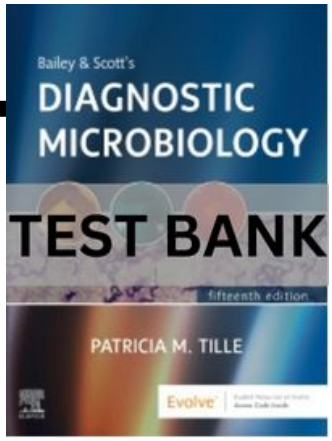

Chapter 01: Microbial Taxonomy
Tille: Bailey and Scott's Diagnostic Microbiology, 15th Edition

MULTIPLE CHOICE

1. Taxonomy can be described as a system that:

   a. classifies, names, and identifies microorganisms in a consistent manner.
   b. classifies microorganisms, based on their genetic makeup.
   c. classifies microorganisms, based on their phenotypic makeup.
   d. classifies microorganisms, based on their cellular and colonial traits.

   ANS: A
   Taxonomy is a system that consistently classifies, names, and identifies microorganisms. Although organisms have genotypic and phenotypic characteristics, as well as cellular and colonial characteristics, answer *A* best describes the term *taxonomy*.

2. The most basic taxonomic group that can be defined as a collection of bacterial strains that share many common physiologic and genetic features is:
   a. genus.
   b. species.
   c. class.
   d. kingdom.

   ANS: B
   Bacteria are classified into the same species, based on their physiologic and genetic similarities and their differences from bacteria in other species.

3. Colonial and microscopic morphologic properties, along with the pigmentation of colonies, would belong to a microorganism group of _____ characteristics.
   a. genotypic
   b. taxonomic
   c. phenotypic
   d. subspecies

   ANS: C
   Phenotypic characteristics are the observable properties of the subject.

4. Which binomial name is correctly written?
   a. *Escherichia coli*
   b. Escherichia *coli*
   c. *Escherichia* coli
   d. *Escherichia Coli*

   ANS: A
   The genus should be capitalized, and the species should be in lowercase. The entire name is either italicized or underlined.

5. The use of a double genus in a microorganism's label, such as *Burkholderia (Pseudomonas),* indicates that the bacterium:
   a. does not fit well in either group but has some characteristics of both groups.
   b. is a genetic cross between the two groups.
   c. has been moved from one genus *(Pseudomonas)* to another genus *(Burkholderia)*.
   d. has been moved from one genus *(Burkholderia)* to another genus *(Pseudomonas)*.

   ANS: C
   A name of an organism may change as scientists learn more about the organism. An older name is often included in parentheses next to the current name to alleviate confusion about the identity of the organism.

6. A bacterium that has been moved from one genus *(Pseudomonas)* to another genus *(Burkholderia)* would be correctly noted as which one of the following?
   a. *Pseudomonas (Burkholderia)*
   b. *Burkholderia (Pseudomonas)*
   c. *Pseudomonas*, formerly *Burkholderia*
   d. *Burkholderia*, formerly *Pseudomonas*

   ANS: B
   The name of an organism may change as scientists learn more about the organism. An older name is often included in parentheses next to the current name to alleviate confusion about the identity of the organism.

7. The taxon that is composed of similar species that have several important features in common but differ sufficiently to still maintain their status as individual species is which one of the following?
   a. Class
   b. Order
   c. Family
   d. Genus

   ANS: D
   The genus is composed of similar species.

8. Which binomial name is correctly written?
   a. *Staphylococcus Aureus*
   b. staphylococcus *aureus*
   c. *Staphylococcus aureus*
   d. *Staphylococcus* aureus

   ANS: C
   The genus should be capitalized, and the species should be in lowercase. The entire name is either italicized or underlined.

9. An example of an organism's genotypic characteristic is its:
   a. macroscopic morphologic structure.
   b. microscopic morphologic structure.
   c. nucleic acid composition.
   d. antigenic properties.

