

## CHAPTER 1: Microbial Life: Origin and Discovery

### MULTIPLE CHOICE

1. Viruses are
  - a. infectious agents that infect exclusively multicellular organisms.
  - b. noncellular particles that take over the metabolism of a cell to generate more virus particles.
  - c. pathogens that replicate in complex growth media.
  - d. cellular particles that belong to the archaea domain.
  - e. microbes that consist of lipid membrane–enclosed genomes.

ANS: B                      DIF: Easy                      REF: 1.1  
OBJ: 1.1a Recall the definition of a microbe | 1.1b List examples of microbes  
MSC: Remembering

2. Analysis of DNA sequences reveals
  - a. the ancient convergence of two cell types (i.e., prokaryotes and eukaryotes).
  - b. that prokaryotes and eukaryotes evolved from a common ancestral cell.
  - c. that bacteria share a common ancestor with archaea but not with eukarya.
  - d. that prokaryotes are cells with a nucleus.
  - e. that the genome of *Haemophilus influenzae* has about 2 billion base pairs.

ANS: B                      DIF: Easy                      REF: 1.1  
OBJ: 1.1d Explain the implications of microbial genome sequencing  
MSC: Understanding

3. Which of these groups are considered to be microbes but NOT considered to be cells?
  - a. viruses
  - b. bacteria
  - c. archaea
  - d. protists
  - e. filamentous fungi

ANS: A                      DIF: Easy                      REF: 1.1  
OBJ: 1.1a Recall the definition of a microbe | 1.1c Describe some problems with the definition of a microbe  
MSC: Understanding

4. A microbe is commonly defined as a \_\_\_\_\_ that requires a microscope to be seen.
  - a. virus
  - b. bacterium
  - c. single-cellular prokaryote
  - d. multicellular eukaryote
  - e. living organism

ANS: E                      DIF: Easy                      REF: 1.1  
OBJ: 1.1a Recall the definition of a microbe                      MSC: Remembering

5. Which one of the following statements regarding microbial cells is FALSE?
  - a. Microbial cells acquire food, gain energy to build themselves, and respond to environmental change.
  - b. Most single-celled organisms require a microscope to render them visible, but some bacterial cells are large enough to be seen with naked eyes.
  - c. Microbes function as individual entities.
  - d. Many microbes form complex multicellular assemblages.
  - e. Viruses are not considered microbial cells.

ANS: C                      DIF: Easy                      REF: 1.1

OBJ: 1.1a Recall the definition of a microbe

MSC: Understanding

6. Which of the following statements is FALSE?
- A genome is the total genetic information contained in an organism's chromosomal DNA.
  - If a microbe's genome includes genes for nitrogenase, that microbe probably can fix nitrogen.
  - By comparing DNA sequences of different organisms, we can figure out how closely related they are.
  - Fred Sanger developed the first applicable DNA sequencing method.
  - Fred Sanger completed the sequences of *Haemophilus influenzae*.

ANS: E                      DIF: Easy                      REF: 1.1

OBJ: 1.1d Explain the implications of microbial genome sequencing

MSC: Remembering

7. The first cellular genomes to be sequenced were those of
- humans.
  - bacteria.
  - viruses.
  - prions.
  - fungi.

ANS: B                      DIF: Easy                      REF: 1.1

OBJ: 1.1d Explain the implications of microbial genome sequencing

MSC: Remembering

8. The environment of early Earth may have contained all of the following EXCEPT
- ferrous iron.
  - methane.
  - ammonia.
  - oxygen.
  - hydrogen gas.

ANS: D                      DIF: Medium                      REF: Special Topic 1.1

OBJ: 1.1a Recall the definition of a microbe

MSC: Remembering

9. The development of the theory of the "RNA world" resulted from the discovery of
- archaea.
  - prions.
  - bacteria.
  - ribozymes.
  - endosymbionts.

ANS: D                      DIF: Medium                      REF: 1.6

OBJ: 1.6b Explain how studies on microbes fostered our knowledge of DNA function and enhanced DNA technology      MSC: Remembering

10. What is the evidence that living cells existed on Earth up to 3.8 billion years ago?
- microfossils
  - 16S ribosomal RNA
  - Miller and Urey's experiments
  - Martian folded rock formations
  - diatom shells

ANS: A                      DIF: Medium                      REF: Special Topic 1.1

OBJ: 1.5a Explain why microbes can be challenging to classify taxonomically | 1.5b Outline how microbial classification has changed over time      MSC: Remembering

11. What did van Leeuwenhoek discover using microscopic observations before and after drinking hot beverages?
- Heat did not kill microbes.
  - Heat killed microbes.
  - Heat did not kill algae.

