Chapter 01
The Evolution of Microorganisms and Microbiology

True / False Questions

1. Extant microorganisms are organisms from the fossil record that are no longer present on Earth today.
FALSE

ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Topic: Module 01 Evolution
Blooms Level: 2. Understand
Learning Outcome: 01.01.04 Determine the type of microbe (e.g., bacterium, fungus, etc.) when given a description of a newly discovered microbe
Learning Outcome: 01.02.01 Propose a time line of the origin and history of microbial life and integrate supporting evidence into it
Section: 01.02
Topic: Taxonomy of Microorganisms

Fill in the Blank Questions

2. All cellular organisms can be placed into one of three _____, which include the *Bacteria*, *Archaea*, and the *Eukarya*.
domains

ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Topic: Module 01 Evolution
Blooms Level: 2. Understand
Learning Outcome: 01.01.04 Determine the type of microbe (e.g., bacterium, fungus, etc.) when given a description of a newly discovered microbe
Section: 01.02
Topic: Taxonomy of Microorganisms

3. *Archaea* are cellular organisms that have unique cell membrane _____.
lipids

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.03 Bacteria and Archaea have specialized structures (e.g. flagella, endospores, and pili) that often confer critical capabilities.
ASM Topic: Module 02 Cell Structure and Function
Blooms Level: 1. Remember
Learning Outcome: 01.01.04 Determine the type of microbe (e.g., bacterium, fungus, etc.) when given a description of a newly discovered microbe
Learning Outcome: 01.02.02 Design a set of experiments that could be used to place a newly discovered cellular microbe on a phylogenetic tree based on small subunit (SSU) rRNA sequences
Section: 01.01
Topic: Archaea

True / False Questions

4. Microbiologists study a variety of organisms, but all are considered either *Bacteria* or *Archaea*.
FALSE

ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 2. Understand
Learning Outcome: 01.01.01 Differentiate the biological entities studied by microbiologists from those studied by other biologists
Section: 01.01
Topic: Taxonomy of Microorganisms

5. All eukaryotes have a membrane-delimited nucleus.
TRUE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.04 While microscopic eukaryotes (for example, fungi, protozoa and algae) carry out some of the same processes as bacteria, many of the cellular properties are fundamentally different.
ASM Topic: Module 02 Cell Structure and Function
Blooms Level: 2. Understand
Learning Outcome: 01.01.01 Differentiate the biological entities studied by microbiologists from those studied by other biologists
Learning Outcome: 01.01.04 Determine the type of microbe (e.g., bacterium, fungus, etc.) when given a description of a newly discovered microbe
Section: 01.01
Topic: Taxonomy of Microorganisms

6. Viruses are not generally studied by microbiologists because they are not classified as living organisms.
FALSE

ASM Objective: 02.05 The replication cycles of viruses (lytic and lysogenic) differ among viruses and are determined by their unique structures and genomes.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 05 Microbial Systems
Blooms Level: 2. Understand
Learning Outcome: 01.01.01 Differentiate the biological entities studied by microbiologists from those studied by other biologists
Section: 01.01
Topic: Taxonomy of Microorganisms

7. Viruses constitute the fourth domain of life in current biological classification schemes.
FALSE

ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Topic: Module 01 Evolution
Blooms Level: 2. Understand
Learning Outcome: 01.01.02 Explain Carl Woese's contributions in establishing the three-domain system for classifying cellular life
Section: 01.01
Topic: Taxonomy of Microorganisms

Multiple Choice Questions

8. Protists contain all of the following forms of life EXCEPT
A. protozoa.
B. fungi.
C. slime molds.
D. algae.

ASM Objective: 02.04 While microscopic eukaryotes (for example, fungi, protozoa and algae) carry out some of the same processes as bacteria, many of the cellular properties are fundamentally different.
ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.01.01 Differentiate the biological entities studied by microbiologists from those studied by other biologists
Section: 01.01
Topic: Taxonomy of Microorganisms

9. Cells with a relatively complex morphology that have a true membrane-delimited nucleus are called
A. prokaryotes.
B. eukaryotes.
C. urkaryotes.
D. nokaryotes.

ASM Objective: 01.01 Cells, organelles (e.g. mitochondria and chloroplasts) and all major metabolic pathways evolved from early prokaryotic cells.
ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.04 While microscopic eukaryotes (for example, fungi, protozoa and algae) carry out some of the same processes as bacteria, many of the cellular properties are fundamentally different.
ASM Topic: Module 01 Evolution
ASM Topic: Module 02 Cell Structure and Function
Blooms Level: 2. Understand
Learning Outcome: 01.01.01 Differentiate the biological entities studied by microbiologists from those studied by other biologists
Learning Outcome: 01.01.04 Determine the type of microbe (e.g., bacterium, fungus, etc.) when given a description of a newly discovered microbe
Section: 01.01
Topic: Taxonomy of Microorganisms

10. Cells with a relatively simple cell morphology that do not have a true membrane-delimited nucleus are called
A. prokaryotes.
B. eukaryotes.
C. urkaryotes.
D. nokaryotes.

ASM Objective: 01.01 Cells, organelles (e.g. mitochondria and chloroplasts) and all major metabolic pathways evolved from early prokaryotic cells.
ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.04 While microscopic eukaryotes (for example, fungi, protozoa and algae) carry out some of the same processes as bacteria, many of the cellular properties are fundamentally different.
ASM Topic: Module 01 Evolution
ASM Topic: Module 02 Cell Structure and Function
Blooms Level: 2. Understand
Learning Outcome: 01.01.01 Differentiate the biological entities studied by microbiologists from those studied by other biologists
Learning Outcome: 01.01.04 Determine the type of microbe (e.g., bacterium, fungus, etc.) when given a description of a newly discovered microbe
Section: 01.01
Topic: Taxonomy of Microorganisms

11. The ribosomal RNA studies that led to the division of prokaryotic organisms into the Bacteria and the Archaea were begun by

A. Pasteur.

B. Woese.

C. Needham.

D. Watson.

ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Objective: 02.03 Bacteria and Archaea have specialized structures (e.g. flagella, endospores, and pili) that often confer critical capabilities.
ASM Topic: Module 01 Evolution
ASM Topic: Module 02 Cell Structure and Function
Blooms Level: 1. Remember
Learning Outcome: 01.01.02 Explain Carl Woese's contributions in establishing the three-domain system for classifying cellular life
Section: 01.01
Topic: Archaea
Topic: Bacteria
Topic: Taxonomy of Microorganisms

12. Proteins function in modern cells as

A. catalysts.
B. hereditary information.
C. structural elements.
D. both catalysts and structural elements.

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 03.01 Bacteria and Archaea exhibit extensive, and often unique, metabolic diversity (e.g. nitrogen fixation, methane production, anoxygenic photosynthesis).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 03 Metabolic Pathways
Blooms Level: 2. Understand
Learning Outcome: 01.02.01 Propose a time line of the origin and history of microbial life and integrate supporting evidence into it
Section: 01.02
Topic: Bacterial Cellular Morphology