   ANS: C

The organism's nucleic acid composition—deoxyribonucleic acid (DNA) and ribonucleic acid (RNA)—is a genotypic characteristic. All of the other choices are phenotypic characteristics.

10. An organism is serologically identified in the clinical laboratory. This is an example of which phenotypic property?
    a. Subcellular properties
    b. Antigenic properties
    c. Resistant profiles
    d. Nucleic acid sequence analysis

    ANS: B
    Serologic methods examine the organism's antigenic properties.

11. Species identification is based on all of the following *except*:
    a. DNA-DNA hybridization.
    b. 16s rRNA (DNA) sequencing.
    c. cell wall composition.
    d. colonial pigmentation.

    ANS: D
    Species identification is based on consistent, reproducible traits that are linked to specific traits that can be used to classify the organisms as related. Although pigment is a phenotypic trait, it is not sufficient to use to specifically delineate species as various genes are responsible for pigmentation in a variety of organisms.

12. The difference between a subspecies and biotype is:
    a. a subspecies has the same genetic makeup.
    b. a subspecies has a differential expression of the same genes.
    c. a subspecies is genetically different than the type species.
    d. a biotype and subspecies are the same.

    ANS: A
    A subspecies has the same genetic makeup as the species but due to other factors can display some variation in physiologic characteristics. A biotype is a designation that further group organisms based on relatively minor characteristics.

13. The suffix -aceae is added to the root word of the _____, to designate the family of bacteria.
    a. type-species
    b. most common organism
    c. type-genus
    d. specific epithet

    ANS: C
    The type-genus is generally the most important or the first one to be named in a family of bacteria. The root name of the genus is then used with the suffix -ceae for the name of the family. One exception to this is the *Enterobacterales,* which include the enteric genera and is not named after the type genus *Escherichia*.

14. Polyphasic taxonomy:
    a. uses proteins or polypeptides to separate and classify microorganisms.
    b. uses the different growth phases of organisms for the classification and identification of species.

c. uses both genotypic and phenotypic characteristics for the classification and identification of microorganisms.
d. uses all information including genotypic, phenotypic and phylogenetic information in an attempt to accurately classify and identify microorganisms.

ANS: D
Polyphasic taxonomy does take into account all of the genotypic and phenotypic characteristics, however it also considers the phylogeny or historical relevance and ordering of organisms. This is to not only assist in the classification and identification but provides a mechanism to monitor evolutionary relationships and changes in organisms over time.

15. This chemotaxonomic method uses the analysis and separation of proteins and peptides that are present in significant numbers to classify and identify microorganisms.
a. Cultivation
b. Microscopy
c. Mass spectroscopy
d. Matrix-assisted laser desorption ionization time-of-flight mass spectroscopy

ANS: D
Mass spectroscopy is the overall chemical technique used to separate molecules based on their mass and electrical charge. However, in the microbiology laboratory matrix-assisted laser desorption ionization time-of-flight mass spectroscopy separates the high abundant proteins and peptides to create a spectrum that can be used for the classification and identification of microorganisms.

Chapter 02: Bacterial Genetics, Metabolism, and Structure
Tille: Bailey and Scott's Diagnostic Microbiology, 15th Edition

MULTIPLE CHOICE

1. Pieces of deoxyribonucleic acid (DNA) that move from one genetic element to another and contain genes for movement and genes for other features are called:
a. transposons.
b. insertion sequences.
c. plasmids.
d. chromatoids.

ANS: A
Transposons are mobile genetic elements and may be either simple transposons also referred to as insertion sequences that only code for the transposase enzyme and movement, or composite transposons that contain other genes.

2. Miniature chromosomes composed of several genes in double-stranded, closed, circular structures are called:
a. transposons.
b. insertion sequences.
c. plasmids.
d. chromatoids.

ANS: C

Plasmids are considered autonomously replicating extra-chromosomal elements, whereas transposable elements (transposons and insertion sequences) persist in an organism by integration into the chromosome.

