Microbiology with Diseases by Taxonomy, 6e **(Bauman)**
Chapter 1 A Brief History of Microbiology

1.1 Multiple Choice Questions

1) Antoni van Leeuwenhoek was the first person in history to
A) use a magnifying glass.
B) develop a taxonomic system.
C) view microorganisms and record these observations.
D) disprove spontaneous generation.
E) propose the germ theory of disease.
Answer: C
Bloom's Taxonomy: Knowledge
Section: The Early Years of Microbiology
Learning Outcome: 1.1

2) The microbes commonly known as _____ are single-celled eukaryotes that are generally motile.
A) archaea
B) bacteria
C) fungi
D) protozoa
E) viruses
Answer: D
Bloom's Taxonomy: Comprehension
Section: The Early Years of Microbiology
Learning Outcome: 1.3

3) Which of the following statements about algae is FALSE?
A) The group includes seaweeds and kelps.
B) They are photosynthetic organisms.
C) They provide most of the oxygen on Earth.
D) They are important in the degradation of dead plants and animals.
E) They are a source of food for aquatic and marine animals.
Answer: D
Bloom's Taxonomy: Comprehension
Section: The Early Years of Microbiology
Learning Outcome: 1.3

4) Louis Pasteur demonstrated that fermentation of sugar to produce alcohol is caused by
A) aerobes.
B) facultative anaerobes.
C) obligate parasites.
D) archaea.
E) prokaryotes.
Answer: B
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.6

5) Which of the following scientists provided evidence in favor of the concept of spontaneous generation?
A) Pasteur
B) Needham
C) Redi
D) Buchner
E) Spallanzani
Answer: B
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.9

6) Pasteur's experiments on fermentation laid the foundation for
A) industrial microbiology.
B) epidemiology.
C) immunology.
D) abiogenesis.
E) antisepsis.
Answer: A
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.11

7) Which of the following statements about fungi is FALSE?
A) Fungi are eukaryotes.
B) Molds are multicellular.
C) Fungi have a cell wall.
D) Fungi are photosynthetic.
E) Yeasts are unicellular.
Answer: D
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.3

8) Which of the following contributed to the successful application of Koch's postulates?
A) The development of the compound microscope.
B) The theory of abiogenesis.
C) The ability to record the appearance of bacteria photographically.
D) The development of simple bacterial staining techniques.
E) The development of techniques for sterile transfer of bacteria.
Answer: E
Bloom's Taxonomy: Applying
Section: The Golden Age of Microbiology
Learning Outcome: 1.14

9) Which of the following individuals pioneered the use of chemicals to reduce the incidence of infections during surgery?
A) Nightingale
B) Snow
C) Ehrlich
D) Lister
E) Semmelweis
Answer: D
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.16

10) The technique developed by Hans Christian Gram is important for bacterial
A) etiology.
B) identification.
C) classification.
D) isolation.
E) epidemiology.
Answer: B
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.15

11) The use of chemical agents to harm or kill microbes is
A) immunology.
B) chemotherapy.
C) epidemiology.
D) serology.
E) biotechnology.
Answer: B
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.18

12) Parasitic worms, even meters-long tapeworms, are studied in microbiology because
A) they are parasites.
B) diagnosis usually involves microscopic examination of patient samples.
C) the Gram stain can be used to identify them.
D) Leeuwenhoek first discovered them.
E) no one else wants to study them.
Answer: B
Bloom's Taxonomy: Comprehension
Section: The Early Years of Microbiology
Learning Outcome: 1.4

13) Which of the following areas of investigation is considered a major driver of modern microbiology?
A) microbial classification
B) industrial microbiology
C) the etiology of infectious disease
D) genetics
E) food preparation
Answer: D
Bloom's Taxonomy: Comprehension
Section: The Modern Age of Microbiology
Learning Outcome: 1.19

14) Work by _____ laid the foundations of immunology with the development of vaccines.
A) Redi and Spallanzani
B) Koch and Pasteur
C) Jenner and Pasteur
D) Lister and Semmelweis
E) Pauling and Woese
Answer: C
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.17

15) According to Kluyver and van Niel, which of the following are TRUE of basic biochemical reactions?
A) They are shared by all living things.
B) There are an unlimited number of them.
C) They primarily involve the transfer of electrons and ions.
D) Basic biochemical reactions shared by all living things primarily involve transfer of electrons and hydrogen ions.
E) They primarily involve transfers of chemical groups.
Answer: D
Bloom's Taxonomy: Applying
Section: The Modern Age of Microbiology
Learning Outcome: 1.19

