Multiple Choice Review – Prokaryotes & Viruses

1. Prokaryotes consist of both bacteria and archaea. Which of the following statements best characterize these types of organisms?
   a. Bacteria are considered living, however archaea are not.
   b. Both bacteria and archaea meet all the characteristics for life.
   c. Archaea are considered living, however bacteria are not.
   d. Neither are considered to be complete, living organisms.

2. Which of the following correctly states the relationship(s) between bacteria and humans?
   a. Some bacteria act as catalysts in the chemical reactions of human cells.
   b. All bacteria are harmful to humans in some way.
   c. Some bacteria assist humans in digesting food.
   d. All of the above are true.

3. The image below is a representation of the relationships of bacteria, archaea and eukaryotes.

![Image of relationships between domains](http://www.bio.miami.edu/ana/160/160S09_9print.html)

Which of the following correctly describes the relationship between these three domains?
   a. Eukaryotes and bacteria are more closely related than eukaryotes and archaea.
   b. Bacteria and archaea are both related to eukaryotes, which bacteria being more closely related to eukaryotes.
   c. Bacteria and archaea are both related to eukaryotes, with archaea being more closely related to eukaryotes.
   d. Bacteria and archaea are considered non-living, therefore are not closely related to eukaryotes.
4. The image below is of a prokaryote called staphylococcus.

Based upon the characteristics of prokaryotes, which of the following correctly describes what we see in this image?
   a. Prokaryotes may be multicellular or unicellular, therefore this is a single prokaryotic organism.
   b. Bacteria are only unicellular but archaea may be multicellular, therefore this represents archaea.
   c. Prokaryotes are unicellular but may form colonies, therefore this is a unicellular, prokaryotic colony.
   d. This is a eukaryotic organism as all prokaryotes are unicellular and cannot form colonies.

5. Which of the statements below correctly describes prokaryotic cells?
   a. Prokaryotic cells are less complex than eukaryotic cells and do not contain separate organelles.
   b. Prokaryotic cells are more complex than eukaryotic cells and contain all of the same cellular organelles.
   c. Prokaryotic cells share similarities with eukaryotic cells, by containing a nucleus, ribosomes and plasmids.
   d. Prokaryotic cells share similarities with eukaryotic cells, by containing ribosomes and DNA within a cell membrane.

6. Bacterial cells have a carbohydrate cell wall and many also have a capsule. How do these structures function in bacteria?
   a. These two structures replace the cell membrane in bacterial cells.
   b. These two structures both function in protection for the bacterial cell.
   c. The cell wall protects the bacterial cell while the capsule produces food.
   d. The capsule provides protection while the cell wall replaces the cell membrane.
7. Many prokaryotes demonstrate taxis, mainly through the use of flagella. How do these bacteria utilize phototaxis?
   a. Bacteria utilize phototaxis to move towards or away from chemical stimuli.
   b. Bacteria utilize phototaxis to move towards or away from light, often for photosynthesis.
   c. Bacteria utilize phototaxis only to move away from light, to prevent temperature increases.
   d. Bacteria utilize phototaxis only to locate other bacteria for reproduction purposes.

8. Plasmids are small circular pieces of DNA found within certain cells. How does the F plasmid benefit an organism?
   a. The F plasmid benefits prokaryotes by providing resistance to some antibiotics.
   b. The F plasmid benefits prokaryotes by producing a flagella that allows for movement.
   c. The F plasmid benefits both prokaryotes and eukaryotes by increasing genetic variability.
   d. The F plasmid benefits prokaryotes by enabling the production of a sex pilus, increasing genetic variability.

9. Plasmids are small circular pieces of DNA found within certain cells. How does the R plasmid benefit prokaryotes?
   a. R plasmids provide a bacterial cell with resistance to sexual reproduction, ensuring only identical offspring.
   b. R plasmids provide a bacterial cell with resistance to certain antibiotics, increasing chances for survival.
   c. R plasmids provide antibiotic resistance for both prokaryotic and eukaryotic cells, increasing cell survival.
   d. R plasmids allow for the production of ribosomes, which make proteins for the prokaryotic cell.

