

Chapter 1—The Science of Microbiology

MULTIPLE CHOICE

1. Lister used phenol to
 - a. disprove the theory of spontaneous generation.
 - b. prevent the infection in wounds.
 - c. sterilize surgical instruments.
 - d. stimulate bacterial growth.

ANS: B OBJ: TYPE: Knowledge

2. The bacterium that causes the bubonic plague is
 - a. *Bacillus subtilis*.
 - b. *Escherichia coli*.
 - c. *Pseudomonas aeruginosa*.
 - d. *Yersinia pestis*.

ANS: D OBJ: TYPE: Knowledge

3. The Irish potato famine was caused by a
 - a. bacterium.
 - b. fungus.
 - c. protozoan.
 - d. virus.

ANS: B OBJ: TYPE: Knowledge

4. Select the characteristic that all microorganisms have in common.
 - a. They are bacteria.
 - b. They are organisms used in biological research.
 - c. They are pathogens.
 - d. They are too small to be seen with the unaided eye.

ANS: D OBJ: TYPE: Knowledge

5. A microbe is used to produce erythropoietin, a hormone that signals the production of red blood cells in the bone marrow of the human body. The production of this hormone is an advance mainly from the field of _____ microbiology.
 - a. agricultural
 - b. environmental
 - c. industrial
 - d. pathogenic

ANS: C OBJ: TYPE: Comprehension

6. Select the incorrect association.
 - a. algae/eukaryotes
 - b. archaea/prokaryotes
 - c. bacteria/prokaryotes
 - d. protozoa/not microscopic

ANS: D OBJ: TYPE: Comprehension

7. Select the incorrect statement about a virus.
- It contains DNA or RNA.
 - It has a protein coat.
 - It is a cellular organism.
 - It is visible through the electron microscope.

ANS: C OBJ: TYPE: Comprehension

8. Select the correct statement about bacteria.
- Most are multicellular.
 - None exhibit motility.
 - Their cells are filled with uniform, grainy material
 - Their cells are larger than eukaryotic cells.

ANS: C OBJ: TYPE: Comprehension

9. Bacteria can live at temperature extremes that vary as much as _____ degrees C.
- 40 to 60
 - 20 to 80
 - 0 to 100
 - 20 to 110

ANS: D OBJ: TYPE: Knowledge

10. A microbe is discovered in a local waterway. Testing this water reveals its high temperature and high acidity. The microbe produces bubbles in this water. However, tests on the microbe reveal that it does not cause diseases in humans. It probably belongs to the group of
- algae
 - archaea
 - fungi
 - viruses

ANS: B OBJ: TYPE: Application

11. Select the correct statement about algae.
- Their cells do not contain chloroplasts.
 - They are eukaryotes.
 - They do not include kelp, a macroscopic organism.
 - They lack membrane-bound organelles.

ANS: B OBJ: TYPE: Comprehension

12. The group of fungi does not include
- amoeba.
 - molds.
 - mushrooms.
 - yeasts.

ANS: A OBJ: TYPE: Knowledge

13. African sleeping sickness is caused by a(n)
- alga.
 - bacterium.
 - protozoan.
 - yeast.

ANS: C OBJ: TYPE: Knowledge

14. The most animal-like microorganisms are
- algae.
 - bacteria.
 - protozoans.
 - yeasts.

ANS: C OBJ: TYPE: Knowledge

15. Flatworms and roundworms are
- arthropods.
 - echinoderms.
 - helminths.
 - mollusks.

ANS: C OBJ: TYPE: Knowledge

16. Select the disease that is not caused by a virus.
- malaria
 - polio
 - smallpox
 - yellow fever

ANS: A OBJ: TYPE: Knowledge

17. Leeuwenhoek's microscopes could magnify to about
- 266X.
 - 400X.
 - 900X.
 - 1000X.

ANS: A OBJ: TYPE: Knowledge

18. Redi conducted experiments that discredited the theory of
- biogenesis.
 - cells.
 - inheritance.
 - spontaneous generation.

ANS: D OBJ: TYPE: Knowledge

19. In Pasteur's experiments on spontaneous generation, the purpose of the curve in his flasks containing meat broth was to
- increase the surface area of the flask.
 - increase the volume of the flask.
 - prevent microorganisms from entering the flasks.
 - promote heating of the broth.

ANS: C OBJ: TYPE: Comprehension

20. A researcher attempts to duplicate the experiments on spontaneous generation conducted by Pasteur. Nutrient broth is sealed in glass flasks with curved necks and is sterilized with heat. The broth is cooled to room temperature. After 48 hours the researcher observes that bacteria populate the broth in the flask. The best explanation for this observation is that the bacteria studied can
- change their genetic structure rapidly.