13. RNA serves to convert the information stored in DNA to _____.
A. carbohydrates
B. protein
C. lipids
D. RNA

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 03.01 Bacteria and Archaea exhibit extensive, and often unique, metabolic diversity (e.g. nitrogen fixation, methane production, anoxygenic photosynthesis).
ASM Objective: 04.02 Although the central dogma is universal in all cells, the processes of replication, transcription, and translation differ in Bacteria, Archaea, and Eukaryotes.
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 04 Information Flow and Genetics
Blooms Level: 2. Understand
Learning Outcome: 01.02.01 Propose a time line of the origin and history of microbial life and integrate supporting evidence into it
Section: 01.02
Topic: Taxonomy of Microorganisms

True / False Questions

14. The earliest microbial fossils that have been found are dated from approximately 4.5 million years ago.
FALSE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Topic: Module 01 Evolution
ASM Topic: Module 02 Cell Structure and Function
Blooms Level: 1. Remember
Learning Outcome: 01.02.01 Propose a time line of the origin and history of microbial life and integrate supporting evidence into it
Section: 01.02
Topic: Bacteria

Multiple Choice Questions

15. Which of the following distinguish the field of microbiology from other fields of biology?

A. The size of the organism studied.

B. The techniques used to study organisms regardless of their size.

C. Both the size of the organism studied and the techniques employed in the study of organisms.

D. Neither the size of the organism studied nor the techniques employed in the study of organisms regardless of their size.

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.04 While microscopic eukaryotes (for example, fungi, protozoa and algae) carry out some of the same processes as bacteria, many of the cellular properties are fundamentally different.
ASM Objective: 03.01 Bacteria and Archaea exhibit extensive, and often unique, metabolic diversity (e.g. nitrogen fixation, methane production, anoxygenic photosynthesis).
ASM Objective: 04.01 Genetic variations can impact microbial functions (e.g., in biofilm formation, pathogenicity and drug resistance).
ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Objective: 06.01 Microbes are essential for life as we know it and the processes that support life (e.g. in biogeochemical cycles and plant and / or animal microbiota).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 04 Information Flow and Genetics
ASM Topic: Module 05 Microbial Systems
ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 2. Understand
Learning Outcome: 01.04.01 Construct a concept map, table, or drawing that illustrates the diverse nature of microbiology and how it has improved human conditions
Section: 01.02
Section: 01.03
Section: 01.04
Topic: History of Microbiology

16. Who of the following developed a set of criteria that could be used to establish a causative link between a particular microorganism and a particular disease?
A. Fracastoro
B. Koch
C. Pasteur
D. Lister

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Learning Outcome: 01.03.02 Outline a set of experiments that might be used to decide if a particular microbe is the causative agent of a disease
Section: 01.03
Topic: Bacteria
Topic: History of Microbiology

17. Who of the following was the first to observe and accurately describe microorganisms?
A. Pasteur
B. Lister
C. van Leeuwenhoek
D. Tyndall

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ASM Objective: 02.04 While microscopic eukaryotes (for example, fungi, protozoa and algae) carry out some of the same processes as bacteria, many of the cellular properties are fundamentally different.
ASM Topic: Module 02 Cell Structure and Function
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

18. Who of the following provided the evidence needed to discredit the concept of spontaneous generation?
A. Pasteur
B. Koch
C. Semmelweiss
D. Lister

ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

19. The concept that living organisms arise from nonliving material is called
A. biogenesis.
B. cell theory.
C. spontaneous generation.
D. germ theory.

ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

20. The concept that human and animal diseases are caused by microorganisms is called the
A. cell theory.
B. germ theory.
C. causative theory.
D. disease theory.

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 2. Understand
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Learning Outcome: 01.03.02 Outline a set of experiments that might be used to decide if a particular microbe is the causative agent of a disease
Section: 01.03
Topic: History of Microbiology

21. Whose work on spontaneous generation first demonstrated the existence of a very heat-resistant form of bacteria that are called endospores?
A. Schwann
B. Redi
C. Tyndall
D. Pasteur

ASM Objective: 02.03 Bacteria and Archaea have specialized structures (e.g. flagella, endospores, and pili) that often confer critical capabilities.
ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

22. Antiseptic surgery was pioneered by
A. Pasteur.
B. Lister.
C. Jenner.
D. Kitasato.

ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

23. Studies by Emil von Behring and Shibasaburo Kitasato demonstrated that inactivated toxins can induce the synthesis of antitoxins in the blood of rabbits. These antitoxins (antibodies) are the basis of
A. humoral immunity.
B. cell-mediated immunity.
C. antibiotic immunity.
D. phagocyte-mediated immunity.

ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Section: 01.03
Topic: History of Microbiology

24. The first surgical antiseptic to be used was
A. iodine.
B. ethanol.
C. phenol.
D. None of the choices are correct.

ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

25. Old cultures of bacteria that have lost their ability to cause disease are said to be
A. impotent.
B. virulent.
C. pathogenic.
D. attenuated.

ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

26. Who is credited with developing and documenting the first vaccination procedure against smallpox?
A. Koch
B. Pasteur
C. Jenner
D. Lister

ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

27. Who is credited with developing a vaccine against chicken cholera?
A. Koch
B. Pasteur
C. Jenner
D. Lister

ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

28. Who of the following first discovered that some blood leukocytes could engulf disease-causing bacteria?
A. von Behring
B. Meister
C. Metchnikoff
D. Ivanowski

ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

29. The use of enrichment cultures and selective media was pioneered by
A. Beijerinck.
B. Jenner.
C. Pasteur.
D. von Behring.

ASM Objective: 03.03 The survival and growth of any microorganism in a given environment depends on its metabolic characteristics.
ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Topic: Module 03 Metabolic Pathways
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

True / False Questions

30. Fanny Hesse first suggested that agar be used to solidify microbiological media.
TRUE

ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Objective: 06.03 Humans utilize and harness microorganisms and their products.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

31. M. J. Berkeley demonstrated that the great potato blight of Ireland was caused by a fungus.
TRUE

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

32. Invisible living creatures were thought to exist and cause disease long before they were ever observed.
TRUE

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 2. Understand
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

33. Koch's postulates were instrumental in establishing that *Mycobacterium leprae* is the cause of leprosy.
FALSE

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Learning Outcome: 01.03.03 Predict the difficulties that might arise when using Koch's postulates to determine if a microbe causes a disease unique to humans
Section: 01.03
Topic: History of Microbiology

34. Edward Jenner's work in preventing rabies led to the use of the term vaccination to describe a type of procedure used in the prevention of disease.
FALSE

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Objective: 06.03 Humans utilize and harness microorganisms and their products.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

35. Although developed over 100 years ago, Koch's postulates continue to be used successfully in all known human infectious diseases.
FALSE