3. A DNA sequence that encodes for a specific product (ribonucleic acid [RNA] or protein) is defined as a:
   a. gene.
   b. genome.
   c. nucleotide.
   d. deoxyribonucleic acid.

   ANS: A
   The genome is the collection of all the genes of an organism. Nucleotides and DNA are building blocks of genes.

4. The enzyme that adds nucleotide bases to each growing daughter strand in the replication process is called:
   a. replication enzymes.
   b. DNA polymerase.
   c. insertion sequence enzymes.
   d. transcriptase.

   ANS: B
   DNA polymerase is a specific type of replication enzyme.

5. If a bacterial cell encounters unfavorable environmental conditions, then its metabolism will begin to slow until it eventually transforms into an inactive, dormant state known as an:
   a. polymerization.
   b. oxidation.
   c. spore.
   d. endospore.

   ANS: D
   Organisms will undergo sporulation when unfavorable conditions are encountered and form endospores. The endospore is a means of survival and will remain in a non-vegetative state until favorable conditions return.

6. Teichoic acids, mycolic acids, peptidoglycan, and disaccharide-pentapeptide subunits are all building blocks of which bacterial structure?
   a. Outer cell membrane
   b. Flagella
   c. Inner cell membrane
   d. Cell wall

   ANS: D
   These elements are all part of the cell walls of some types of bacteria.

7. The major difference between gram-positive and gram-negative bacteria is that:
   a. the peptidoglycan layer in gram-positive bacteria is substantially thinner than in gram-negative bacteria.
   b. gram-positive bacteria contain a periplasmic space, whereas gram-negative bacteria do not.
   c. flagella are only present in gram-positive bacteria.

d. gram-negative bacteria contain an outer membrane that functions as the cell's initial barrier to the environment.

ANS: D
Gram-negative bacteria contain an outer membrane and have a substantially thinner layer of peptidoglycan, but gram-positive bacteria do not contain an outer cell membrane and have a substantially thicker, more highly cross-linked layer of peptidoglycan in their cell wall.

8. In gene regulation and control, *repression* is defined as the:
   a. internal change in the original nucleotide sequence of a gene or genes within an organism's genome.
   b. mechanism of genetic control in which genes are induced only when the substrate to be degraded by enzymatic action is present.
   c. change of the bacterial genotypes through the exchange of DNA from one cell to another.
   d. mechanism of genetic control in which genes are not transcribed and therefore are not expressed in the presence of those target products in sufficient supply.

   ANS: D
   To avoid waste and overproduction of enzymes in the cell, some genes are *turned off* by the presence of the product of that gene expression.

9. In gene regulation and control, *induction* can be defined as the:
   a. mechanism of genetic control in which genes are induced only when the substrate to be degraded by enzymatic action is present.
   b. uptake of free DNA from the environment and recombination with the recipient's homologous DNA.
   c. mechanism of genetic control in which genes are not transcribed and therefore are not expressed in the presence of those target products in sufficient supply.
   d. change of the bacterial genotypes through the exchange of DNA from one cell to another.

   ANS: A
   To avoid waste and overproduction of enzymes in the cell, some genes are *turned on* only by the presence of the substrate of that gene expression.

10. *Mutation* is defined as the:
    a. change of the bacterial genotypes through the exchange of DNA from one cell to another.
    b. internal change in the original nucleotide sequence of a gene or genes within an organism's genome.
    c. process by which genetic elements such as plasmids and transposons excise from one genomic location and insert into another.
    d. uptake of free DNA from the environment and recombination with the recipient's homologous DNA.

    ANS: B
    Mutation occurs as an internal change in the original nucleotide sequence of a gene or genes within an organism's genome.

11. *Recombination* is defined as the:
    a. change of the bacterial genotypes through the exchange of DNA from one cell to another.

b. internal change in the original nucleotide sequence of a gene or genes within an organism's genome.
c. process by which genetic elements such as plasmids and transposons excise from one genomic location and insert into another.
d. uptake of free DNA from the environment and recombination with the recipient's homologous DNA.

