

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

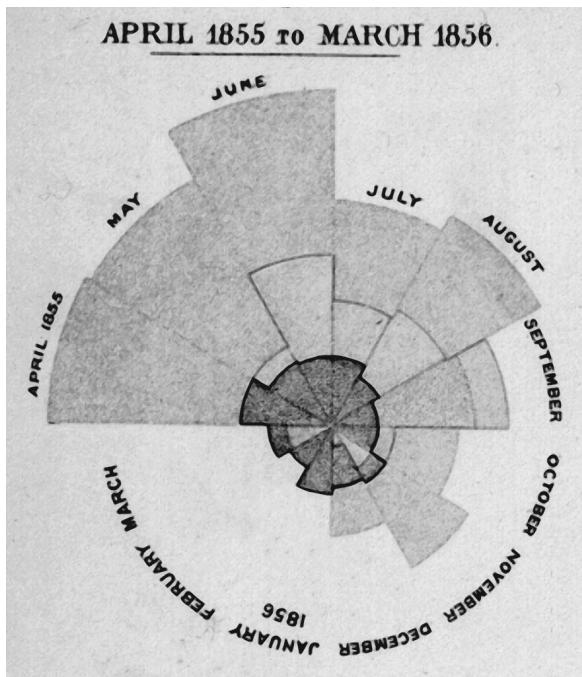
OBJ: 1.2a List both positive and negative impacts that microbes have had on human history
MSC: Understanding

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

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
- inject.
 - smallpox.
 - immunize.
 - cow.
 - 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?
- chickenpox virus
 - cowpox virus
 - rabies virus
 - smallpox virus
 - 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?
- the U.S. Civil War
 - the Korean War
 - the Vietnam War
 - World War I
 - World War II

ANS: E

DIF: Easy

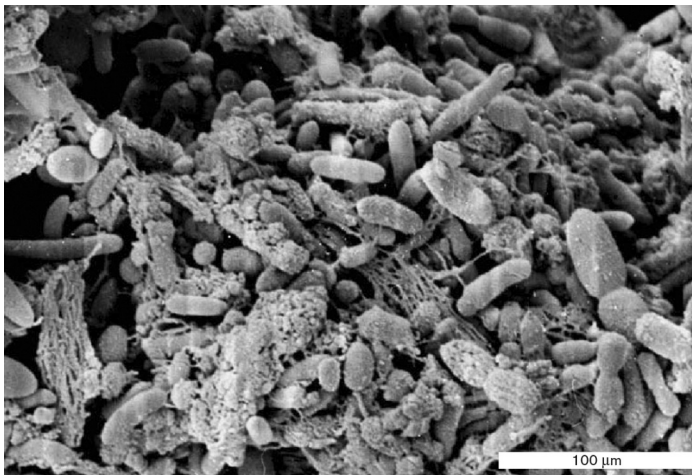
REF: 1.3

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?



- on the surface of the host
- on low nutrients
- by reducing iron oxide
- on inorganic minerals
- 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

- a. was discovered by Alexander Fleming.
- b. was an accidental discovery.
- c. is produced by a bacterium.
- d. was the first antibiotic used by humans.
- e. 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?
- a. Most are too small to be seen by a light microscope.
 - b. They are “filterable agents” that can pass through porcelain filters that have a pore size that blocks microbes.
 - c. Their genomes could be composed of DNA or RNA.
 - d. They are smaller than plasmids and prions.
 - e. 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?
- a. Determine the shape of the bacterial cells.
 - b. Inject the bacteria into a healthy frog.
 - c. Isolate the bacterium from a sick frog.
 - d. Show that the bacterium is not present in healthy frogs.
 - e. 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?
- a. enrichment culture
 - b. organic media
 - c. pure culture
 - d. endosymbiosis
 - e. 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
- a. organelles.
 - b. cyanobacteria.
 - c. mitochondria.
 - d. endosymbionts.
 - e. 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
- a. digesting plant fibers.
 - b. bioluminescence.
 - c. protection from pathogens.
 - d. converting ammonia to nitrate.
 - e. providing nutrients to the host.