- d. Caffeine in coffee killed microbes.
- e. The existence of spiral-shaped microbes.

ANS: B                      DIF: Medium                      REF: 1.2

OBJ: 1.2b Explain why the microscope is an important tool in the field of microbiology | 1.2c Identify the contributions of the following individuals: Nightingale, Hooke, van Leeuwenhoek, Pasteur, and Tyndall  
MSC: Analyzing

12. Tyndall's spontaneous generation experiments occasionally failed due to
- a. nutrient chirality.
  - b. dust.
  - c. fermentation.
  - d. lack of oxygen.
  - e. endospores.

ANS: E                      DIF: Easy                      REF: 1.2

OBJ: 1.2d Compare and contrast Spallanzani's, Pasteur's, and Tyndall's experiments that tested spontaneous generation  
MSC: Analyzing

13. The discovery of microbes occurred in the \_\_\_\_\_ century?
- a. seventeenth
  - b. eighteenth
  - c. nineteenth
  - d. twentieth
  - e. twenty-first

ANS: C                      DIF: Easy                      REF: 1.2

OBJ: 1.2b Explain why the microscope is an important tool in the field of microbiology  
MSC: Remembering

14. Robert Koch won the Nobel Prize for his contribution to medical bacteriology regarding
- a. *Escherichia coli*.
  - b. *Bacillus subtilis*.
  - c. *Mycobacterium tuberculosis*.
  - d. rabies.
  - e. smallpox.

ANS: C                      DIF: Medium                      REF: 1.3                      OBJ: 1.3b List Koch's postulates  
MSC: Remembering

15. How did European invaders to North America kill much of the native population?
- a. tuberculosis
  - b. leprosy
  - c. smallpox
  - d. HIV
  - e. bubonic plague

ANS: C                      DIF: Medium                      REF: 1.2

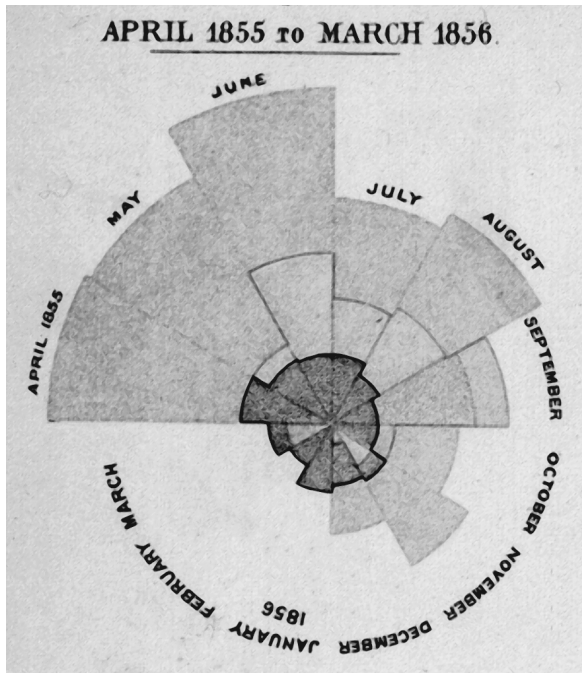
OBJ: 1.2a List both positive and negative impacts that microbes have had on human history  
MSC: Understanding

16. Florence Nightingale
- a. is best known as the founder of professional nursing.
  - b. was the first to use disinfectant to demonstrate the significance of aseptic technique.
  - c. developed the pie chart of mortality data during the Crimean War.
  - d. performed the first controlled experiment on the chemical conversion of matter, known today as chemotherapy.
  - e. argued that the environment of early Earth contained mainly reduced compounds.

ANS: A                      DIF: Easy                      REF: 1.2

OBJ: 1.2a List both positive and negative impacts that microbes have had on human history | 1.2c Identify the contributions of the following individuals: Nightingale, Hooke, van Leeuwenhoek, Pasteur, and Tyndall  
MSC: Remembering

17. Who developed the concept of medical statistics?



- a. Francis Crick
- b. Florence Nightingale
- c. Edward Jenner
- d. Louis Pasteur
- e. Alexander Fleming

ANS: B                      DIF: Easy                      REF: 1.2

OBJ: 1.2c Identify the contributions of the following individuals: Nightingale, Hooke, van Leeuwenhoek, Pasteur, and Tyndall                      MSC: Remembering

18. The first person to visualize individual microbial cells was

- a. Antonie van Leeuwenhoek.
- b. Robert Hooke.
- c. Louis Pasteur.
- d. Lady Montagu.
- e. Edward Jenner.