16) Semmelweis advocated handwashing as a method of preventing which of the following diseases?
A) cholera
B) puerperal fever
C) smallpox
D) anthrax
E) syphilis
Answer: B
Bloom's Taxonomy: Applying
Section: The Golden Age of Microbiology
Learning Outcome: 1.16

17) Paul Ehrlich used chemotherapy to treat
A) cholera.
B) cancer.
C) anthrax.
D) smallpox.
E) syphilis.
Answer: E
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.18

18) Which of the following is NOT a characteristic of viruses?
A) They are visible with a light microscope.
B) They are acellular.
C) They are composed of genetic material and protein.
D) They are typically smaller than prokaryotic cells.
E) They are obligatory parasites.
Answer: A
Bloom's Taxonomy: Comprehension
Section: The Early Years of Microbiology
Learning Outcome: 1.3

19) The first true vaccine protected against disease caused by a(n) _____ pathogen.
A) bacterial
B) protozoal
C) fungal
D) viral
E) archaeal
Answer: D
Bloom's Taxonomy: Applying
Section: The Golden Age of Microbiology
Learning Outcome: 1.17

20) All of the following individuals were involved in improving public health in the 19th century EXCEPT
A) Snow.
B) Spallanzani.
C) Nightingale.
D) Semmelweis.
E) Lister.
Answer: B
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.16

21) The microorganisms Antoni van Leeuwenhoek called "animalcules" we would recognize as
A) bacteria.
B) algae.
C) protozoa.
D) fungus.
E) both bacteria and protozoa.
Answer: E
Bloom's Taxonomy: Knowledge
Section: The Early Years of Microbiology
Learning Outcome: 1.2

22) Inserting a gene from the hepatitis B virus into yeast so that the yeast produces a viral protein is an example of
A) etiology.
B) genetic engineering.
C) immunology.
D) microbial genetics.
E) gene therapy.
Answer: B
Bloom's Taxonomy: Applying
Section: The Modern Age of Microbiology
Learning Outcome: 1.19

23) Which of the following was NOT an aspect of Pasteur's experiments to disprove spontaneous generation?
A) The necks of the flasks he used were bent into an S-shape.
B) He boiled the infusions to kill any microbes present.
C) The flasks were incubated for very long periods of time.
D) The flasks were free of microbes until they were opened.
E) The flasks he used were sealed with corks.
Answer: E
Bloom's Taxonomy: Applying
Section: The Golden Age of Microbiology
Learning Outcome: 1.9

24) Which of the following was a crucial difference between the work of John T. Needham and Louis Pasteur on the question of spontaneous generation?
A) Whether or not the infusions were boiled.
B) Whether or not the flasks were sealed.
C) Whether meat or infusions were used.
D) The length of time the flasks were boiled.
E) The method of sealing the flasks.
Answer: B
Bloom's Taxonomy: Analyzing
Section: The Golden Age of Microbiology
Learning Outcome: 1.9

25) Which of the following is NOT a characteristic of protozoa?
A) Most exhibit asexual reproduction.
B) They are single-celled organisms.
C) They are eukaryotic organisms.
D) They are all photosynthetic.
E) They frequently possess cilia or flagella.
Answer: D
Bloom's Taxonomy: Comprehension
Section: The Early Years of Microbiology
Learning Outcome: 1.4

26) Who formulated the hypothesis that certain chemicals could kill microbes without harming humans was the foundation for chemotherapy?
A) Ehrlich
B) Koch
C) Gram
D) Lister
E) Pasteur
Answer: A
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.18

27) The work of Eduard Buchner and the discovery of enzymes laid the foundations for the field of
A) biochemistry.
B) epidemiology.
C) immunology.
D) mycology.
E) genetics.
Answer: A
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.12

28) What is the correct order for the application of Koch's postulates?
I. Inoculate suspect agent into test subject and observe that subject develops disease of interest.
II. Isolate and culture suspect agent in the laboratory.
III. Find suspect agent is every case of disease of interest but not in healthy hosts.
IV. Recover and isolate suspect agent from test subject.
A) III, I, IV, II
B) IV, I, III, II
C) I, II, III, IV
D) III, II, I, IV
E) IV, I, II, III
Answer: D
Bloom's Taxonomy: Analyzing
Section: The Golden Age of Microbiology
Learning Outcome: 1.14