ANS: D DIF: Easy REF: 1.4

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

MSC: Applying

36. Carl Woese's discovery replaced the classification scheme of five kingdoms with a scheme of three
- a. phyla.
 - b. domains.
 - c. classes.
 - d. orders.
 - e. genera.

ANS: B

DIF: Easy

REF: 1.5

OBJ: 1.5b Outline how microbial classification has changed over time | 1.5d Describe the importance of DNA sequencing in classification

MSC: Remembering

37. The gene expression machinery of archaea is MOST similar to
- a. monera.
 - b. prokaryotes.
 - c. bacteria.
 - d. eukaryotes.
 - e. mitochondria.

ANS: D

DIF: Medium

REF: 1.5

OBJ: 1.5e Compare and contrast archaea, bacteria, and eukaryotes

MSC: Understanding

38. In the three-domain model, the bacterial ancestor of mitochondria derives from ancient
- a. fungi.
 - b. cyanobacteria.
 - c. respiring bacteria.
 - d. archaea.
 - e. protists.

ANS: C

DIF: Medium

REF: 1.5

OBJ: 1.5c Appraise endosymbiosis as an explanation for mitochondria and chloroplasts

MSC: Remembering

39. Which of the following organelles are thought to be of prokaryotic origin?
- a. chloroplast
 - b. mitochondria
 - c. nucleus
 - d. chloroplast and mitochondria
 - e. chloroplast and nucleus

ANS: D

DIF: Medium

REF: 1.5

OBJ: 1.5c Appraise endosymbiosis as an explanation for mitochondria and chloroplasts

MSC: Understanding

40. In the three-domain model, the bacterial ancestor of chloroplasts derives from ancient
- a. fungi.
 - b. cyanobacteria.
 - c. proteobacteria.
 - d. archaea.
 - e. protists.

ANS: B

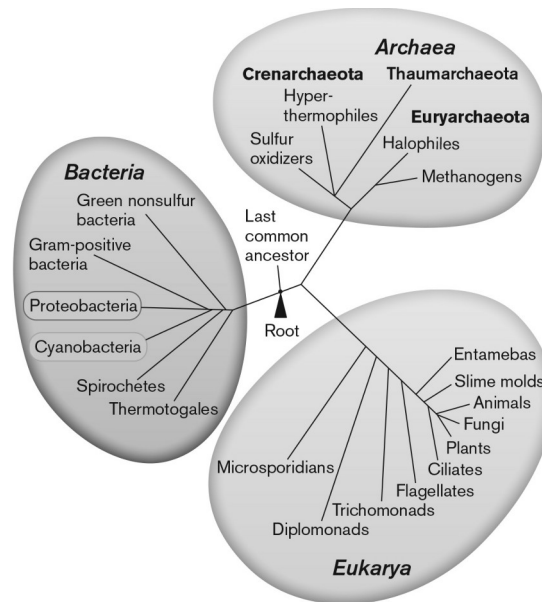
DIF: Medium

REF: 1.5

OBJ: 1.5c Appraise endosymbiosis as an explanation for mitochondria and chloroplasts

MSC: Remembering

41. Which commonly used microbial classification advancement led to the tree by Carl Woese in 1977?



- a. comparative genomics
- b. microscopy
- c. X-ray diffraction
- d. protein sequencing
- e. 16S rRNA sequencing

ANS: E DIF: Medium REF: 1.5

OBJ: 1.5b Outline how microbial classification has changed over time | 1.5d Describe the importance of DNA sequencing in classification MSC: Understanding

42. Electron microscopes use what to focus the beam of electrons?
- a. electromagnets
 - b. a condenser lens
 - c. light rays
 - d. X-ray diffraction
 - e. glass

ANS: A DIF: Easy REF: 1.6

OBJ: 1.6a Describe the roles of the electron microscope and the ultracentrifuge in advancing our knowledge of cell structure and function MSC: Remembering

43. Peter Mitchell and Jennifer Moyle discovered the _____ theory in the 1960s.
- a. germplasm
 - b. evolution
 - c. chemiosmotic
 - d. DNA synthesis
 - e. polymerase chain reaction