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 2. Understand
Learning Outcome: 01.03.03 Predict the difficulties that might arise when using Koch's postulates to determine if a microbe causes a disease unique to humans
Section: 01.03
Topic: History of Microbiology

36. Viruses and bacteria were first cultured in the laboratory at about the same time.
FALSE

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 2. Understand
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

37. Charles Chamberland developed porcelain filters that allowed other scientists to demonstrate that viruses are smaller than bacteria.
TRUE

ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

38. The first disease to be identified as being caused by a virus was tobacco mosaic disease.
TRUE

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Learning Outcome: 01.03.02 Outline a set of experiments that might be used to decide if a particular microbe is the causative agent of a disease
Section: 01.03
Topic: History of Microbiology

39. John Tyndall demonstrated that microorganisms present in the air are carried on dust particles.
TRUE

ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

40. Agastino Bassi demonstrated that a type of silkworm disease was caused by a fungus and proposed that many diseases are caused by microorganisms.
TRUE

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

41. The usefulness of agar in solidifying microbiological growth media is limited because it does not remain solid at temperatures above 28^{o}C.
FALSE

ASM Objective: 03.03 The survival and growth of any microorganism in a given environment depends on its metabolic characteristics.
ASM Objective: 06.03 Humans utilize and harness microorganisms and their products.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 2. Understand
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

42. Robert Koch developed a vaccine that could be used to prevent anthrax.
FALSE

ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

Fill in the Blank Questions

43. Elie Metchnikoff discovered _____, which is a major feature of the host immune response.
phagocytosis

ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Section: 01.03
Topic: History of Microbiology

44. An Italian physician, _____, challenged the concept of spontaneous generation by demonstrating that maggots do not arise from decaying meat but rather from developing fly eggs.
Redi

ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

45. _____ discovered that soil bacteria could oxidize iron, sulfur, and ammonia to obtain energy.
Winogradsky

ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Objective: 06.01 Microbes are essential for life as we know it and the processes that support life (e.g. in biogeochemical cycles and plant and / or animal microbiota).
ASM Topic: Module 05 Microbial Systems
ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

46. _____ was the first to isolate a root nodule bacterium capable of nitrogen fixation.
Beijerinck

ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

True / False Questions

47. The endosymbiotic hypothesis is generally accepted as the origin of two eukaryotic organelles: mitochondria and chloroplasts.
TRUE

ASM Objective: 01.01 Cells, organelles (e.g. mitochondria and chloroplasts) and all major metabolic pathways evolved from early prokaryotic cells.
ASM Topic: Module 01 Evolution
Blooms Level: 2. Understand
Learning Outcome: 01.02.01 Propose a time line of the origin and history of microbial life and integrate supporting evidence into it
Section: 01.02
Topic: Taxonomy of Microorganisms

48. The relationship between specific bacteria and specific diseases was first demonstrated by Koch.
TRUE

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

49. Some microorganisms are useful in bioremediation processes that reduce the effects of pollution.
TRUE

ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Objective: 06.01 Microbes are essential for life as we know it and the processes that support life (e.g. in biogeochemical cycles and plant and / or animal microbiota).
ASM Objective: 06.03 Humans utilize and harness microorganisms and their products.
ASM Topic: Module 05 Microbial Systems
ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 2. Understand
Learning Outcome: 01.04.01 Construct a concept map, table, or drawing that illustrates the diverse nature of microbiology and how it has improved human conditions
Learning Outcome: 01.04.02 Support the belief held by many microbiologists that microbiology is experiencing its second golden age
Section: 01.04
Topic: History of Microbiology

Fill in the Blank Questions

50. The branch of microbiology that deals with diseases of humans and animals is called _____ microbiology.
medical

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.04.01 Construct a concept map, table, or drawing that illustrates the diverse nature of microbiology and how it has improved human conditions
Section: 01.04
Topic: History of Microbiology

51. The branch of microbiology that deals with the mechanisms by which the human body protects itself from disease-causing organisms is called _____.
immunology

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.04.02 Support the belief held by many microbiologists that microbiology is experiencing its second golden age
Section: 01.04
Topic: History of Microbiology

52. _____ _____microbiologists monitor community food establishments and water supplies in order to control the spread of communicable diseases.
Public health

ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.04.01 Construct a concept map, table, or drawing that illustrates the diverse nature of microbiology and how it has improved human conditions
Section: 01.04
Topic: History of Microbiology

53. The branch of microbiology that studies the relationship between microorganisms and their habitats is called _____ _____.
microbial ecology

ASM Objective: 03.03 The survival and growth of any microorganism in a given environment depends on its metabolic characteristics.
ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.04.01 Construct a concept map, table, or drawing that illustrates the diverse nature of microbiology and how it has improved human conditions
Section: 01.04
Topic: History of Microbiology

54. _____ and _____ microbiology investigates the spoilage of products for human consumption and the use of microorganisms in the production of cheese, yogurt, pickles, beer, and the like.
Food, dairy

ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.04.01 Construct a concept map, table, or drawing that illustrates the diverse nature of microbiology and how it has improved human conditions
Section: 01.04
Topic: History of Microbiology

55. _____ microbiology involves the use of microorganisms to make products such as antibiotics, vaccines, steroids, alcohols, vitamins, amino acids, and enzymes.
Industrial

ASM Objective: 06.03 Humans utilize and harness microorganisms and their products.
ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 1. Remember
Learning Outcome: 01.04.01 Construct a concept map, table, or drawing that illustrates the diverse nature of microbiology and how it has improved human conditions
Section: 01.04
Topic: History of Microbiology

56. Microbial _____ are scientists who investigate the synthesis of antibiotics and toxins, the production of energy with microorganisms, and the ways in which microorganisms survive harsh environmental conditions.
physiologists

ASM Objective: 03.02 The interactions of microorganisms among themselves and with their environment are determined by their metabolic abilities (e.g., quorum sensing, oxygen consumption, nitrogen transformations).
ASM Objective: 03.03 The survival and growth of any microorganism in a given environment depends on its metabolic characteristics.
ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 05 Microbial Systems
Blooms Level: 1. Remember
Learning Outcome: 01.04.01 Construct a concept map, table, or drawing that illustrates the diverse nature of microbiology and how it has improved human conditions
Section: 01.04
Topic: History of Microbiology

57. Microbial _____ focuses on the nature of heredity and how it regulates the development and function of cells and organisms.
genetics

ASM Objective: 04.01 Genetic variations can impact microbial functions (e.g., in biofilm formation, pathogenicity and drug resistance).
ASM Objective: 04.02 Although the central dogma is universal in all cells, the processes of replication, transcription, and translation differ in Bacteria, Archaea, and Eukaryotes.
ASM Objective: 04.03 The regulation of gene expression is influenced by external and internal molecular cues and/or signals.
ASM Topic: Module 04 Information Flow and Genetics
Blooms Level: 1. Remember
Learning Outcome: 01.04.01 Construct a concept map, table, or drawing that illustrates the diverse nature of microbiology and how it has improved human conditions
Section: 01.04
Topic: History of Microbiology

Multiple Choice Questions

58. Which of the following provides the best explanation for why viruses are not included in the three domain system?
A. Viruses are too small.
B. Viruses have either DNA or RNA, not both.
C. Viruses are not a cellular life form.
D. Viruses show no evidence of evolution.

ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Topic: Module 01 Evolution
Blooms Level: 5. Evaluate
Learning Outcome: 01.01.02 Explain Carl Woese's contributions in establishing the three-domain system for classifying cellular life
Section: 01.01
Topic: Taxonomy of Microorganisms

59. A new microbe has been discovered in the rumen of sheep. Microscopy shows no evidence of a nuclear membrane and biochemical studies of the cell wall demonstrate the lack of peptidoglycan. Metabolic studies show that this microbe generates methane. This microbe would most likely be classified in the:
A. Domain Bacteria
B. Domain Archaea
C. Domain Eukarya, Kingdom Fungi
D. Domain Eukarya, Protists

ASM Objective: 03.01 Bacteria and Archaea exhibit extensive, and often unique, metabolic diversity (e.g. nitrogen fixation, methane production, anoxygenic photosynthesis).
ASM Objective: 03.03 The survival and growth of any microorganism in a given environment depends on its metabolic characteristics.
ASM Topic: Module 03 Metabolic Pathways
Blooms Level: 4. Analyze
Learning Outcome: 01.01.02 Explain Carl Woese's contributions in establishing the three-domain system for classifying cellular life
Learning Outcome: 01.01.04 Determine the type of microbe (e.g., bacterium, fungus, etc.) when given a description of a newly discovered microbe
Section: 01.01
Topic: Taxonomy of Microorganisms

60. What is the most compelling reason why "protists" are not considered to be a taxonomic group?
A. They are not cellular life forms.
B. They are too small to be included among the eukaryotes.
C. The group includes both prokaryotic and eukaryotic cell types.
D. The organisms often included in this group are very diverse and don't form a cohesive taxon.

ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Topic: Module 01 Evolution
ASM Topic: Module 05 Microbial Systems
Blooms Level: 5. Evaluate
Learning Outcome: 01.01.02 Explain Carl Woese's contributions in establishing the three-domain system for classifying cellular life
Learning Outcome: 01.01.04 Determine the type of microbe (e.g., bacterium, fungus, etc.) when given a description of a newly discovered microbe
Section: 01.01
Topic: Taxonomy of Microorganisms

61. Scientists study microorganisms on Earth today to search for life forms elsewhere, as well as to explore the origins of life on Earth. These microorganisms that are studied are referred to as:
A. existing.
B. extant.
C. extinct.
D. extirpated.

ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Objective: 06.02 Microorganisms provide essential models that give us fundamental knowledge about life processes.
ASM Topic: Module 05 Microbial Systems
ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 3. Apply
Learning Outcome: 01.01.01 Differentiate the biological entities studied by microbiologists from those studied by other biologists
Learning Outcome: 01.02.01 Propose a time line of the origin and history of microbial life and integrate supporting evidence into it
Section: 01.01
Section: 01.02
Topic: Taxonomy of Microorganisms

62. The most important aspect of agar that makes it a useful ingredient for solidifying media for bacterial culture is
A. It provides an excellent nitrogen source for bacteria.
B. Bacteria are unable to break it down so it stays solidified.
C. It melts at 100^{o}C and solidifies at temperatures below 50^{o}C.
D. It provides an excellent carbon and energy source for bacteria.

ASM Objective: 03.03 The survival and growth of any microorganism in a given environment depends on its metabolic characteristics.
ASM Objective: 03.04 The growth of microorganisms can be controlled by physical, chemical, mechanical, or biological methods.
ASM Objective: 06.03 Humans utilize and harness microorganisms and their products.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 5. Evaluate
Learning Outcome: 01.03.01 Evaluate the importance of the contributions to microbiology made by Hooke, Leeuwenhoek, Pasteur, Koch, Cohn, Beijerinck, von Behring, Kitasato, Metchnikoff, and Winogradsky
Section: 01.03
Topic: History of Microbiology

63. Which molecule is believed to have preceded the other three during the evolution of life?

A. ATP
B. Proteins
C. DNA
D. RNA

ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Objective: 04.01 Genetic variations can impact microbial functions (e.g., in biofilm formation, pathogenicity and drug resistance).
ASM Topic: Module 01 Evolution
ASM Topic: Module 04 Information Flow and Genetics
Blooms Level: 3. Apply
Learning Outcome: 01.02.01 Propose a time line of the origin and history of microbial life and integrate supporting evidence into it
Section: 01.02
Topic: Taxonomy of Microorganisms

64. What is the most compelling reason why DNA, rather than RNA, evolved to be the storage repository for genetic information in cellular life forms?
A. DNA has deoxyribose rather than ribose.
B. DNA molecules are more chemically stable than RNA molecules.
C. DNA is double-stranded rather than single-stranded.

ASM Objective: 04.02 Although the central dogma is universal in all cells, the processes of replication, transcription, and translation differ in Bacteria, Archaea, and Eukaryotes.
ASM Topic: Module 04 Information Flow and Genetics
Blooms Level: 5. Evaluate
Learning Outcome: 01.02.01 Propose a time line of the origin and history of microbial life and integrate supporting evidence into it
Section: 01.02
Topic: Taxonomy of Microorganisms

65. Each of the following provides evidence in support of the primary role of RNA in the evolution of life EXCEPT:
A. Some RNA molecules are catalytic.
B. RNA catalyzes peptide bond formation during protein synthesis.
C. ATP (energy currency of the cell) is a ribonucleotide.
D. RNA is less chemically stable than DNA.
E. RNA can regulate gene expression.

