

**COVENANT UNIVERSITY  
NIGERIA**

*TUTORIAL KIT  
OMEGA SEMESTER*

**PROGRAMME: MICROBIOLOGY**

**COURSE: MCB 122**

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# MCB 122: Microbial Taxonomy and Classification

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1. Name the three domains and state the evidence that supports this system of classification.
2. Describe proper binomial nomenclature
3. State the basis for the definition of species in bacteria and explain why bacterial species cannot be defined using the same criteria that are used for defining eukaryotic species
4. Why does classification of bacteria rely heavily on genetic testing?
5. Give a brief description of how morphology is used in identification and/or classification of microorganisms
6. Give a brief description of how gram staining is used in identification and/or classification of microorganisms
7. Give a brief description of how biochemical tests are used in identification and/or classification of microorganisms
8. Give a brief description of how nucleic acid sequencing is used in identification and/or classification of organisms
9. Give a brief description of how PCR is used in identification and/or classification of organisms
10. Give a brief description of how nucleic acid hybridization is used in identification and/or classification of organisms
11. Discuss the significance of rRNA in determining phylogeny and explain why and how RNAs are used
12. Which of the following represents a proper scientific name?
  - A. Anthrax
  - B. Bacillus
  - C. *Bacillus anthracis*
  - D. Rod-shaped bacterium
  - E. Anthrax bacillus
13. Which of the following is not a eukaryotic kingdom?
  - A. Fungi
  - B. Plantae
  - C. Animalia
  - D. Protista
  - E. All of the above are eukaryotic kingdoms
14. The relationship, or evolutionary history, of organisms is called
  - A. Taxonomy
  - B. Classification
  - C. Phylogeny
  - D. Identification
  - E. Domain
15. True or False: Based on comparisons of rRNA sequences, humans and plants are much more closely related to each other than they are to the bacteria
16. Which of the following is found in all three domains?
  - A. Nucleus
  - B. Peptidoglycan

- C. Prokaryotic (70S) ribosome
  - D. rRNA
  - E. None of the above is correct
17. Complete hybridization between strands of DNA from two organisms include
- A. Organisms are identical
  - B. Organisms are related
  - C. Organisms are unrelated
18. The G-C content of *E. coli* is 51 percent and the G-C content of *Shigella flexneri* is 51 percent. From this information, what would you conclude about the relationship between *E. coli* and *Shigella flexneri*?
19. Which of the following references would be most beneficial for identifying an unknown bacterial isolate?
- A. Encyclopaedia
  - B. Dictionary
  - C. *Bergey's Manual of systematic Bacteriology*
  - D. Microbiology Text Book
20. A method used to amplify short fragment of DNA is
- A. DNA hybridization
  - B. Southern blotting
  - C. Cloning
  - D. Polymerase chain reaction

**SOLUTION:**

1. The three domains are the Eukarya, the Bacteria, and the Archaea. The separation of life into three domains was originally based on sequence comparisons of rRNA molecules. These comparisons showed that the prokaryotes actually contained two different groups of cells. It also showed that eukaryotes were much more closely related to each other than they were to either two groups of prokaryotes. Since the initial RNA sequence comparisons, other fundamental differences between the three types of cells have given support to the three-domain system. These include differences in the cell walls, membrane lipids, tRNA and the first amino acid used in protein synthesis.
2. Proper binomial nomenclature describes each organism by a combination of two names: the genus followed by the specific epithet. The genus is capitalized and the specific epithet is lower case. The name is italicized or underlined to indicate that it is a proper scientific name.
3. Species in bacteria are defined based on similarities in characteristics. It is not possible to define bacterial species based on the ability to sexually reproduce, as it is in eukaryotes, because sexual reproduction does not exist in bacteria. Gene exchange in bacteria is not linked to reproduction. Reproduction occurs by binary fission, which is an asexual process.
4. The classification of bacteria relies heavily upon genetic testing because bacteria do not have a great deal of morphological complexity, so morphology is not very useful.
5. Morphology is determined by staining and is used in identification to narrow the list of possible bacteria.

6. Differential staining, such as the Gram stain, reveals unique characteristics about the bacteria. The Gram stain indicates the cell wall structure of the bacterium and is used in both classification and identification.
7. Biochemical tests determine whether particular enzymes are present. They are used primarily in identification.
8. For nucleic acid sequencing, nucleic acids such as RNA and DNA are isolated, and their specific sequence is determined. These sequences can be compared to establish relationships, as in the example of rRNA sequence comparisons that led to the identification of three domains. DNA sequences of unknown viruses can be compared to those of known viruses in a computer database in order to identify the unknown virus.
9. The polymerase chain reaction (PCR) makes many copies of a targeted piece of DNA. This technique is used to generate enough DNA for sequence comparisons, evaluation of G-C content and nucleic acid hybridization. It is thus important in both the identification and classification of organisms.
10. Nucleic acid hybridization tests the ability of DNA from different sources to base pair with each other. The more similar the DNA sequence is, the greater the amount of pairing, or hybridization. The more hybridization that occurs, the greater the degree of relationship. This technique is used for both classification and identification of bacteria.
11. One of the reasons that ribosomal RNA (rRNA) is a useful molecule for comparisons between cells is because it is found in all cells. Also, even though there has been enough change in rRNA sequences over evolutionary time to show differences between cells, there are still enough similarities to make comparisons possible. When rRNA sequences are compared, cells fall into three groups, called domains. These are the Bacteria, Archaea and Eukarya.
12. C
13. E
14. C
15. True
16. D
17. A
18. A
19. C
20. D