國立清華大學 106 學年度碩士班考試入學試題

系所班組別：生命科學院甲組、丁組

考試科目（代碼）：微生物學(0503、0803)

　　*請在【答案卷】作答

Part 1 單選題 Single choice (2 points/each)

1. Which of the following is not true about bacterial plasmids?
   A. Col plasmids encode colicin which kills strains of *E. coli.*
   B. R plasmids usually do not integrate into the host chromosome.
   C. F factor of *E. coli* is both a conjugative plasmid and an episome.
   D. Plasmids can be cured by treating with UV.
   E. All bacteriocin genes are on plasmids.

2. Which of the following statements is correct:
   A. When the cell wall is removed from a Gram-negative bacterium, the resulting form is called a protoplast.
   B. Sortase is a protein enzyme of bacteria that catalyzes covalent attachment of some surface proteins to peptidoglycan.
   C. When the cell wall is removed from a Gram-positive bacterium, the resulting form is called a spheroplast.
   D. The periplasmic space is found only in gram-positive bacteria.
   E. The lipopolysaccharide (LPS) that is found in the outer membrane of Gram-positive bacteria is also known as endotoxin.

3. For a light microscope, a 63× objective and a 10× ocular produce a total magnification of
   A. 73×
   B. 53×
   C. 630×
   D. 6.3×
   E. 1260×

4. _____ are infectious agents which can cause scrapie and mad cow disease.
   A. Prions.
   B. Viruses.
   C. Viroids.
   D. Virusoids.
   E. Water molds.

5. Which of the following statements is <u>not correct</u> about bacterial cytoskeleton?
   A. MreB is a homologue of actin and many rod-shaped bacteria and archaea have it.
   B. CreS is a homologue of lamin and keratin, and can help bacteria to maintain a curved shape.
   C. Cytoskeletal protein MamK can help the formation of magnetosome chains.
   D. FtsZ is a homologue of intermediate filament and can form a ring during septum formation in cell division.
   E. Some members of bacterial cytoskeleton can direct protein localization.

6. The disinfectant action of phenol and phenolic derivatives mainly is due to
   A. its inherent detergent action.
   B. membrane damage and protein denaturation.
   C. oxidation of disulfide bonds in proteins.
   D. extraction of lipids from membranes.
   E. damage to nucleic acids and proteins caused by free radicals.

7. Which of the statement is correct for the genus *Mycobacterium* ?
   A. Mycobacterium contains mycolic acids, complex fatty acids that feature an invariant C22 fatty acids attached to a longer variable fatty acid.
   B. The members of the genus *Mycobacterium* are considered Gram negative and are acid-fast.
   C. False negative Mantoux test can be observed in both early and advanced tuberculosis.
   D. *Mycobacterium tuberculosis* is the major causative agent of human disease called leprosy.
   E. People are most frequently infected with *M. tuberculosis* by ingestion, followed by contact and inhalation.

8. The yeast Saccharomyces cerevisiae belongs to which of the following phylum?
   A. Zygomycota
   B. Ascomycota
   C. Basidiomycota
   D. Oomycota
   E. Deuteromycota

9. The process that microorganisms can transform nitrates to gaseous nitrogen is called:
   A. nitrification
   B. ammonification
   C. nitrogen fixation
   D. denitrification
   E. none of the above

10. Food poisoning caused by *Clostridium botulinum* is due to
   A. biofilm formation of bacteria
   B. production and release of toxin
   C. acute diarrhea
   D. bacteria invasion in the intestine
   E. none of the above

11. Please choose one correct statement for the proteobacteria.
   A. Most purple nonsulfur bacteria are alpha-proteobacteria and use anoxygenic photosynthesis with bacteriochlorophylls a or b.
   B. Purple sulfur bacteria are strict aerobic and oxidize hydrogen sulfide to sulfur.
   C. Pseudomonads such as *Pseudomonas syringae* is an important human pathogen that infects cystic fibrosis patients.
   D. The genus *Rhizobium* can invade the crown, roots and stems of many plants to transform plant cells into autonomously proliferating tumor cells.
   E. Beat-proteobacteria are the smallest of the proteobacteria classes and include *Helicobacter*.