ASM Topic: Module 01 Evolution
ASM Topic: Module 04 Information Flow and Genetics
Blooms Level: 4. Analyze
Learning Outcome: 01.02.01 Propose a time line of the origin and history of microbial life and integrate supporting evidence into it
Section: 01.02
Topic: Taxonomy of Microorganisms

66. While each of these processes are believed to have evolved prior to aerobic respiration, which one is the most critical process, without which aerobic respiration could never have developed?
A. Oxygenic photosynthesis
B. Anoxygenic photosynthesis
C. Alcohol fermentation
D. Lactic acid fermentation

ASM Objective: 03.01 Bacteria and Archaea exhibit extensive, and often unique, metabolic diversity (e.g. nitrogen fixation, methane production, anoxygenic photosynthesis).
ASM Objective: 03.02 The interactions of microorganisms among themselves and with their environment are determined by their metabolic abilities (e.g., quorum sensing, oxygen consumption, nitrogen transformations).
ASM Objective: 03.03 The survival and growth of any microorganism in a given environment depends on its metabolic characteristics.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Topic: Module 03 Metabolic Pathways
ASM Topic: Module 05 Microbial Systems
Blooms Level: 4. Analyze
Learning Outcome: 01.02.01 Propose a time line of the origin and history of microbial life and integrate supporting evidence into it
Section: 01.02
Topic: History of Microbiology

67. Which term is most inclusive? In other words, which term includes all the others?
A. Microbial species
B. Microbial strain
C. Biovars
D. Serovars

ASM Objective: 01.04 The traditional concept of species is not readily applicable to microbes due to asexual reproduction and the frequent occurrence of horizontal gene transfer.
ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Topic: Module 01 Evolution
Blooms Level: 4. Analyze
Learning Outcome: 01.02.03 Compare and contrast the definitions of plant and animal species, microbial species, and microbial strains
Section: 01.02
Topic: Bacteria
Topic: Taxonomy of Microorganisms

68. Which of the processes named here is the least likely to contribute to the evolution of genetic diversity of bacteria and archaea?
A. Mutation
B. Sexual reproduction
C. Binary fission
D. Horizontal gene transfer

ASM Objective: 01.02 Mutations and horizontal gene transfer, with the immense variety of microenvironments, have selected for a huge diversity of microorganisms.
ASM Objective: 01.04 The traditional concept of species is not readily applicable to microbes due to asexual reproduction and the frequent occurrence of horizontal gene transfer.
ASM Topic: Module 01 Evolution
Blooms Level: 4. Analyze
Learning Outcome: 01.02.03 Compare and contrast the definitions of plant and animal species, microbial species, and microbial strains
Section: 01.02
Topic: Archaea
Topic: Bacteria
Topic: Taxonomy of Microorganisms

69. A student is observing microorganisms in a sample of pond water. One organism of interest has an obvious nucleus, small oval structures containing a green pigment, and does not appear to be motile. In which of the following groups would this microbe most likely be classified?
A. Eukaryotes (Fungi)
B. Eukaryotes (Algae)
C. Bacteria
D. Archaea
E. Eukaryotes (Protozoa)

ASM Objective: 02.04 While microscopic eukaryotes (for example, fungi, protozoa and algae) carry out some of the same processes as bacteria, many of the cellular properties are fundamentally different.
ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 05 Microbial Systems
Blooms Level: 4. Analyze
Learning Outcome: 01.01.04 Determine the type of microbe (e.g., bacterium, fungus, etc.) when given a description of a newly discovered microbe
Section: 01.01
Topic: Taxonomy of Microorganisms

70. A student is observing microorganisms in a sample of pond water. One organism of interest has an obvious nucleus and has been moving rapidly during observation and appears to have rows of cilia along its surface. In which of the following groups would this microbe most likely be classified?
A. Eukaryotes (Fungi)
B. Eukaryotes (Algae)
C. Bacteria
D. Eukaryotes (Protozoa)

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.04 While microscopic eukaryotes (for example, fungi, protozoa and algae) carry out some of the same processes as bacteria, many of the cellular properties are fundamentally different.
ASM Topic: Module 02 Cell Structure and Function
Blooms Level: 4. Analyze
Learning Outcome: 01.01.04 Determine the type of microbe (e.g., bacterium, fungus, etc.) when given a description of a newly discovered microbe
Section: 01.01
Topic: Taxonomy of Microorganisms

Fill in the Blank Questions

71. A microbial _____ is a collection of strains that share many stable properties and differ significantly from other groups of strains.
species

ASM Objective: 01.04 The traditional concept of species is not readily applicable to microbes due to asexual reproduction and the frequent occurrence of horizontal gene transfer.
ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Topic: Module 01 Evolution
Blooms Level: 2. Understand
Learning Outcome: 01.02.03 Compare and contrast the definitions of plant and animal species, microbial species, and microbial strains
Section: 01.02
Topic: Taxonomy of Microorganisms

Multiple Choice Questions

72. Morphovars, serovars, biovars, and pathovars are examples of terms that refer to microbial _____.
A. species
B. strains
C. types
D. Archaea

ASM Objective: 01.02 Mutations and horizontal gene transfer, with the immense variety of microenvironments, have selected for a huge diversity of microorganisms.
ASM Objective: 01.04 The traditional concept of species is not readily applicable to microbes due to asexual reproduction and the frequent occurrence of horizontal gene transfer.
ASM Topic: Module 01 Evolution
Blooms Level: 2. Understand
Learning Outcome: 01.02.03 Compare and contrast the definitions of plant and animal species, microbial species, and microbial strains
Section: 01.02
Topic: Taxonomy of Microorganisms

73. In a search for new antibiotics, a previously unknown organism has been recovered from the soil. It is nonmotile and is composed of long threadlike structures formed from nucleated cells. It is not-photosynthetic and absorbs its nutrients. This organism will most likely be classified among the
A. Bacteria
B. Archaea
C. Eukaryotes (Fungi)
D. Eukaryotes (Protozoa)
E. Eukaryotes (Algae)

ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Objective: 02.04 While microscopic eukaryotes (for example, fungi, protozoa and algae) carry out some of the same processes as bacteria, many of the cellular properties are fundamentally different.
ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Objective: 06.04 Because the true diversity of microbial life is largely unknown, its effects and potential benefits have not been fully explored.
ASM Topic: Module 01 Evolution
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 05 Microbial Systems
ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 3. Apply
Learning Outcome: 01.01.01 Differentiate the biological entities studied by microbiologists from those studied by other biologists
Learning Outcome: 01.01.04 Determine the type of microbe (e.g., bacterium, fungus, etc.) when given a description of a newly discovered microbe
Section: 01.01
Topic: Taxonomy of Microorganisms

Matching Questions

74. Match the microbe with an example of its importance to humans.

1. Members of this group have caused "mad cow diseaese" and Creutzfeld Jacob disease.	Viruses	**5**
2. Members of this group are photosynthetic, include unicellular and multicellular forms, and are the foundation of aquatic food chains.	Prions	**1**
3. This group includes beneficial microorganisms that fix nitrogen, make antibiotics, vitamins and enzymes, as well as harmful microorganisms that cause disease such as plague and strep throat.	Fungi	**4**
4. Members of this group include decomposers, associate with plant roots and help plants grow, produce antibiotics, help bread rise, and help make wine.	Algae	**2**
5. Members of this microbial group cause serious diseases such as smallpox, AIDS, and Ebola fever.	Bacteria	**3**

