon? _____,
and _____

29. The inducible enzyme β -galactosidase catalyzes the breakdown of lactose to what? _____
and _____

In case you missed the point, cells use glucose in their cellular metabolism to produce ATP. They do not use lactose (a dissacharide). Therefore, if glucose levels are high, it would be a waste of ATP to produce and enzyme that breaks down dissacharides; however, if glucose levels are low and lactose is available, lactose (*actually an isomer of lactose called allolactose*) can induce the production of β -galactosidase which will hydrolyze lactose to glucose and as a result the cell lives rather than dies from the lack of ATP !!!!

30. Describe the function of the following:

Regulatory gene _____

RNA polymerase _____

Promotor _____

Operator _____

Structural gene lacZ _____

Structural gene lacy _____

Structural gene lacA _____

31. Substrate Induction:

a) If a gene coding for an enzyme is inducible then the gene is usually **on** or **off**?

b) The repressor protein produced by the regulatory gene is usually **active** or **inactive**?

c) The molecule that acts on the repressor protein is the **substrate** or **end product**?

32. Repressible Operons:

a) If the gene coding for enzymes such as the ones that synthesize tryptophan are repressible, the gene or genes are usually **on** or **off**?

b) The repressor protein would be **active** or **inactive**?

c) The molecule that acts on the repressor protein is the **substrate** or **end product**?

d) Because the repressor in trp operon is inactive it is incapable of binding to the _____

- e) The incompetent protein needs the assistance called the _____ to turn off the operon.
- f) Sooooo.....in this upside down world of negative feedback, the more end product a cell produces the **more** or **less** it is able to produce in the future.