ANS: C DIF: Easy REF: 1.6

OBJ: 1.6a Describe the roles of the electron microscope and the ultracentrifuge in advancing our knowledge of cell structure and function MSC: Remembering

44. The X-ray diffraction studies by which of the following scientists concluded that DNA was a double helix?
- a. James Watson
 - b. Rosalind Franklin
 - c. Francis Crick
 - d. Maurice Wilkins
 - e. Kary Mullis

ANS: B DIF: Easy REF: 1.6

OBJ: 1.6a Describe the roles of the electron microscope and the ultracentrifuge in advancing our knowledge of cell structure and function MSC: Remembering

45. What feature of bacteria facilitated the DNA revolution in the 1970s?

- a. They are very small.
- b. They readily recombine DNA.
- c. They have very large genomes.
- d. All of their genes were known.
- e. They do not cause disease.

ANS: B DIF: Medium REF: 1.6

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

46. This scientist first discovered the process of transformation.
- a. Francis Crick
 - b. Robert Koch
 - c. Edward Jenner
 - d. Louis Pasteur
 - e. Frederick Griffith

ANS: E DIF: Difficult REF: 1.6

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

47. Taq polymerase forms the basis of a technique for
- a. comparative genomics.
 - b. recombinant DNA.
 - c. X-ray diffraction.
 - d. DNA amplification.
 - e. protein synthesis.

ANS: D DIF: Easy REF: 1.6

OBJ: 1.6c State some uses of microbes in medicine and industry
MSC: Understanding

48. In 1975, scientists held a conference at Asilomar to regulate and restrict the field of
- a. recombinant DNA.
 - b. comparative genomics.
 - c. DNA sequencing.
 - d. DNA amplification.
 - e. forensic microbiology.

ANS: A DIF: Medium REF: 1.6

OBJ: 1.6c State some uses of microbes in medicine and industry
MSC: Understanding

49. The study of and cause of disease in humans, animals, and plants is called
- a. microbiology.
 - b. phylogeny.
 - c. genomics.
 - d. epidemiology.
 - e. forensics.

ANS: D DIF: Medium REF: 1.6

OBJ: 1.6c State some uses of microbes in medicine and industry
MSC: Remembering

50. The ultracentrifuge is a high-speed centrifuge ideally suited for separating individual
- a. cellular proteins and nucleotides.
 - b. microbial cells.
 - c. mold spores.
 - d. secondary metabolites.
 - e. base pairs.

ANS: A DIF: Medium REF: 1.6

OBJ: 1.6a Describe the roles of the electron microscope and the ultracentrifuge in advancing our knowledge of cell structure and function MSC: Understanding

SHORT ANSWER

1. What is the MOST recent evidence suggesting that all life on Earth shares a common ancestry?

ANS:

Many genomes have now been sequenced, and those sequences are available in databases for comparison. This field is referred to as comparative genomics. Comparisons have revealed that there is a set of core genes shared by all organisms.

DIF: Difficult REF: 1.1 | 1.5

OBJ: 1.1d Explain the implications of microbial genome sequencing | 1.5b Outline how microbial classification has changed over time MSC: Analyzing

2. How are prokaryotes and eukaryotes different?

ANS:

A prokaryote lacks a nucleus and membrane-bounded organelles, whereas a eukaryote has a nucleus and membrane-bounded organelles.

DIF: Easy REF: 1.1 | 1.5 OBJ: 1.1a Recall the definition of a microbe

MSC: Remembering

3. How do microbes help in the extraction of minerals?

ANS:

Several lithotrophic bacteria help in the rapid oxidation of minerals, which generates strong acids that expedite the breakdown of mineral ore. Currently, approximately 20% of the world's copper, as well as some uranium and zinc, is produced by bacterial leaching.

DIF: Medium REF: 1.2

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

MSC: Applying

4. Antonie van Leeuwenhoek worked as a cloth draper, inspecting the quality of cloth. How did this lead to his interest in microscopy?