10. If we assume that a bacterium can double every hour and all of the bacteria survive and reproduce at the same rate, how long will it take for one bacteria to reproduce into 1,000 bacteria?
    a. Approximately 11 hours
    b. Approximately 10 hours
    c. Approximately 24 hours
    d. Approximately 1000 hours
The graph below represents the bacterial growth over a period of time for a specific bacterial species. Use this graph to answer questions 11 and 12.

11. What is the pattern of bacterial reproduction as shown in the graph above?
   a. The bacterial population doubles every 20 minutes.
   b. The bacterial population increases by 20 cells every 20 minutes.
   c. The bacterial population increases by 20 from 0 to 20 minutes then rises exponentially.
   d. The bacterial population triples every 20 minutes.

12. Assuming that the same pattern of bacterial reproduction continues, what can we project the bacterial population to be after another 60 minutes?
   a. 10,240 bacteria
   b. 81,920 bacteria
   c. 163,840 bacteria
   d. 40,960 bacteria

13. Comparing and contrasting the process of transcription found within eukaryotic cells and prokaryotic cells, which of the following statements are accurate?
   a. Transcription occurs in both eukaryotic and prokaryotic cells.
   b. Transcription occurs in the nucleus of both cell types.
   c. Most prokaryotic cells perform translation only, only a few perform transcription.
   d. Transcription utilizes DNA to produce RNA, but the DNA in prokaryotes is only single stranded.
14. What is the role of the operator, as seen in the image above?
   a. The operator is where the RNA polymerase binds.
   b. The operator is direct coding for the amino acid within the protein.
   c. The operator alone determines whether or not the protein will be produced.
   d. The operator acts as an on/off switch.

15. What is the role of the promoter, as seen in the image above?
   a. The promoter indicates where translation will begin.
   b. The promoter acts alone as the on/off switch.
   c. The promoter attracts the RNA polymerase to the DNA molecule.
   d. The promoter destroys the RNA polymerase so that transcription can occur.

16. Bacteria and humans can have different types of relationships based upon who benefits and who does not. Which of the following describes a mutualistic benefit between bacteria and humans?
   a. One type of bacteria enables further digestion of foods within the human intestine, while using this food as its own food source.
   b. One type of bacteria can cause mild infections within human sinuses, without benefitting humans.
   c. One type of bacteria lives on human skin digesting materials found there, causing an infection in humans if the skin is broken.
   d. One type of bacteria provides plasmids for human DNA research, but is destroyed in the process.

17. Which of the following correctly describes binary fission?
   a. A sex pili is formed where genetic information is transferred from one bacteria to another.
   b. Binary fission produces two copies of the parent cell, each with half the parental DNA.
   c. Binary fission increases the genetic variation of the bacterial colony.
   d. The chromosome is replicated then the cell divides in half, producing two exact copies of the parent cell.
18. All prokaryotes contain the genetic information required to produce a new prokaryotic cell. Which of the following correctly describes prokaryotic DNA?

a. Prokaryotic DNA has the same molecular structure as human DNA; a double helix with sugars, phosphate groups and nitrogenous bases.

b. Prokaryotic DNA is similar to human RNA; it is single stranded with sugars, phosphate groups and nitrogenous bases.

c. Prokaryotic DNA is very different from human DNA; it has a different type of sugar, no phosphate group and entirely different nitrogenous bases.

d. Prokaryotic DNA is exactly the same as human DNA; it has the same molecular structure and the genes are located on numerous chromosomes.

The image below illustrates the major steps of Griffith’s experiments regarding transformation of cells. Use this image to respond to questions 19 and 20 below.

![Image of experiments](http://activity.ntsec.gov.tw/lifeworld/english/content/gene_cc7.html)

19. Frederick Griffith took the S (smooth) strain of bacteria from the dead mice seen in panel B above. He then killed the bacteria using heat. Why, then, were the mice in panel C able to survive?

a. The mice had developed a resistance to the S strain bacteria so they could not be affected.

b. The heat killed S strain could not produce any products nor reproduce in order to affect the mice.

c. The heat killed S strain bacteria were non-pathogenic to begin with.

d. The heat killed S strain shared the genetic information with mouse cells, causing the mouse to resist the disease.
20. How was the heat killed S strain able to affect the R bacterial strain, resulting in mouse death, as seen in panel D above?
   a. The heat killed S strain bacteria infected a virus which then infected the mouse cells, killing the mice.
   b. Some of the heated S strain bacteria survived the heating, reproduced quickly, and killed the mice.
   c. The R strain bacteria took in pieces of the heat killed bacterial DNA, transforming the R strain into S strain bacteria.
   d. The R strain bacteria were transformed by toxins produced by the heat killed S strain, causing the R strain to become pathogenic.

