

國立清華大學 107 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(0403、0703)

共 9 頁，第 1 頁 *請在【答案卷】作答

I. Single choice (每題 2 分) (共 42 分)

1. Which of the following statements is correct for the microscopy used in microbiological studies?
 - A. By applying transmission electron microscope (TEM), a denser region in the specimen scatters less electrons and therefore appears brighter in the image.
 - B. Scanning tunneling microscope (STM) applies a sharp probe to move over the specimen surface at a constant distance can be used to study surfaces that do not conduct electricity well.
 - C. In epifluorescence microscopy, the excitatory light is passed through the specimen first and then into the objective lens
 - D. The phase-contrast microscope contains an annular stop and a phase plate, and is an excellent way to observe living cells.
 - E. The Bright-Field microscope produces a bright image of the object against a dark background.

2. All of the following statements are correct except:
 - A. The endosymbiotic hypothesis is generally accepted as the origin of mitochondria, chloroplasts, and hydrogenosomes.
 - B. The universal phylogenetic tree developed by Pace is based on comparisons of protein sequences.
 - C. According to the last universal common ancestor (LUCA) theory, Archaea and Eukarya diverged from common ancestry.
 - D. According to the RNA world hypothesis, the first self-replicating molecule in the evolution of life was RNA.
 - E. The spontaneous generation theory suggested that living organisms could develop from nonliving matter.

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3. Which of the following is not correct about bacteria?
 - A. Mycoplasmas lack a cell wall.
 - B. Some of bacteria have sex pili for mating (conjugation).
 - C. The size of a bacterial ribosome is 70S.
 - D. Some bacteria contain intracytoplasmic membranes to provide a larger membrane surface for greater metabolic activity.
 - E. The nucleoid in bacteria contains chromosome and histones.

4. Which of these methods can be used to determine the number of viable microorganisms in a sample?
 - A. light scattering in a spectrophotometer
 - B. measuring total cell mass
 - C. measuring colony forming units per ml
 - D. counting a known volume of cells in a hemocytometer
 - E. counting a known volume of cells with an electronic counter such as Coulter Counter

5. Which of the following best describe the energy source of a chemoorganoheterotroph?
 - A. glucose
 - B. carbon dioxide
 - C. oxidized metals
 - D. light
 - E. nitrate

6. Which of the following protects bacteria from lysis in dilute solutions and helps to determine their cellular morphology or shape?
 - A. plasma membrane
 - B. peptidoglycan
 - C. capsule
 - D. gas vacuoles
 - E. flagella

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7. Which of the statement is not true for the microbe-host and microbe-microbe interactions?
- A. Epiphytes are microbes that live on the plant surfaces.
 - B. In soils, fungi and archaea are as abundant as bacteria.
 - C. Mutualism defines a relationship in which the microbe and host are dependent on each other.
 - D. Consortium represents physical association between microorganisms, in which one organism hosts more than one symbiont.
 - E. Amensalism is a relationship between microorganisms, in which one microbe benefits, while another microbe is neither harmed nor helped.
8. Which statement related to photosynthetic bacteria is correct?
- A. In the process of chromatic adaptation, the production of phycoerythrin in cyanobacteria is promoted by orange light.
 - B. Purple non-sulfur photosynthetic bacteria usually use water as an electron donor.
 - C. Purple sulfur photosynthetic bacteria are obligate aerobic photoorganoheterotrophs.
 - D. Bacteriochlorophylls a and c are major photosynthetic pigments for green non-sulfur photosynthetic bacteria.
 - E. Cyanobacteria perform anoxygenic photosynthesis to use water as an electron source.
9. Which following disease is caused by *Bordetella pertussis*?
- A. Malaria
 - B. Whooping cough
 - C. Lyme disease
 - D. Legionnaires' disease
 - E. Meningitis

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10. Please choose one correct statement for microbial pathogenicity and infections.
- A. The lipopolysaccharide is a soluble, heat-labile exotoxin produced by human pathogens.
 - B. Aflatoxins are produced by Gram-negative bacteria and are extremely carcinogenic and mutagenic.
 - C. In the bacterial AB type of toxins, the A portion can enter the host cells to facilitate enzyme activity that cause the toxicity.
 - D. Host susceptibility is not a factor in determining infectious disease.
 - E. SARS is an air-borne disease caused by virus.
11. Please choose a wrong statement related to mechanisms for bacterial pathogens to evade and resist host defenses, and bacterial transmission in human reservoirs.
- A. M protein of *Streptococcus pyogenes* can prevent phagocytosis by the host cells, and is also involved in bacterial attachment to host cells.
 - B. *Neisseria meningitides* can produce capsule to prevent the host immune cells from effectively capturing.
 - C. Hepatitis B virus secretes a large number of decoy proteins that bind available antimicrobial proteins, so that virus is unnoticed by the host cells
 - D. *Haemophilus influenzae* is an obligate intracellular pathogen and can eject itself from cell to cell using host actin.
 - E. Plaque can be transmitted by flea biting.