12. Which of the following comparison of *Bacteria*, *Archaea* and *Eukarya* is correct?
    A. Gas vesicles are present in both *Archaea* and *Eukarya*.
    B. For membrane lipid, both *Bacteria* and *Archaea* contain ester-linked, straight-chained fatty acid.
    C. Messenger RNA (mRNA) splicing are present in both *Bacteria* and *Archaea*.
    D. Chlorophyll-based photosynthesis are present in both *Archaea* and *Eukarya*.
    E. Ribosomes in both *Archaea* and *Eukarya* are insensitive to kanamycin.

13. Which statement related to human diseases caused by bacteria is correct?
    A. Staphylococci are gram-positive bacteria causing pharyngitis (sore throat).
    B. Peptic ulcer disease is caused by enterotoxigenic *E. coli* (ETEC).
    C. Cholera is an acute diarrheal disease caused by enteroaggregative *E. coli* (EAEC).
    D. Septic shock and sepsis are commonly caused by gram-negative bacteria, mediated by the lipid A of the outer membrane.
    E. none of the above

14. Choose a correct target for each antibiotic acts.
    A. The quinolones are synthetic drugs that can inhibit nucleic acid synthesis in bacteria.
    B. Tetracyclines are a family of antibiotics that target the cell membrane of bacteria.
    C. Aminoglycoside antibiotics (for example, streptomycin) are inhibitor of bacterial cell wall synthesis.
    D. Members of the penicillin family disrupt the outer membrane of gram-negative bacteria.
    E. Vancomycin inhibits bacterial protein synthesis.

15. Which one of the following statements is NOT true?
    A. Influenza can be transmitted by direct contact or inhalation
    B. Streptolysin O & streptolysin S can kill host leukocytes
    C. Leukocidins are superantigens that can cause B cells of the immune system to overexpress and release cytokines
    D. Mitochondria arose from endosymbiotic association with an ancestor of *Rickettsia*
    E. Genus *Deinococcus* contains bacteria that can be extraordinarily resistant to radiation

16. Which of the following drugs has been shown to reduce the duration and symptoms of influenza?
    A. penicillin
    B. AZT
    C. amantadine
    D. acyclovir
    E. ampicillin

17. Large-scale screening of blood for the hepatitis B virus uses an assay designed to detect
    A. the Delta agent.
    B. the Dane particle.
    C. viral surface antigens.
    D. alanine transaminase.
    E. ribosome

18. Which of the following pathways for complement activation is generally dependent upon the formation of antigen-antibody complexes?
    A. The classical pathway.
    B. The alternative pathway.
    C. The lectin complement pathway.
    D. The consistent pathway.
    E. The lactic acid pathway.

19. Negri bodies are produced within _____ in rabies infected humans.
    A. skeletal muscle
    B. connective tissue
    C. brain neurons
    D. lungs
    E. small intestine

Part 2 簡答題 Term description and short answers

1. Photoorganoheterotroph (3%)
2. Endospore (3%)
3. Ribotyping (3%)
4. Bioremediation (3%)
5. Pasteurization (3%)
6. Quorum sensing (3%)
7. Alpha-hemolysis (3%)
8. Zika virus (2%)
9. Natural killer cells (2%)
10. Recombinant subunit vaccine (2%)

Part 3 問答題 Long answers

1. Draw a diagram and describe the mechanism of flagellar rotation and movement. (4%) Explain how bacteria operate flagella to move toward substances such as nutrients and why do you think this type of chemotaxis is sometimes called a "biased random walk" ? (4%)

2. (a) Plot a bacterial growth curve in a closed system and describe the four phases of this curve and discuss the causes of each. (5%) (b) Suppose the generation time of a bacterium is 40 minutes and the number of cells in a culture is 10^4 cells at the start of the log phase. How many bacteria will be there after 4 hours of exponential growth? (2%)

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3. Describe the functions of reverse transcriptase during human immunodeficiency virus replication and transcription. (4%)

4. What are the antigenic shift and antigenic draft? (4%) Why antigenic shift and antigenic draft are so important in infectious disease spreading? (4%)

5. What are the possible sources and models of transmission in the Middle East respiratory syndrome virus? (4%)

6. Describe the roles of interferons in innate immunity. (4%)