ANS:

His work introduced him to magnifying lenses. He began the hobby of grinding lenses, ultimately making a microscope that enabled him to observe single-celled microbes.

DIF: Medium REF: 1.2

OBJ: 1.2c Identify the contributions of the following individuals: Nightingale, Hooke, van

Leeuwenhoek, Pasteur, and Tyndall MSC: Understanding

5. What was the major complaint about Lazzaro Spallanzani's experiment to disprove spontaneous generation, and how did Louis Pasteur's swan-neck flasks overcome this?

ANS:

Spallanzani's flasks were plugged so as not to let organisms accidentally enter the boiled medium. Opponents argued that no growth was observed simply due to the lack of oxygen. Pasteur's swan-neck flasks did not allow organisms to enter the flask but did allow oxygen to enter. Growth was still not observed.

DIF: Medium REF: 1.2

OBJ: 1.2c Identify the contributions of the following individuals: Nightingale, Hooke, van

Leeuwenhoek, Pasteur, and Tyndall MSC: Evaluating

6. Describe the discoveries of Louis Pasteur while working with the French beer and wine manufacturers in assessing alcohol versus vinegar production during fermentation.

ANS:

Previously, it was believed that the conversion of grapes and grain to wine and beer was a spontaneous chemical process. Pasteur discovered that this fermentation was caused by living yeast, which did not require oxygen for growth. He also discovered that when the grapes or grain are contaminated with bacteria instead of yeast, acetic acid is produced instead of alcohol.

DIF: Medium REF: 1.2

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

7. Describe the effects of three microbial diseases that have significantly affected human populations throughout history.

ANS:

Answers may vary. Some examples include bubonic plague, which killed one-third of Europe's population in the fourteenth century; tuberculosis, which was common in the nineteenth century; AIDS, which affects many people today; and smallpox, which killed a large number of native North Americans.

DIF: Medium 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: Applying

8. Why did it take so long for humans to determine that microbes cause infectious diseases?

ANS:

Microbes are too small to be seen with the naked eye, so until powerful-enough microscopes were invented, humans did not know that microbes existed. Even after humans were aware of the presence of microbes, they did not suspect them of causing disease until people such as Joseph Lister and Ignaz Semmelweis performed experiments that showed antiseptics decrease the incidence of infection.

DIF: Difficult REF: 1.2 | 1.3

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

9. Robert Koch's postulates have not been used to prove HIV as the causative agent of AIDS. Why not?

ANS:

Answers may vary, but a major reason is that humans cannot be injected with HIV to see if they develop AIDS, and a suitable animal host doesn't exist for testing.

DIF: Medium REF: 1.3

OBJ: 1.3c Assess some of the practical obstacles in applying Koch's postulates MSC: Understanding

10. Define "attenuation" and describe some mechanisms used to attenuate pathogens.

ANS:

Attenuation results in a weakened organism that will not produce full-blown disease but will generate immunity. Answers for mechanisms may vary, but heat treatment or aging for various periods or natural attenuation in the host are mentioned in the chapter.

DIF: Medium 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: Applying

11. What is the significance of the work of Ignaz Semmelweis and Joseph Lister?

ANS:

They showed that use of antiseptics on doctors' hands and medical instruments drastically reduced the mortality rate of hospital patients. They made these observations before Robert Koch's germ theory of disease.

DIF: Medium REF: 1.3

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

12. How would you use Robert Koch's postulates to prove that a specific organism causes a new disease in mice?

ANS:

See Figure 1.17 in the textbook:

- (1) The suspected organism is found in all diseased mice, but is absent from healthy mice.
- (2) The suspected organism is isolated from the diseased mice and grown in pure culture.
- (3) When the suspected organism is introduced into a healthy mouse, the same disease occurs.
- (4) The same strain of microbe is obtained from the newly diseased mouse.

DIF: Difficult REF: 1.3 OBJ: 1.3b List Koch's postulates
MSC: Applying

13. Explain why the organisms that were studied by Sergei Winogradsky could not be grown on Robert Koch's plate media containing agar or gelatin.