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12. 'Which is wrong for microbial genomics and next-generation DNA sequencing (NGS)?
- A. Multiple strand displacement (MDA) is a PCR-based DNA amplification technique, using in single-cell genomic sequencing.
 - B. Metagenomics is to study genomes directly recovered from environmental samples, without culturing individual microbes.
 - C. In pyrosequencing reaction of the next-generation DNA sequencing (NGS), the release of PPi is measured and is proportionally converted into visible light by a series of enzymatic reactions.
 - D. In comparative genomics, synteny represents partial or complete conservation of gene order in the genomes of two closely related microorganisms.
 - E. Phylotypes are taxon characterized only by nucleic acid sequence (e.g., 16S rRNA encoding sequence).
13. Choose a wrong statement about human diseases caused by microorganisms.
- A. *Staphylococcus epidermidis* is one of the coagulase-negative staphylococci (CoNS), non-pigmented, and generally less invasive.
 - B. *Mycoplasma pneumonia* can cause atypical pneumonia and *M. pneumonia* are resistant to all beta-lactam antibiotics due to the inability to synthesize peptidoglycan precursors.
 - C. *Helicobacter pylori* is an obligate microaerophile, and causes gastritis and peptic ulcer disease.
 - D. Histoplasmosis is primarily a disease of the human lungs.
 - E. Legionnaires' disease is a bacterial infection in human gastrointestinal tract.

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14. In the comparison of bacterial archaeal and eukaryotic cells, choose a wrong one from the following.
- A. DNAs are complexed with histones in all eukaryotic and some archaeal cells, but not in bacterial cells.
 - B. Peptidoglycan is existed in the cell wall of bacterial and archaeal cells.
 - C. The eukaryotic cells contain a plasma membrane of ester-linked phospholipids and sterols, but plasma membrane of the archaeal cells contain glycerol diethers and diglycerol tetraethers.
 - D. The eukaryotic cells contain more than one linear chromosomes, but the archaeal cells have one circular chromosome.
 - E. The nucleolus is found in the nucleus of the eukaryotic cells, but not in the nucleus of the archaeal cells.
15. Choose a correct answer for activity of antimicrobial drugs.
- A. Chloramphenicol inhibits bacterial DNA-dependent RNA polymerase.
 - B. Penicillins can bind to small ribosomal subunit and interfere with protein synthesis.
 - C. Dilution susceptibility tests is used to determine both minimal inhibitory concentration (MIC) and minimal lethal concentration (MLC) values for a specific antimicrobial drug.
 - D. The Kirby-Bauer test is a disk diffusion test is used to determine the level of antimicrobial activity for both aerobic and anaerobic bacteria.
 - E. Vancomycin inhibits DNA gyrase and topoisomerase II to block DNA replication.
16. Which of the following uses dsRNA as the genome?
- A. parvovirus
 - B. bunyavirus
 - C. rotavirus
 - D. poxvirus
 - E. influenzavirus

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17. Unlike most enveloped viruses, herpes viruses involve the host _____ membrane in the formation of their envelope.
- A. plasma
 - B. nuclear
 - C. mitochondrial
 - D. none of these
 - E. Golgi body
18. For which of the following DNA viruses do(es) DNA replication occur in the cytoplasm rather than in the nucleus?
- A. poxviruses
 - B. herpesviruses
 - C. adenoviruses
 - D. DNA replication occurs in the nucleus for all of these
 - E. parvovirus
19. 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. C5~C9 pathway
 - E. C10~C12 pathway.
20. Macrophages are derived from
- A. granulocytes.
 - B. basophils.
 - C. neutrophils.
 - D. monocytes.
 - E. mast cells

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21. Which of the following cell types migrates to the lymphoid tissue after encountering pathogens in the skin or the mucous membranes?

- A. mast cells.
- B. dendritic cells.
- C. macrophages.
- D. spleen cell
- E. natural killer cell

II. Term description and short answer (共 33 分)

1. Facultative anaerobe (3 分)
2. Bacteriocin (3 分)
3. Microbiome (3 分)
4. Biofilms (3 分)
5. Methyloph (3 分)
6. Diauxic growth (3 分)
7. Bioaugmentation (3 分)
8. epitopes (3 分)
9. haptens (3 分)
10. shingles (3 分)
11. dual infections (3 分)

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III. Long answers (25 分)

1. Koch's postulates have been used to connect many diseases to their causative microorganisms. (a) Describe Koch's postulates. (4 分) (b) What is a pure culture? (2 分) (c) Why are pure cultures important to Koch's postulates? (2 分)
2. (a) Name the reagent used and state the purpose of each of the following in the Gram stain: mordant, primary stain, decolorizer, and counterstain. (4 分) (b) Describe the mechanism of Gram staining. (3 分)
3. Describe the roles of cytokines in immunity. (5 分)
4. Describe the roles of neuraminidase during influenza virus infection. (5 分)