ASM Objective: 02.04 While microscopic eukaryotes (for example, fungi, protozoa and algae) carry out some of the same processes as bacteria, many of the cellular properties are fundamentally different.
ASM Objective: 05.01 Microorganisms are ubiquitous and live in diverse and dynamic ecosystems.
ASM Objective: 05.03 Microorganisms and their environment interact with and modify each other.
ASM Objective: 05.04 Microorganisms, cellular and viral, can interact with both human and nonhuman hosts in beneficial, neutral or detrimental ways.
ASM Objective: 06.01 Microbes are essential for life as we know it and the processes that support life (e.g. in biogeochemical cycles and plant and / or animal microbiota).
ASM Objective: 06.03 Humans utilize and harness microorganisms and their products.
ASM Topic: Module 05 Microbial Systems
ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 3. Apply
Learning Outcome: 01.01.03 Provide an example of the importance to humans of each of the major types of microbes
Section: 01.01
Topic: Taxonomy of Microorganisms

Multiple Choice Questions

75. Three the SSU rRNA sequences of 3 organisms have been compared. For organisms 1 and 2, two of the twelve nucleotides in the sequence are different. For organisms 1 and 3, six of the twelve nucleotides are different. Which organism has greater evolutionary distance from organism 1?
A. Organism 2
B. Organism 3
C. The evolutionary distance is the same.
D. Evolutionary distance cannot be predicted from this data.

ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Topic: Module 01 Evolution
Blooms Level: 3. Apply
Learning Outcome: 01.02.02 Design a set of experiments that could be used to place a newly discovered cellular microbe on a phylogenetic tree based on small subunit (SSU) rRNA sequences
Section: 01.02
Topic: Taxonomy of Microorganisms

Ranking Questions

76. The following are steps in using SSU rRNA molecules to develop phylogenetic trees. Place these steps in the correct order.
5 Count the number of nucleotide differences between each pair of sequences and calculate the evolutionary distance.
6 Input data into computer and use appropriate software to construct a phylogenetic tree.
4 Align nucleotide sequences to compare.
1 Isolate DNA from cells of each organism being tested.
2 Amplify the DNA of the SSU rRNA genes of each organism using polymerase chain reaction.
3 Determine the nucleotide sequence of the SSU rRNA genes of each organism.

ASM Objective: 01.05 The evolutionary relatedness of organisms is best reflected in phylogenetic trees.
ASM Topic: Module 01 Evolution
Blooms Level: 3. Apply
Learning Outcome: 01.02.02 Design a set of experiments that could be used to place a newly discovered cellular microbe on a phylogenetic tree based on small subunit (SSU) rRNA sequences
Section: 01.02
Topic: Taxonomy of Microorganisms

Multiple Choice Questions

77. Which group of microbes contains organisms necessary for production of wine and bread?

A. Bacteria
B. Archaea
C. Fungi
D. Algae

ASM Objective: 06.03 Humans utilize and harness microorganisms and their products.
ASM Topic: Module 06 Impact of Microorganisms
Blooms Level: 1. Remember
Learning Outcome: 01.01.03 Provide an example of the importance to humans of each of the major types of microbes
Section: 01.01
Topic: Taxonomy of Microorganisms

Chapter 02
Microscopy

Fill in the Blank Questions

1. The _____ is the point at which a lens focuses parallel beams of light.
focal point

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.01.02 Correlate lens strength and focal length
Section: 02.01
Topic: Microscopy

2. The _____ is the distance between the center of a lens and the point at which it focuses parallel beams of light.
focal length

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.01.02 Correlate lens strength and focal length
Section: 02.01
Topic: Microscopy

True / False Questions

3. Light rays are refracted (bent) when they cross the interface between materials with different refractive indices.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.01.01 Relate the refractive indices of glass and air to the path light takes when it passes through a prism or convex lens
Section: 02.01
Topic: Microscopy

Multiple Choice Questions

4. Confocal microscopes exhibit improved contrast and resolution by
A. illumination of a large area of the specimen.
B. blocking out stray light with an aperture located above the objective lens.
C. use of light at longer wavelengths.
D. use of ultraviolet light to illuminate the specimen.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
Blooms Level: 2. Understand
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

5. A 30× objective and a 20× ocular produce a total magnification of
A. 230×.
B. 320×.
C. 50×.
D. 600×.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

6. A 45× objective and a 10× ocular produce a total magnification of
A. 900×.
B. 55×.
C. 450×.
D. 145×.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

7. A microscope that exposes specimens to ultraviolet, violet, or blue light and forms an image with the light emitted at a different wavelength is called a _____ microscope.
A. phase-contrast
B. dark-field
C. scanning electron
D. fluorescence

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.02.03 Create a table that compares and contrasts the various types of light microscopes in terms of their uses, how images are created, and the quality of images produced
Section: 02.02
Topic: Microscopy

8. Immersion oil can be used to increase the resolution achieved with some microscope lenses because it increases the _____ between the specimen and the objective lens.
A. optical density
B. refractive index
C. optical density and refractive index
D. neither optical density nor refractive index

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.01.01 Relate the refractive indices of glass and air to the path light takes when it passes through a prism or convex lens
Section: 02.01
Topic: Microscopy

True / False Questions

9. A substage condenser is used to focus light onto the specimen, which increases the resolution of a light microscope.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

Fill in the Blank Questions

10. The _____ is the distance between the specimen and the objective lens when the specimen is in focus.
working distance

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

11. The useful magnification of a light microscope is limited by the _____ of the light source being utilized.
wavelength

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

12. The special dyes used in fluorescence microscopy that absorb light at one wavelength and emit light at a different wavelength are called _____.
fluorochromes

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
Blooms Level: 1. Remember
Learning Outcome: 02.02.03 Create a table that compares and contrasts the various types of light microscopes in terms of their uses, how images are created, and the quality of images produced
Section: 02.02
Topic: Microscopy

13. In order to view a specimen with a total magnification of 400×, a _____ objective must be used if the ocular is 10×.
40ò

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

True / False Questions

14. Confocal microscopes, in combination with specialized computer software, can be used to create three-dimensional images of cell structures.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.03 Create a table that compares and contrasts the various types of light microscopes in terms of their uses, how images are created, and the quality of images produced
Section: 02.02
Topic: Microscopy

15. A light microscope with an objective lens numerical aperture of 0.65 is capable of allowing two objects 400 nm apart to be distinguished when using light with a wavelength of 420 nm.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

16. Resolution improves when the wavelength of the illuminating light decreases.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

17. Immersion oil is used to prevent a specimen from drying out.
FALSE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

18. It is possible to build a light microscope capable of 10,000× magnification, but the image would not be sharp because resolution is independent of magnification.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

19. Immersion oil increases the amount of light entering the objective lens.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

Multiple Choice Questions

20. If the objective lenses of a microscope can be changed without losing focus on the specimen, they are said to be
A. equifocal.
B. totifocal.
C. parfocal.
D. optifocal.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.01 Evaluate the parts of a light microscope in terms of their contributions to image production and use of the microscope
Section: 02.02
Topic: Microscopy

21. An instrument that magnifies slight differences in the refractive index of cell structures is called a (n) _____ microscope.
A. phase-contrast
B. electron
C. fluorescence
D. densitometric