29) John Snow's research during a cholera outbreak in London laid the foundation for which of the following branches of microbiology?
A) infection control only
B) epidemiology only
C) immunology only
D) both infection control and epidemiology
E) infection control, epidemiology, and immunology
Answer: D
Bloom's Taxonomy: Applying
Section: The Golden Age of Microbiology
Learning Outcome: 1.16

30) Robert Koch was involved in research on all of the following topics EXCEPT
A) the cause of anthrax.
B) the cause of fermentation.
C) development of a method to determine the cause of an infectious disease.
D) the cause of tuberculosis.
E) techniques for isolating microbes in the laboratory.
Answer: B
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.13

31) Which of the following is an INCORRECT pairing?
A) protozoa; multicellular
B) fungi; cell walls
C) algae; aquatic and marine habitats
D) prokaryotes; no nuclei
E) viruses; acellular parasites
Answer: A
Bloom's Taxonomy: Comprehension
Section: The Early Years of Microbiology
Learning Outcome: 1.3

32) What was the first disease shown to be bacterial in origin?
A) yellow fever
B) cholera
C) anthrax
D) malaria
E) tuberculosis
Answer: C
Bloom's Taxonomy: Applying
Section: The Golden Age of Microbiology
Learning Outcome: 1.13

33) The work of Lister, Nightingale, and Semmelweis all contributed to controlling infectious disease by
A) developing techniques for isolating pathogens.
B) developing methods for reducing healthcare-associated infections (HAIs).
C) identifying the sources of infectious agents.
D) determining the taxonomic relationships among microbes.
E) developing vaccines.
Answer: B
Bloom's Taxonomy: Applying
Section: The Golden Age of Microbiology
Learning Outcome: 1.16

34) Who discovered penicillin?
A) Fleming
B) Ehrlich
C) Kitasato
D) Pasteur
E) Domagk
Answer: A
Bloom's Taxonomy: Knowledge
Section: The Modern Age of Microbiology
Learning Outcome: 1.18

35) The principle of disinfection to reduce HAIs (healthcare-associated infections) among patients was initially introduced by
A) L. Pasteur and R. Koch.
B) I. Semmelweis and J. Lister.
C) P. Ehrlich and A. Fleming.
D) J. Snow and R. Koch.
E) E. Jenner and L. Pasteur.
Answer: B
Bloom's Taxonomy: Comprehension
Section: The Modern Age of Microbiology
Learning Outcome: 1.16

36) Microorganisms characterized by the absence of a nucleus are called
A) fungi.
B) pathogens.
C) eukaryotes.
D) prokaryotes.
E) viruses.
Answer: D
Bloom's Taxonomy: Knowledge
Section: The Early Years of Microbiology
Learning Outcome: 1.5

37) The term that literally means "against putrefaction" is
A) antisepsis.
B) prokaryote.
C) chemotherapy.
D) recombinant technology.
E) nosocomial.
Answer: A
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.16

38) The experiments conducted by John T. Needham using infusions were interpreted as supporting the theory of
A) antisepsis.
B) bioremediation.
C) spontaneous generation.
D) etiology.
E) chemotherapy.
Answer: C
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.6

39) An explanation of observations and data supported by the experimental results of many scientists for many years is
A) a theory.
B) a hypothesis.
C) scientific method.
D) popular opinion.
E) a control group.
Answer: A
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.10

40) The first school of nursing was founded by
A) Robert Koch.
B) Joseph Lister.
C) Florence Nightingale.
D) Ignaz Semmelweis.
E) John Snow.
Answer: C
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.16

41) The term for the use of microorganisms to restore damaged environments is
A) epidemiology.
B) bioremediation.
C) chemotherapy.
D) serology.
E) ecology.
Answer: B
Bloom's Taxonomy: Comprehension
Section: The Modern Age of Microbiology
Learning Outcome: 1.20

42) The term _____ refers to the study of the blood components that fight infection.
A) antisepsis
B) chemotherapy
C) etiology
D) serology
E) bioremediation
Answer: D
Bloom's Taxonomy: Applying
Section: The Modern Age of Microbiology
Learning Outcome: 1.20

43) The work of _____ demonstrated the role of microbes in the cycling of sulfur in the environment.
A) Sergei Winogradski
B) Paul Ehrlich
C) Eduard Buchner
D) Martinus Beijerinck
E) Albert Kluyver
Answer: A
Bloom's Taxonomy: Knowledge
Section: The Modern Age of Microbiology
Learning Outcome: 1.20