ANS:

The organisms studied by Winogradsky were lithotrophs, which feed solely on inorganic substances. Koch's plate media contained organic nutrient sources, which may even be toxic to the organisms he was attempting to grow.

DIF: Medium REF: 1.4

OBJ: 1.4a List Winogradsky's contributions to microbial culture technique
MSC: Analyzing

14. Is it true that only culturable bacteria contribute to ecology? Explain your answer.

ANS:

No, this is not a true statement. It is estimated that barely 0.1% of microbial species can be cultured. The work of Winogradsky and later microbial ecologists showed that bacteria are necessary for geochemical cycling. Many of these organisms can't be grown in pure culture on laboratory media but can be grown in enrichment culture such as a Winogradsky column.

DIF: Difficult REF: 1.4

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

MSC: Analyzing

15. Define the term “endosymbiont” and give an example of an endosymbiotic relationship found in nature.

ANS:

An endosymbiont is an organism living symbiotically inside a larger organism. Examples may vary, but include the following: *Rhizobium* in a leguminous plant, bioluminescent bacteria in the light organs of fish and squid, and photosynthetic algae and coral.

DIF: Medium REF: 1.4

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

MSC: Applying

16. Give two reasons why microbes have been difficult to classify.

ANS:

First, even with the use of light microscopes, only the basic shape of microbes can be determined, and many microbes have similar shapes even though they are very different in other ways. Second, microbes do not fit the classic definition of a species, which is a group of organisms that interbreed. Microbes typically reproduce asexually. When they do exchange genes, they may do so with distantly related species.

DIF: Medium REF: 1.5

OBJ: 1.5a Explain why microbes can be challenging to classify taxonomically

MSC: Analyzing

17. Briefly explain the endosymbiosis theory and the evidence that supports it.

ANS:

The endosymbiosis theory proposes that mitochondria and chloroplasts evolved from bacteria that were engulfed by pre-eukaryotic cells, and that over time these endosymbiotic prokaryotic cells lost the ability to survive outside of the host cell but were maintained as organelles. Evidence supporting the endosymbiosis theory includes the fact that mitochondria and chloroplasts possess circular DNA with similarity to modern bacteria.

DIF: Medium REF: 1.5

OBJ: 1.5c Appraise endosymbiosis as an explanation for mitochondria and chloroplasts

MSC: Understanding

18. What were Rosalind Franklin’s contributions toward discovering the structure of DNA, and why wasn’t she one of the recipients of the Nobel Prize for this discovery?

ANS:

She was an X-ray crystallographer who studied the structure of DNA. Her X-ray micrographs showed for the first time that DNA was a double helix. A colleague showed her micrographs to James Watson, who was also studying the structure of DNA. Watson and Francis Crick published their model of the structure of DNA in the journal *Nature* and denied that they had used Franklin’s micrographs. Franklin also died before the awarding of the prize.

DIF: Medium REF: 1.6

OBJ: 1.6a Describe the roles of the electron microscope and the ultracentrifuge in advancing our

knowledge of cell structure and function MSC: Understanding

19. Briefly describe how the ultracentrifuge is used to determine the sizes of cellular macromolecules.

ANS:

The ultracentrifuge uses centrifugal forces to separate cell components. Theodor Svedberg calculated that the particle sizes could be determined based on the rate of sedimentation of the particles in an ultracentrifuge.

DIF: Medium REF: 1.6

OBJ: 1.6a Describe the roles of the electron microscope and the ultracentrifuge in advancing our knowledge of cell structure and function MSC: Understanding

20. If you want to produce DNA polymerases like those used in polymerase chain reaction (PCR) for amplification of DNA, from which natural environment would you try to isolate the producers?

ANS:

Since DNA polymerase in PCR must survive many rounds of cycling to near-boiling temperatures, the most conducive environment for finding DNA polymerase, such as the enzymes used in PCR reactions, would be searching for microbes in an environment where the temperature is extremely high.

DIF: Difficult REF: 1.6

OBJ: 1.6c State some uses of microbes in medicine and industry
MSC: Applying