ANS: A
Recombination is an event that frequently occurs in many varieties of bacteria and is a major means by which bacteria may achieve genetic diversity.

12. *Transformation* is defined as the:
a. change of the bacterial genotypes through the exchange of DNA from one cell to another.
b. internal change in the original nucleotide sequence of a gene or genes within an organism's genome.
c. process by which genetic elements such as plasmids and transposons excise from one genomic location and insert into another.
d. uptake of free DNA from the environment and recombination with the recipient's homologous DNA.

ANS: D
Transformation involves recipient uptake of DNA that is free in the environment when another bacterial cell dies and undergoes lysis.

13. *Transduction* is defined as the:
a. change of the bacterial genotypes through the exchange of DNA from one cell to another.
b. internal change in the original nucleotide sequence of a gene or genes within an organism's genome.
c. process by which genetic elements such as plasmids and transposons excise from one genomic location and insert into another.
d. mechanism that is mediated by viruses, by which DNA from two bacteria may come together in one cell, thus allowing for recombination.

ANS: D
Bacteriophages, viruses that infect bacteria, integrate their DNA into the bacterial cell's chromosome, in which viral DNA replication and expression is directed; thus, the DNA is dispersed to another bacterium when other cells are infected.

14. The mechanism for adenosine triphosphate (ATP) production in which high-energy phosphate bonds produced by the central metabolic pathways are donated to adenosine diphosphate (ADP) to form ATP is:
a. substrate-level phosphorylation.
b. fermentative metabolism.
c. oxidative phosphorylation.
d. aerobic respiration.

ANS: A

Fermentative metabolism is one form of substrate-level phosphorylation that does not require oxygen. Oxidative phosphorylation is an electron transport system that can use either oxygen as the terminal electron acceptor (aerobic respiration) or acceptors other than oxygen (anaerobic respiration).

15. A pathway that generates ATP by substrate-level phosphorylation that does not require oxygen and produces various end products, including alcohols, acids, carbon dioxide, and hydrogen, is:
    a. substrate-level phosphorylation.
    b. fermentative metabolism.
    c. oxidative phosphorylation.
    d. aerobic respiration.

    ANS: B
    Fermentative metabolism is one form of substrate-level phosphorylation that does not require oxygen. Oxidative phosphorylation, including both aerobic and anaerobic respiration, is an electron transport system.

16. The pathway of metabolism that involves a series of electron transfers from reduced carrier molecules such as $NADH_2$ and $NADPH_2$ to a terminal electron acceptor is:
    a. substrate-level phosphorylation.
    b. fermentative metabolism.
    c. oxidative phosphorylation.
    d. aerobic respiration.

    ANS: C
    Fermentative metabolism is one form of substrate-level phosphorylation. Oxidative phosphorylation is an electron transport system that can use either oxygen as the terminal electron acceptor (aerobic respiration) or acceptors other than oxygen (anaerobic respiration).

17. The term used when oxidative phosphorylation uses oxygen as the terminal electron acceptor is:
    a. substrate-level phosphorylation.
    b. fermentative metabolism.
    c. anaerobic respiration.
    d. aerobic respiration.

    ANS: D
    Oxidative phosphorylation is an electron transport system that can use either oxygen as the terminal electron acceptor (aerobic respiration) or acceptors other than oxygen (anaerobic respiration).

18. Which organelle is found in eukaryotic cells and is responsible for controlled enzymatic degradation of intracellular substances?
    a. Mitochondria
    b. Lysosomes
    c. Endoplasmic reticulum
    d. Golgi body

    ANS: B
    Lysosomes in the cell are responsible for controlled degradation of intracellular substances.

19. Teichoic acids are:

a. waxy substances that are found in some bacterial cell walls that make the cells resistant to toxic substances, including acids.
b. glycerol- or ribitol-phosphate polymers that are combined with various sugars, amino acids, and amino sugars, which are a part of the cell wall of gram-positive bacteria.
c. high–molecular-weight polysaccharides that coat some bacterial cells and protect the bacteria from attack by cells of the human defense system.
d. hairlike, proteinaceous structures that extend from the cell.