The illustration below represents a process that can be performed by certain prokaryotic cells. Use this illustration to respond to questions 21 and 22.

21. The process in the image above results in the direct transfer of genetic material. Which of the following correctly describes or identifies the process within this image?
   a. This process is known as conjugation.
   b. The transfer of genetic information goes both ways.
   c. This process is a type of binary fission.
   d. Both prokaryotic and eukaryotic cells can perform this process.

22. The small piece of genetic information that is transferred is usually the
   ________.
   a. large circular chromosome
   b. chromosome #1
   c. RNA segment
   d. plasmid
23. Viruses are small particles that infect living organisms. Are the considered to be living? Why, why not?
   a. Viruses are considered to be living because they are composed of cells and cell organelles.
   b. Viruses are not considered to be living because they cannot process energy on their own.
   c. Viruses are not considered to be living because they do not carry any genetic material.
   d. Viruses are considered to be living because some can photosynthesize.

24. Which of the following are characteristics of viruses?
   a. They can infect all types of cells.
   b. They always kill the host cell releases multiple new viruses.
   c. They use molecules and cell organelles from the host cell to reproduce.
   d. They can only infect eukaryotic cells.

25. Below is a list of steps associated with one type of life cycle of a phage.
   i. The particle releases its genetic instructions into the host cell.
   ii. The new particles break free from the host cell.
   iii. A virus particle attaches to a host cell
   iv. The injected genetic material recruits the host cell’s enzymes.
   v. The enzymes make parts for more new virus particles.
   vi. The new particles assemble the parts into new viruses.

   Which of the following correctly lists the order of these steps as shown above?
   a. i, ii, iii, iv, v, vi
   b. vi, i, ii, v, iii, iv
   c. ii, iv, vi, i, ii, iii
   d. iii, i, iv, v, vi, ii

26. Which type of life cycle of a bacteriophage is most immediately harmful to the bacterial cell and why?
   a. The lytic cycle because the new viruses are immediately produced and the host cell is killed.
   b. The lysogenic cycle because the new viruses are immediately produced and the host cell is killed.
   c. The lytic phase because the viral DNA is immediately incorporated into the bacterial DNA.
   d. The lysogenic phase because the viral DNA is immediately incorporated into the bacterial DNA.
27. Temperate phages are unique because they are able to ________________
   a. utilize only the lysogenic cycle
   b. utilize only the lytic cycle
   c. utilize the transducive cycle
   d. utilize both the lysogenic and lytic cycles

The illustration below represents a process whereby new viruses are produced and potentially new bacterial DNA is added to bacterial cells. Use this illustration to answer questions 28 and 29.

http://bytesizebio.net/2011/03/16/why-are-there-no-disease-causing-archaea/

28. The steps of the process shown above are labeled 1 through 5. Which of the following represents the caption that is best used for step 3?
   a. Bacteriophage enzymes break apart bacterial cell DNA.
   b. The bacterial cell is infected with viral genetic material.
   c. The bacterial cell synthesizes new phages that incorporate both viral DNA and bacterial DNA.
   d. Viruses with both viral genetic material and bacterial DNA infect a new cell.

29. Steps 1 through 3 in the illustration above are the same steps as those found in which life cycle of bacteriophages?
   a. the lytic cycle
   b. the lysogenic cycle
   c. both the lytic and lysogenic cycles
   d. the translation cycle
30. Many archaea are considered to be extremophiles. What characteristic do these organisms have that results in this designation?
   a. These organisms have been found in extreme sizes.
   b. These organisms have been found in extreme temperatures, pH, and high salt.
   c. These organisms have been able to withstand extreme heights in the earth’s atmosphere.
   d. These organisms developed extremely early in earth’s history, before bacteria.