ANS: A                      DIF: Easy                      REF: 1.2

OBJ: 1.2c Identify the contributions of the following individuals: Nightingale, Hooke, van Leeuwenhoek, Pasteur, and Tyndall                      MSC: Remembering

19. Semmelweis and Lister noted that many of their patients' deaths were due to

- a. fungi.
- b. *Escherichia coli*.
- c. chlorine.
- d. pathogen transmission by doctors.
- e. *Staphylococcus*.

ANS: D                      DIF: Medium                      REF: 1.3

OBJ: 1.3a Describe what constitutes a pure culture and how to obtain one                      MSC: Understanding

20. What is the standard sterilization method for the controlled study of microbes?

- a. boiling
- b. pasteurization
- c. filter sterilization
- d. autoclaving
- e. irradiation

ANS: D                      DIF: Medium                      REF: 1.2

OBJ: 1.2c Identify the contributions of the following individuals: Nightingale, Hooke, van Leeuwenhoek, Pasteur, and Tyndall      MSC: Remembering

21. How does the Winogradsky column differ from Koch's plate media?
- Koch's media creates a gradient from oxygen-rich conditions at the surface to highly reduced conditions below.
  - The Winogradsky column is used for culturing viruses.
  - The Winogradsky column is used for growing extremophiles.
  - The Winogradsky column uses the kinds of nutrients that feed humans.
  - The bacteria that Winogradsky isolated can grow only on inorganic minerals.

ANS: E      DIF: Easy      REF: 1.4

OBJ: 1.4a List Winogradsky's contributions to microbial culture technique | 1.4b Define what distinguishes lithotrophs from other organisms      MSC: Understanding

22. Suppose Pasteur's swan-necked flasks containing boiled broth became cloudy twenty-four hours after boiling. Which choice could best explain the turbidity or cloudiness in the broth without supporting spontaneous generation?
- Endospores in the broth survived boiling and grew after the broth cooled.
  - Contaminating organisms in the broth killed by boiling became alive again after the broth cooled.
  - Chemicals in the broth came together to form living organisms.
  - The broth allowed light to pass through it with less interference after boiling.
  - Solid material in the broth dissolved during boiling.

ANS: A      DIF: Difficult      REF: 1.2

OBJ: 1.2c Identify the contributions of the following individuals: Nightingale, Hooke, van Leeuwenhoek, Pasteur, and Tyndall | 1.2d Compare and contrast Spallanzani's, Pasteur's, and Tyndall's experiments that tested spontaneous generation      MSC: Applying

23. Which of the following is NOT considered to be an extremophilic condition for bacteria?
- high alkalinity
  - high salinity
  - high acidity
  - high nutrients
  - high temperature

ANS: D      DIF: Medium      REF: 1.4

OBJ: 1.4c Explain the role of microbes in geochemical cycling, especially that of nitrogen      MSC: Remembering

24. The use of agar as a more robust gelling agent in solid media was suggested by
- Robert Koch.
  - Ignaz Semmelweis.
  - Angelina Hesse.
  - Louis Pasteur.
  - Richard Petri.

ANS: C      DIF: Easy      REF: 1.3

OBJ: 1.3a Describe what constitutes a pure culture and how to obtain one | 1.3c Assess some of the practical obstacles in applying Koch's postulates      MSC: Remembering

25. It took the advent of the polymerase chain reaction to detect the presence of the causative agent for which disease?
- anthrax
  - tuberculosis
  - AIDS
  - rabies
  - smallpox

ANS: C      DIF: Difficult      REF: 1.3

OBJ: 1.3c Assess some of the practical obstacles in applying Koch's postulates | 1.3f Describe how viruses were discovered  
MSC: Understanding

26. The word "vaccination" is derived from the Latin word *vacca*, which means
- a. inject.
  - b. smallpox.
  - c. immunize.
  - d. cow.
  - e. pustule.