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.03 Create a table that compares and contrasts the various types of light microscopes in terms of their uses, how images are created, and the quality of images produced
Section: 02.02
Topic: Microscopy

22. The instrument that produces a bright image of the specimen against a dark background is called a (n) _____ microscope.
A. phase-contrast
B. electron
C. bright-field
D. dark-field

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.02.03 Create a table that compares and contrasts the various types of light microscopes in terms of their uses, how images are created, and the quality of images produced
Section: 02.02
Topic: Microscopy

23. As the magnification of a series of objective lenses increases, the working distance
A. increases.
B. decreases.
C. stays the same.
D. cannot be predicted.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.01.02 Correlate lens strength and focal length
Section: 02.01
Topic: Microscopy

24. Prior to staining, smears of microorganisms are heat-fixed in order to
A. allow eventual visualization of internal structures.
B. ensure removal of dust particles from the slide surface.
C. attach it firmly to the slide.
D. create small pores in cells that facilitates binding of stain to cell structures.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.01 Recommend a fixation process to use when the microbe is a bacterium or archaeon and when the microbe is a protist
Section: 02.03
Topic: Preparing Microscopy Specimens

25. Acid-fast organisms such as *Mycobacterium tuberculosis* contain _____ constructed from mycolic acids in their cell walls.
A. proteins
B. carbohydrates
C. lipids
D. peptidoglycan

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.02 Bacteria have unique cell structures that can be targets for antibiotics, immunity and phage infection.
ASM Topic: Module 02 Cell Structure and Function
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Mycobacteria
Topic: Preparing Microscopy Specimens

26. In the Gram-staining procedure, the primary stain is
A. iodine.
B. safranin.
C. crystal violet.
D. alcohol.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

27. In the Gram-staining procedure, the decolorizer is
A. iodine.
B. safranin.
C. crystal violet.
D. ethanol or acetone.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

28. In the Gram-staining procedure, the counterstain is
A. iodine.
B. safranin.
C. crystal violet.
D. alcohol.

ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Identifying Microorganisms
Topic: Preparing Microscopy Specimens

29. In the Gram-staining procedure, the mordant is
A. iodine.
B. safranin.
C. crystal violet.
D. alcohol.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

30. After the primary stain has been added but before the decolorizer has been used, gram-positive organisms are stained _____ and gram-negative organisms are stained _____.
A. purple; purple
B. purple; colorless
C. purple; pink
D. pink; pink

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

31. After the decolorizer has been added, gram-positive organisms are stained _____ and gram-negative organisms are stained _____.
A. purple; purple
B. purple; colorless
C. purple; pink
D. pink; pink

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

32. After the secondary stain has been added, gram-positive organisms are stained _____ and gram-negative organisms are stained _____.
A. purple; purple
B. purple; colorless
C. purple; pink
D. pink; pink

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

33. If the decolorizer is left on too long in the Gram-staining procedure, gram-positive organisms will be stained _____ and gram-negative organisms will be stained _____.
A. purple; blue
B. purple; colorless
C. purple; pink
D. pink; pink

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

34. If the decolorizer is not left on long enough in the Gram-staining procedure, gram-positive organisms will be stained _____ and gram-negative organisms will be stained _____.

A. purple; purple
B. purple; colorless
C. purple; pink
D. pink; pink

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

35. Which of the following is considered to be a differential staining procedure?
A. Gram stain
B. Acid-fast stain
C. Both Gram stain and Acid-fast stain

D. Leifson's flagella stain

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Identifying Microorganisms
Topic: Preparing Microscopy Specimens

36. Basic dyes such as methylene blue bind to cellular molecules that are
A. hydrophobic.
B. negatively charged.
C. positively charged.
D. aromatic.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Preparing Microscopy Specimens

True / False Questions

37. Gram staining divides bacterial species into two groups based on differences in cell wall structure.
TRUE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Bacterial Cellular Morphology
Topic: Preparing Microscopy Specimens

38. Negative staining facilitates the visualization of bacterial capsules that are intensely stained by the procedure.
FALSE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.03 Bacteria and Archaea have specialized structures (e.g. flagella, endospores, and pili) that often confer critical capabilities.
ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Bacterial Cellular Morphology
Topic: Microscopy
Topic: Preparing Microscopy Specimens

39. Negative staining with India ink can be used to reveal the presence of capsules that surround bacterial cells.
TRUE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.03 Bacteria and Archaea have specialized structures (e.g. flagella, endospores, and pili) that often confer critical capabilities.
ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Bacterial Cellular Morphology
Topic: Microscopy
Topic: Preparing Microscopy Specimens

40. Mordants increase the binding between a stain and specimen.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Microscopy
Topic: Preparing Microscopy Specimens

41. In order to stain flagella so that they may be readily observed by light microscopy, it is usually necessary to increase their thickness.
TRUE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 02.03 Bacteria and Archaea have specialized structures (e.g. flagella, endospores, and pili) that often confer critical capabilities.
ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Bacterial Cellular Morphology
Topic: Microscopy
Topic: Preparing Microscopy Specimens

Fill in the Blank Questions

42. The procedure in which a single stain is used to visualize microorganisms is called _____ staining.
simple

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Microscopy
Topic: Preparing Microscopy Specimens

43. _____ is the process by which internal and external structures of cells and organisms are preserved and maintained in position.
Fixation

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.01 Recommend a fixation process to use when the microbe is a bacterium or archaeon and when the microbe is a protist
Section: 02.03
Topic: Bacterial Cellular Morphology
Topic: Preparing Microscopy Specimens

44. Thin films of bacteria that have been air-dried onto a glass microscope slide are called _____.
smears

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Microscopy
Topic: Preparing Microscopy Specimens

45. A procedure that divides organisms into two or more groups depending on their individual reactions to the same staining procedure is referred to as _____ staining.
differential

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Microscopy
Topic: Preparing Microscopy Specimens

Multiple Choice Questions

46. The Gram-staining procedure is an example of _____.
A. simple staining
B. negative staining
C. differential staining
D. fluorescent staining

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

True / False Questions

47. The Gram-staining procedure is widely used because it allows rapid identification of a microorganism with little additional testing.
FALSE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.03.02 Plan a series of appropriate staining procedures to describe an unknown bacterium as fully as possible
Section: 02.03
Topic: Identifying Microorganisms
Topic: Preparing Microscopy Specimens

Multiple Choice Questions

48. Regions of a specimen with higher electron density scatter _____ electrons and, therefore, appear _____ in the image projected onto the screen of a transmission electron microscope.
A. more; lighter
B. more; darker
C. fewer; darker
D. fewer; lighter

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

True / False Questions

49. Because transmission electron microscopy uses electrons rather than light, it is not necessary to stain biological specimens before observing them.
FALSE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