1.2 True/False Questions

1) Protozoa are also called prokaryotes.
Answer: FALSE
Bloom's Taxonomy: Knowledge
Section: The Early Years of Microbiology
Learning Outcome: 1.4

2) Single-celled organisms known as diatoms have glasslike walls and are a type of algae.
Answer: TRUE
Bloom's Taxonomy: Knowledge
Section: The Early Years of Microbiology
Learning Outcome: 1.4

3) Bioremediation is the study of how diseases emerge and how to prevent them.
Answer: FALSE
Bloom's Taxonomy: Comprehension
Section: The Modern Age of Microbiology
Learning Outcome: 1.19

4) Louis Pasteur is considered the Father of Microbiology because of the many carefully conducted experiments and observations he made with microbes.
Answer: TRUE
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.11

5) Gene therapy is a modern approach to preventing infectious disease.
Answer: FALSE
Bloom's Taxonomy: Comprehension
Section: The Modern Age of Microbiology
Learning Outcome: 1.20

6) Koch's postulates can be used to determine the causes of infectious diseases.
Answer: TRUE
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.14

7) Joseph Lister reduced the incidence of wound infections in health care settings by using chlorinated lime water.
Answer: FALSE
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.16

8) Robert Koch sought a "magic bullet" for the treatment of disease caused by bacteria.
Answer: FALSE
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.13

9) Fermentation can occur in the absence of living cells.
Answer: TRUE
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.12

10) Lazzaro Spallanzani was the first scientist to provide evidence disproving the spontaneous generation of microorganisms.
Answer: TRUE
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.9

1.3 Short Answer Questions

1) The amateur scientist (Koch/Leeuwenhoek/Pasteur) made his own microscopes and first reported the existence of microbes.
Answer: Leeuwenhoek
Bloom's Taxonomy: Knowledge
Section: The Early Years of Microbiology
Learning Outcome: 1.1

2) A cell that contains a nucleus is called a(n) (prokaryotic/archaeal/eukaryotic) cell.
Answer: eukaryotic
Bloom's Taxonomy: Knowledge
Section: The Early Years of Microbiology
Learning Outcome: 1.5

3) A(n) (photosynthetic/algae/prokaryotic) organism makes its own food using light energy.
Answer: photosynthetic
Bloom's Taxonomy: Comprehension
Section: The Early Years of Microbiology
Learning Outcome: 1.3

4) Microbes that cause infectious diseases are called (pathogens/germs/viruses).
Answer: pathogens
Bloom's Taxonomy: Knowledge
Section: The Early Years of Microbiology
Learning Outcome: 1.3

5) Multicellular eukaryotes that derive nutrients from organisms, and have a cell wall are (algae/fungi/protozoa).
Answer: fungi
Bloom's Taxonomy: Knowledge
Section: The Early Years of Microbiology
Learning Outcome: 1.3

6) A scientist conducts experiments to test a(n) (observation/hypothesis/theory).
Answer: hypothesis
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.10

7) The work of (Needham/Redi/Spallanzani) using infusions in sealed vials provided strong evidence that spontaneous generation does not occur.
Answer: Spallanzani
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.9

8) Work by (Ehrlich/Koch/Pasteur) contributed to the foundation of immunology, the study of the body's defenses against disease.
Answer: Pasteur
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.17

9) A (colony/habitat/biofilm) is a mixed population of microbes growing together on surfaces.
Answer: biofilm
Bloom's Taxonomy: Comprehension
Section: The Modern Age of Microbiology
Learning Outcome: 1.20

10) Experiments conducted by (Needham/Redi/Spallanzani) provided support for the theory of spontaneous generation.
Answer: Needham
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.8

11) Ignaz Semmelweis demonstrated the importance of (antisepsis/vaccination/hand-washing) as a means of preventing disease transmission.
Answer: hand-washing
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.16

12) An important tool for identification of bacteria was developed by (H. C. Gram/R. Koch/S. Winogradski).
Answer: H. C. Gram
Bloom's Taxonomy: Comprehension
Section: The Golden Age of Microbiology
Learning Outcome: 1.15

13) The use of chemicals to treat diseases, such as bacterial infections, is called (gene therapy/chemotherapy/bioremediation).
Answer: chemotherapy
Bloom's Taxonomy: Knowledge
Section: The Golden Age of Microbiology
Learning Outcome: 1.18