ANS: D                      DIF: Easy                      REF: 1.3

OBJ: 1.3d Recall the contributions of various individuals to the discovery and implementation of vaccination | 1.3e Compare the roles of immunization, antiseptics, and antibiotics in human disease treatment and prevention  
MSC: Remembering

27. What was the basis for the original smallpox vaccine?
- a. chickenpox virus
  - b. cowpox virus
  - c. rabies virus
  - d. smallpox virus
  - e. anthrax

ANS: B                      DIF: Medium                      REF: 1.3

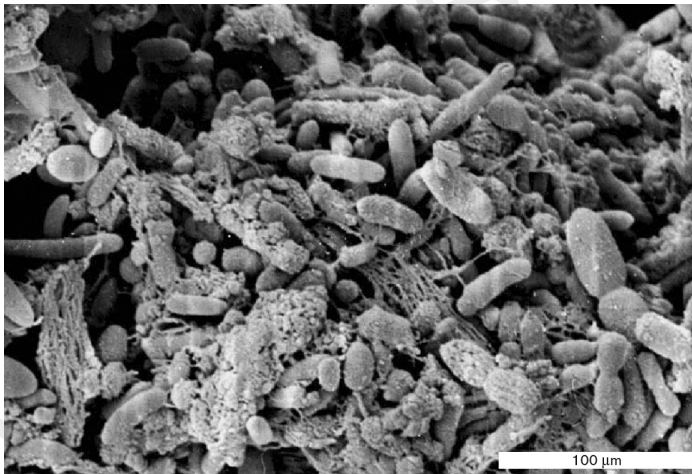
OBJ: 1.3d Recall the contributions of various individuals to the discovery and implementation of vaccination  
MSC: Remembering

28. Penicillin was first used to save the lives of many people during which war?
- a. the U.S. Civil War
  - b. the Korean War
  - c. the Vietnam War
  - d. World War I
  - e. World War II

ANS: E                      DIF: Easy                      REF: 1.3

OBJ: 1.3e Compare the roles of immunization, antiseptics, and antibiotics in human disease treatment and prevention  
MSC: Remembering

29. How do many animal endosymbionts grow?



- a. on the surface of the host
- b. on low nutrients
- c. by reducing iron oxide
- d. on inorganic minerals
- e. in biofilms

ANS: E                      DIF: Medium                      REF: 1.4

OBJ: 1.4d Compare the roles of animal endosymbionts and plant endosymbionts  
MSC: Remembering

30. All of the following are true about penicillin EXCEPT that it
- was discovered by Alexander Fleming.
  - was an accidental discovery.
  - is produced by a bacterium.
  - was the first antibiotic used by humans.
  - was purified by Florey and Chain.

ANS: C                      DIF: Difficult                      REF: 1.3

OBJ: 1.3e Compare the roles of immunization, antiseptics, and antibiotics in human disease treatment and prevention                      MSC: Remembering

31. Which of the following statements regarding viruses is FALSE?
- Most are too small to be seen by a light microscope.
  - They are “filterable agents” that can pass through porcelain filters that have a pore size that blocks microbes.
  - Their genomes could be composed of DNA or RNA.
  - They are smaller than plasmids and prions.
  - Viral particles, when pure enough, can be crystallized.

ANS: D                      DIF: Medium                      REF: 1.3

OBJ: 1.3f Describe how viruses were discovered                      MSC: Analyzing

32. You have isolated a bacterium that you believe to be the causative agent of a new disease in frogs. How would you test the third of Koch’s postulates?
- Determine the shape of the bacterial cells.
  - Inject the bacteria into a healthy frog.
  - Isolate the bacterium from a sick frog.
  - Show that the bacterium is not present in healthy frogs.
  - Grow a pure culture of the bacterium outside the frog.

ANS: B                      DIF: Difficult                      REF: 1.3                      OBJ: 1.3b List Koch’s postulates  
MSC: Applying

33. How did Sergei Winogradsky grow lithotrophs?
- enrichment culture
  - organic media
  - pure culture
  - endosymbiosis
  - chain of infection

ANS: A                      DIF: Easy                      REF: 1.4

OBJ: 1.4a List Winogradsky’s contributions to microbial culture technique | 1.4b Define what distinguishes lithotrophs from other organisms                      MSC: Understanding

34. Organisms that live symbiotically inside a larger organism are known as
- organelles.
  - cyanobacteria.
  - mitochondria.
  - endosymbionts.
  - chloroplasts.

ANS: D                      DIF: Easy                      REF: 1.4

OBJ: 1.4d Compare the roles of animal endosymbionts and plant endosymbionts  
MSC: Remembering

35. Animal microbiomes are NOT significant in
- digesting plant fibers.
  - bioluminescence.
  - converting ammonia to nitrate.
  - providing nutrients to the host.