- b. develop from a nonliving source.
- c. form endospores.
- d. pass through pores in the glass.

ANS: C OBJ: TYPE: Application

21. Select the incorrect association.
- a. Jenner/studied smallpox
 - b. Koch/anthrax
 - c. Pasteur/French chemist
 - d. Spallanzani/studied typhoid fever

ANS: D OBJ: TYPE: Comprehension

22. A vaccine can contain a
- a. chemical in high concentration.
 - b. chemical in low concentration.
 - c. potent form of a microorganism.
 - d. weakened form of a microorganism.

ANS: D OBJ: TYPE: Knowledge

23. When Jenner inoculated a child with the fluid from a cowpox blister, it
- a. caused an infection.
 - b. had no effect.
 - c. stimulated immunity.
 - d. worked against a vaccine.

ANS: C OBJ: TYPE: Knowledge

24. To test a drug by selective toxicity is a principle of
- a. chemotherapy.
 - b. genetic engineering.
 - c. immunology.
 - d. virology.

ANS: A OBJ: TYPE: Knowledge

25. The first medically useful antibiotic was
- a. a sulfa drug.
 - b. erythromycin.
 - c. penicillin.
 - d. tetracycline.

ANS: C OBJ: TYPE: Knowledge

26. A researcher attempts to duplicate the experiments by Iwanowski on the tobacco mosaic virus. The researcher pours filtered juice from a plant through a filter. However, he discovers that this filtered fluid contains both bacteria and viruses from the plant. This probably occurs because the filter has pores with a diameter
- a. larger than bacteria but not larger than viruses.
 - b. larger than viruses but not larger than bacteria.
 - c. larger than both bacteria and viruses.
 - d. smaller than both bacteria and viruses.

ANS: C OBJ: TYPE: Application

27. Salvarsan comes from the Latin word that means
- disease.
 - healing.
 - to save.
 - to solve.

ANS: C OBJ: TYPE: Knowledge

28. A bacterial culture can double its number of cells every 30 minutes. One bacterial cell placed in nutrient broth leads to the production of _____ cells in one hour.
- four
 - eight
 - six
 - ten

ANS: A OBJ: TYPE: Application

29. Genetic engineering involves recombinant _____ technology.
- carbohydrate
 - DNA
 - lipid
 - protein

ANS: B OBJ: TYPE: Knowledge

30. The most common microorganism manipulated for genetic engineering is a
- bacterium.
 - fungus.
 - protozoan.
 - virus.

ANS: A OBJ: TYPE: Knowledge

TRUE/FALSE

1. The host of the microorganism causing the bubonic plague was a fish.

ANS: F OBJ: TYPE: Knowledge

2. *Phytophthora infestans* was the microorganism causing the potato blight in Ireland.

ANS: T OBJ: TYPE: Knowledge

3. An organism is discovered growing on the surface of a tree trunk. Studies show it is non-photosynthetic and lives off the decaying matter of the tree. These studies show that the organism cannot be a fungus.

ANS: F OBJ: TYPE: Comprehension

4. A cellular organism is studied. The results show that the organism lacks a defined nucleus and most organelles. These results show that the organism could be a prokaryote.

ANS: T OBJ: TYPE: Comprehension

5. Some bacteria are photosynthetic.

ANS: T OBJ: TYPE: Knowledge

6. The organisms of archaea are not closely related to bacteria or humans.

ANS: T OBJ: TYPE: Knowledge

7. Phytoplankton is algae.

ANS: T OBJ: TYPE: Knowledge

8. Fungi are nonphotosynthetic, prokaryotic, scavengers, and lack mycelia.

ANS: F OBJ: TYPE: Comprehension

9. A microorganism is identified under the microscope. It moves by the beating action of its cilia. This organism is probably a protozoan.

ANS: T OBJ: TYPE: Comprehension

10. A tapeworm is a flatworm.

ANS: T OBJ: TYPE: Knowledge

11. The light microscope in a biology lab has a total magnification of about 1000X. This can be used to study viruses in the lab.

ANS: F OBJ: TYPE: Comprehension

12. The pathogen for AIDS is a bacterium.

ANS: F OBJ: TYPE: Knowledge

13. The organism *Trichinella* is a helminth.

ANS: T OBJ: TYPE: Knowledge

14. Needham's experimental results apparently supported the theory of spontaneous generation. The experiments of Spallanzani and Pasteur disproved this theory.