50. Scanning electron microscopes bombard specimens with a stream of electrons; however, the specimen image is produce by electrons that are derived from atoms of the specimen itself rather than by the electrons used to bombard the specimen.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

51. It was possible to view viruses only after the invention of the electron microscope because they are too small to be seen with a light microscope.
TRUE

ASM Objective: 02.01 The structure and function of microorganisms have been revealed by the use of microscopy (including bright field, phase contrast, fluorescent, and electron).
ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 02 Cell Structure and Function
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy

Fill in the Blank Questions

52. An electron microscope uses _____ lenses to focus beams of electrons onto a specimen.
magnetic

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Section: 02.04
Topic: Microscopy

Multiple Choice Questions

53. Scanning electron microscopy is most often used to reveal
A. surface structures.
B. internal structures.
C. both surface and internal structures simultaneously.
D. either surface or internal structures, but not simultaneously.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy

54. Small internal cell structures are best visualized with a
A. light microscope.
B. dark-field microscope.
C. transmission electron microscope.
D. flagellar microscope.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Bacterial Cellular Morphology
Topic: Microscopy

55. In transmission electron microscopy, spreading a specimen out in a thin film with uranyl acetate, which does not penetrate the specimen, is called
A. freeze-etching.
B. simple staining.
C. shadow staining.

D. negative staining.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

Fill in the Blank Questions

56. _____ breaks frozen specimens along lines of greatest weakness, often down the middle of lipid bilayer membranes so that they may be observed by transmission electron microscopy.
Freeze-etching

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

57. The _____ microscope is capable of atomic resolution of specimens, even when they are immersed in water.
Scanning tunneling

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.05.01 Distinguish scanning tunneling from atomic force microscopes in terms of how they create images and their uses
Section: 02.05
Topic: Microscopy

58. The designer of the first transmission electron microscope, _____, was awarded the 1986 Nobel Prize in physics.
Ernst Ruska

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 1. Remember
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: History of Microbiology
Topic: Microscopy

Multiple Choice Questions

59. Atomic force microscopes use a scanning probe that maintains a fixed distance from the surface of the specimen. It is useful for specimens that
A. do not conduct electricity well.
B. have extremely uneven surfaces.
C. both do not conduct electricity well and have extremely uneven surfaces are correct.
D. neither do not conduct electricity well nor have extremely uneven surfaces is correct.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.05.01 Distinguish scanning tunneling from atomic force microscopes in terms of how they create images and their uses
Section: 02.05
Topic: Microscopy

True / False Questions

60. Scanning tunneling electron microscopes create a three-dimensional image of specimens at atomic level resolution.
TRUE

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 2. Understand
Learning Outcome: 02.05.01 Distinguish scanning tunneling from atomic force microscopes in terms of how they create images and their uses
Section: 02.05
Topic: Microscopy

Multiple Choice Questions

61. If immersion oil was replaced with water, what would happen?
A. The refractive index would increase, improving resolution.
B. The refractive index of water would be greater than air but less than oil, improving resolution less than oil.
C. The refractive index of water would be less than that of air, decreasing resolution.
D. There would be no difference.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.02.02 Predict the relative degree of resolution based on light wavelength and numerical aperture of the lens used to examine a specimen
Section: 02.02
Topic: Microscopy

62. As the resolution of a microscope system improves, the size of the smallest object that can be seen clearly
A. is larger.
B. is smaller.
C. is not affected.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Section: 02.02
Topic: Microscopy

63. If you forgot to heat fix a smear before doing a Gram stain, which of the following might occur?
A. The stains would not adhere to the bacteria.
B. The smear may not adhere to the slide.
C. The decolorization step of the Gram stain would not work properly.
D. Gram-positive and Gram-negative bacteria would both stain purple.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.01 Recommend a fixation process to use when the microbe is a bacterium or archaeon and when the microbe is a protist
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Microscopy
Topic: Preparing Microscopy Specimens

64. A specimen has been prepared for viewing with a transmission electron microscope, using uranyl acetate as a negative stain. The area stained by the uranyl acetate will be _____ electron dense compared to specimen itself.

A. more
B. less
C. equally

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.04.01 Create a concept map, illustration, or table that compares transmission electron microscopes (TEMs) to light microscopes
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Section: 02.04
Topic: Microscopy
Topic: Preparing Microscopy Specimens

65. If you forgot the decolorization step while performing a Gram stain, which outcome would you expect?

A. Gram-positive bacteria would stain pink.
B. Gram–negative bacteria would stain purple.
C. Gram-negative bacteria would be unstained.
D. Gram–positive bacteria would be unstained.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

66. If you forgot to apply the safranin counterstain while performing a Gram stain, which outcome would you expect?
A. Gram-positive bacteria would stain pink.
B. Gram-negative bacteria would stain purple.
C. Gram-negative and Gram-positive bacteria would be unstained.
D. Gram-negative bacteria would be unstained.

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 4. Analyze
Learning Outcome: 02.03.03 Compare what happens to Gram-positive and Gram-negative bacterial cells at each step of the Gram-staining procedure
Section: 02.03
Topic: Preparing Microscopy Specimens

67. Which type of microscopy would be preferred for creating a three dimensional view of the distribution and arrangement of flagella on a bacterial cell surface?
A. Bright-field microscopy
B. Scanning electron microscopy
C. Fluorescence microscopy
D. Transmission electron microscopy

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Learning Outcome: 02.05.02 Evaluate light microscopy, electron microscopy, and scanning probe microscopy in terms of their uses, resolution, and the quality of the images created
Section: 02.04
Section: 02.05
Topic: Microscopy

68. Which type of microscopy would be preferred for showing fine internal detail of the eukaryotic organelles?
A. Bright-field microscopy
B. Scanning electron microscopy
C. Fluorescence microscopy
D. Transmission electron microscopy

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.04.02 Decide when it would be best to examine a microbe by TEM, scanning electron microscopy (SEM), and electron cryotomography
Learning Outcome: 02.05.02 Evaluate light microscopy, electron microscopy, and scanning probe microscopy in terms of their uses, resolution, and the quality of the images created
Section: 02.04
Section: 02.05
Topic: Microscopy

69. You are researching the structure of a transmembrane protein. Which type of microscopy would provide you the best view of this protein?
A. Bright field microscopy
B. Scanning electron microscopy
C. Transmission electron microscopy
D. Atomic force microscopy

ASM Objective: 08.01 Properly prepare and view specimens for examination using microscopy (bright field and, if possible, phase contrast).
ASM Topic: Module 08 Microbiology Laboratory Skills
Blooms Level: 3. Apply
Learning Outcome: 02.05.01 Distinguish scanning tunneling from atomic force microscopes in terms of how they create images and their uses
Learning Outcome: 02.05.02 Evaluate light microscopy, electron microscopy, and scanning probe microscopy in terms of their uses, resolution, and the quality of the images created
Section: 02.05
Topic: Microscopy