31. A gram stain test can be performed using bacteria cells. If the bacteria, as a result of this test, retain a purple color what can we conclude about this type of bacteria?
   a. The bacteria is gram-negative and has a thick peptidoglycan layer.
   b. The bacteria is gram-negative and has a thin peptidoglycan layer.
   c. The bacteria is gram-positive and has a thin peptidoglycan layer.
   d. The bacteria is gram-positive and has a thick peptidoglycan layer.

32. Some bacteria are more susceptible to antibiotics because of their external structure. Which type of bacteria is more susceptible?
   a. Gram-negative bacteria
   b. Gram-positive bacteria
   c. Both gram-negative and gram-positive are equally susceptible.
   d. Gram-indeterminate

33. Bacterial DNA has a circular structure. How does this affect DNA replication in bacterial cells?
   a. An operon must be present in order for DNA replication to take place.
   b. DNA polymerase is not required because of the circular nature of bacterial DNA.
   c. Two DNA Polymerase molecules attach and replication moves in one direction.
   d. A replication bubble must form because there is not an open end to the DNA strand.

34. Prokaryotes have a small amount of DNA when compared to eukaryotic cells. How does this fact often lead to mutualism between bacterial cells?
   a. Different species of bacterial cells living in the same environment can join forces to block invaders.
   b. Each species of bacteria can produce particular proteins that can be absorbed and benefit all bacteria living within the same area.
   c. One species of bacteria can colonize another species of bacteria and take over the protein production mechanism.
   d. Some bacterial cells are eukaryotic and therefore can produce more proteins; prokaryotic bacteria benefit from the eukaryotic bacteria.
35. Which characteristic of viruses lead most directly to them being called “obligate intracellular parasites”?
   a. The fact that viruses are not cells.
   b. Viruses attach to bacterial cells utilizing the food products from photosynthesis.
   c. Viruses must infect another species of virus in order to reproduce.
   d. Viruses cannot reproduce on their own but must infect and reproduce harming the host cell.

36. A wide variety of antibiotics have been discovered in nature and used by humans to destroy pathogenic bacteria. Where were most of these antibiotics discovered?
   a. Most were discovered within bacteria cells, which use them as protection against other bacterial cells.
   b. Most were discovered within viral cells, which use them to break open bacterial cells.
   c. Most were discovered within eukaryotic cells, which use them to fight off fungi.
   d. Most were discovered within plants, which use them to establish ground territory.

37. How do transcription and translation differ between prokaryotic and eukaryotic cells?
   a. The processes of transcription and translation in prokaryotes result in sugars being produced rather than proteins.
   b. In prokaryotic cells both transcription and translation occur in the nucleus.
   c. In prokaryotic cells both transcription and translation occur in the cytoplasm.
   d. In eukaryotic cells sugars are the result of these processes, while in prokaryotes proteins are the result.

38. Methicillin-resistant *Staphylococcus aureus* is just like any other staph bacteria. The difference is, this strain is particularly *virulent*. MRSA bacteria are able to divide every 15 minutes, at body temperature conditions. A man has an open cut on his hand, which is exposed to 100 MRSA bacteria from equipment at his gym. He does not wash his hand until he reaches home 3 ½ hours later. Estimate how many MRSA bacterial cells are embedded inside of his cut by the time he washes his hands.
   a. 819,200
   b. 16,384
   c. 1,638,400
   d. 1,024,000
39. *Mycobacterium* tuberculosis is the bacteria that can cause tuberculosis. This bacillus bacteria spreads slowly and widely in the lungs. The generation time for the bacteria is 12 hours. A woman becomes infected with 200 bacteria but does not show any symptoms of illness for 15 days. Estimate the number of bacteria present by the time the woman has noticed any symptoms.

- a. $1.07 \times 10^9$ bacteria
- b. $2.15 \times 10^{11}$ bacteria
- c. 600 bacteria
- d. $6.00 \times 10^{11}$ bacteria

40. Serial dilution is often used in the study of bacterial cultures. Cultures can become so concentrated that they are difficult to observe when plated onto a petri dish. By how much is the amount of bacterial cells typically reduced for each dilution?

- a. 5%
- b. 50%
- c. 1%
- d. 10%
## Answer Key

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