ANS: T OBJ: TYPE: Comprehension

15. Koch's experiments established a relationship between microorganisms and disease.

ANS: T OBJ: TYPE: Knowledge

COMPLETION

1. The potato blight in Ireland occurred in the _____ century.

ANS: nineteenth

OBJ: TYPE: Knowledge

2. A local community hires a microbiologist to study the local water supply, testing it for safe human consumption. The training of the microbiologist is mainly in the field of _____ microbiology.

ANS: environmental

OBJ: TYPE: Comprehension

3. DDT is found ineffective at controlling an insect pest that is destroying local crops. A microorganism is tried as a biological control. This is an advance in the field of _____ microbiology.

ANS: agricultural

OBJ: TYPE: Comprehension

4. Prokaryotic cells lack structures that are bound by cell _____

ANS: membranes

OBJ: TYPE: Knowledge

5. You know that a microorganism is a protozoan if it moves by the action of _____, _____, or flagella.

ANS: cilia and pseudopodia

OBJ: TYPE: Comprehension

6. _____ are infectious agents that consist exclusively of protein molecules.

ANS: Prions

OBJ: TYPE: Knowledge

7. A large virus is discovered. If the average bacterial cell has a diameter of one micrometer, the diameter of the virus is about _____.

ANS: one-tenth of a micrometer

OBJ: TYPE: Application

8. The term "vaccination" is derived from the Latin word that means _____.

ANS: cow

OBJ: TYPE: Knowledge

9. Penicillin was originally referred to as the _____ drug.

ANS: wonder

OBJ: TYPE: Knowledge

10. _____ is the bacterium used most often in studies involving recombinant DNA technology.

ANS: *Escherichia coli*

OBJ: TYPE: Knowledge

SHORT ANSWER

1. Most modern classification schemes place the bacteria in a distinct kingdom, one that is apart from the plant or animal kingdoms. However, in the historical two-kingdom scheme of classification, bacteria were classified as plants. Explain the logic of this classification.

ANS:

The bacterial cell has a cell wall. Also, some bacteria are photosynthetic. These are characteristics shared in common with plants.

OBJ: TYPE: Analysis

2. Many biologists described protozoans as "unicellular," as they are one-celled organisms. However, because of their unique cell structure and complexity, other biologists use the term "acellular." Which term do you think is more accurate?

ANS:

They are one-celled. However, the comparison of protozoan cells to animal cells supports the idea of an acellular makeup, as the protozoan cell is usually more versatile for many functions and less specialized. To perform many functions, a protozoan cell is more complex than the cells of other kinds of organisms.

OBJ: TYPE: Analysis

3. As a student planning for a career in microbiology, can you assess the other areas of science that are important in preparation for a career in this field?

ANS:

Chemistry offers an important foundation toward understanding the facts and concepts of microbiology. Bacterial cell structure cannot be described without reference to the chemical makeup of cells. Human anatomy and physiology is relevant, as pathogens overcome the human immune system. Various normal floral populations of bacteria inhabit specific regions of the body. Physics is important for understanding the optics of microscopes.

OBJ: TYPE: Evaluation

ESSAY

1. Consider the following Case History: A female patient visits an urgent care clinic. Her symptoms include abdominal pain and fever. A small sample of blood is withdrawn from her body. This sample is sent to a microbiology clinic. Microscopic examination of her blood generates data for calculation of her total white blood cell count. This cell count normally falls within the range of 5,000 to 10,000 white blood cells per cubic millimeter of blood. Her count is 20,000. What is the advantage of sampling a small volume of blood for this test?

ANS:

The human body normally contains 4 to 6 liters of whole blood. Interpreting test results of the patient's blood depends on knowing the concentration of white blood cells throughout this volume. A small sample of the patient's blood indicates the white blood cell concentration throughout the entire volume of the patient's blood. It is impossible to monitor the entire blood volume of the patient. Therefore, the technique of sampling is used. The data from the sample represents the characteristics of the entire blood volume of the patient.

2. From the Case History cited in question 59, what is the reason for paying close attention to the white blood cell count in this patient?

ANS:

White blood cells are the major infection fighters in the blood. As a major component of the immune system of the human body, their changing concentration reflects the changing immune response of the body (See Chapters 16 through 18 in the textbook). An elevated white blood cell count indicates that the body is making more white blood cells, an appropriate response to combat the effects of the microbe infecting the body. More white blood cells are needed to combat these microbes and protect the body.