ANS: B
Teichoic acids, mycolic acids, peptidoglycan, and disaccharide-pentapeptide subunits are all building blocks of the bacterial cell wall.

20. Pieces of DNA that move from plasmid to chromosome or vice versa but are not found as separate entities are called:
a. DNA polymerases.
b. transposable elements.
c. plasmids.
d. chromatoids.

ANS: B
Plasmids can be separate entities, but transposable elements cannot.

21. All genes within an organism make up that organism's:
a. chromosomes.
b. genome.
c. nucleotides.
d. DNA.

ANS: B
Chromosomes are elements of the genome. Nucleotides and DNA are building blocks of genes.

22. A bacterial cell that contains teichoic acid stains which color on the Gram stain?
a. Pink
b. Red
c. Green
d. Purple

ANS: D
Gram-positive organisms contain teichoic acids and a thick layer of peptidoglycan that retains the primary strain, crystal violet and therefore stain purple on the Gram stain.

23. A bacterial cell that contains an outer membrane and periplasmic space stains pink to red on Gram stain. Which one of the following statements explains this discrepancy?
a. The bacteria were subjected to too much alcohol during the decolorization process, causing the organism to absorb the pink-to-red dye.
b. The bacteria with an outer membrane and periplasmic space should not be Gram stained because of their cell wall content.
c. Something is wrong with the lot of stains and may be expired. The Gram stain reagents are most likely expired.
d. No discrepancy is present; organisms that contain an outer membrane and periplasmic space should stain pink because of their cell wall composition.

ANS: D
Gram-negative organisms contain an outer membrane and periplasmic space and therefore should stain red to pink to red on Gram stain because of their cell wall composition.

24. Amino acids, fatty acids, sugars, and nucleotides are produced during which metabolic reaction?
    a. Fueling
    b. Biosynthesis
    c. Polymerization
    d. Assembly

    ANS: B
    During biosynthesis, amino acids, fatty acids, sugars, and nucleotides are produced using precursor products in dozens of pathways to produce nearly 100 different products.

25. Which of the following processes takes place in the cytoplasm and involves the transfer RNA (tRNA) mediating the sequential addition of amino acids in a specific sequence that is dictated by the codon sequence of the messenger RNA (mRNA) molecule?
    a. Transcription
    b. Initiation
    c. Elongation
    d. Termination

    ANS: C
    Elongation, which is one of the steps of translation, adds amino acids in a specific sequence, which ultimately codes for a specific protein. Translation occurs in the cytoplasm, whereas transcription occurs in the nucleus. Initiation begins with the association of ribosomal subunits, mRNA, and formylmethionine tRNA carrying the initial amino acid of the protein to be synthesized. After the initial complex is formed, addition of individual amino acids begins. Termination is the final step in translation and occurs when the ribosomal A site encounters a stop codon that does not specify an amino acid.

26. The structure of bacterial chromosomes differs from that of eukaryotic organisms in all of the following *except*:
    a. bacterial chromosomes are typically circular.
    b. the genes are polycistronic.
    c. the bacteria have two copies of each chromosome.
    d. bacterial mutations are easily transmitted or inherited.

    ANS: C
    Bacterial typically contain a single chromosome that is circular in nature. In order to maximize usage of a small genome, bacteria produce regions that are polycistronic or include multiple genes under the control of one region. Because bacteria typically contain one copy of the chromosome, mutations that are not lethal to the organism are easily transferred to successive generations.

27. In the following genetic sequence, identify the correct complementary strand of DNA for the sequence 3' CAGTACCGTAAGCT 5'.
    a. 3' GTCATGGCATTCGA 5'
    b. 5' GTCATGGCATTCGA 3'
    c. 5' AGCTTACGGTACTG 3'
    d. 5' GTCATGGCTTCGA 3'