14) The work of Oswald Avery, George Beadle, Edward Tatum and many others into the role of DNA laid the foundations of (microbial genetics/microbiology/recombinant DNA technology).
Answer: microbial genetics
Bloom's Taxonomy: Comprehension
Section: The Modern Age of Microbiology
Learning Outcome: 1.19

15) The microbes known as archaea are (fungi/prokaryotes/protozoa).
Answer: prokaryotes
Bloom's Taxonomy: Knowledge
Section: The Early Years of Microbiology
Learning Outcome: 1.5

1.4 Essay Questions

1) You are a young scientist who has just learned about one of the hot topics in microbiology, biofilms. One aspect of the interest in biofilms is that the microbes living within biofilms appear to behave and function differently from their counterparts not living in a biofilm. Devise a way to explore the idea. (Do not focus on the technical details of how this might be accomplished.)
Answer: Many answers are possible. A good answer should have a clear statement of hypothesis and an experimental design that reflects the hypothesis and will provide interpretable quantitative results. An excellent answer may include projections of possible outcomes and/or alternative hypotheses.
Bloom's Taxonomy: Synthesis
Section: The Modern Age of Microbiology
Learning Outcome: 1.9, 1.19

2) Biotechnology can be said to have ancient roots. Explain.
Answer: Biotechnology is the use of microbes to yield beneficial products. Humans have used microbes to their benefit for millennia in producing beer and wine, which were often safer to drink than the available water, and in preserving foods. Examples of the latter include the production of wine, which essentially preserved fruit juices, and of cheese and yogurt, which extended the storage life of milk products. Soy sauce and other fermented sauces were also preserved by fermentation and were later shown to enhance the flavors of certain foods.
Bloom's Taxonomy: Applying
Section: The Golden Age of Microbiology
Learning Outcome: 1.11

3) Use the basic steps of the scientific method to describe Pasteur's experiments to investigate spontaneous generation.
Answer: The observation that life seemed to appear from non-life led some scientists to believe in the theory of spontaneous generation. However, Pasteur among others believed in biogenesis: that life must come from life. The question Pasteur hoped to answer was "Where do microbes come from?" (step 1). Pasteur's hypothesis (step 2) was that the "parents" of microbes were present in the air on dust particles. In his experiments (step 3), he used swan-necked flasks, which were designed to prevent microbes from entering the sterile broth inside them. He observed that the broth remained sterile in the control flask even though air could move into and out of the flask. The experimental flasks were also swan-necked, but they were tilted to allow the dust that had settled to enter the flask. The control flasks stayed sterile, and the experimental flasks became cloudy. These observations led Pasteur to accept his hypothesis (step 4). He concluded that the microbes came from the dust and that spontaneous generation was therefore not a valid theory.
Bloom's Taxonomy: Applying
Section: The Golden Age of Microbiology
Learning Outcome: 1.10

4) Explain how the discipline of biochemistry grew out of the science of microbiology.
Answer: Some of the first experiments in biochemistry are attributed to Louis Pasteur in his research on the causes of fermentation. His research was extended by Eduard Buchner, who showed that enzymes produced by microbial cells are responsible for the phenomenon of fermentation. Later, in the early 20th century, Kluyver and van Niel advocated the use of microbes in research on basic biochemical reactions, which they maintained are common to all living things. Further advances in biochemistry were made as microbiologists such as Beadle and Tatum and Avery and his colleagues explored the nature of the genetic material and its function using microorganisms as model systems.
Bloom's Taxonomy: Analyzing
Section: The Modern Age of Microbiology
Learning Outcome: 1.12, 1.19

5) Compare and contrast the three types of eukaryotic microbes.
Answer: The three types of eukaryotic microbes are fungi, protozoa, and algae. Because they are all composed of eukaryotic cells, they have basic similarities in cellular structure, including the presence of a nucleus. However, these types of microbes differ in many ways as well. In terms of their nutrition, fungi and protozoa obtain their food from other organisms, whereas algae can make their own food through photosynthesis (a few protozoa also carry out photosynthesis). Fungi are also the major decomposers, recycling the remains of plants and animals. Algae and fungi can be multicellular organisms, but protozoa are found only as single-celled organisms. Protozoa are unique among the three in that they are animal-like in their characteristics, including movement, and lack a cell wall. Algae are most like plants and are found in primarily water-based environments.
Bloom's Taxonomy: Analyzing
Section: The Early Years of Microbiology
Learning Outcome: 1.4