國立清華大學 100 學年度碩士班入學考試試題

系所班組別：生命科學院甲組、醫學生物科技學程

考試科目（代碼）：微生物學(0403、0703)

　　*請在【答案卷】作答

I. Single choice (1.5 points each, total 36%)

1. Which is incorrect?

A. C1q binds to the Fc portion of antigen-antibody complexes

B. C2 causes viral neutralization

C. C3a is anaphylatoxin

D. C3b causes viral neutralization

E. C4a is anaphylatoxin

2. The protein coat surrounding the viral genome is called the

A. Capsule

B. Capsid

C. Matrix

D. Envelope

E. nucleic acid

3. Which of the following is/are not true about viral envelopes?

A. The envelope proteins are virus specific

B. The envelope lipids and carbohydrates are derived from the host

C. They are typical lipid monolayers with embedded proteins

D. The envelope proteins are virus specific and the envelope lipids and carbohydrates are derived from the host

E. All of them are true.

4. Opsonizing antibodies must be against _____ components if they are to effectively stimulate phagocytosis

   A. Surface

   B. Internal

   C. Protein

   D. Polysaccharide

   E. All of them

5. Which is mismatch between ligand and toll-like receptor (TLR)

   A. Peptidoglycan & TLR2

   B. Flagellin & TLR7

   C. Double-stranded viral RNA & TLR3

   D. Bacterial lipopeptides & TLR2

   E. LPS & TLR4

6. During chronic inflammation when the macrophages are unable to protect the host from tissue damage, the body attempts to wall off and isolate the site by forming a(n)

   A. Clot

   B. Cyst

   C. Granuloma

   D. Vesicle

   E. All of them

7. Which of the following description is not correct?
   A. Antony van Leeuwenhoek was the first to observe and accurately describe microorganisms.
   B. Edward Jenner developed a set of criteria that could be used to establish a causative link between a particular microorganism and a particular disease.
   C. Joseph Lister was the pioneer in antiseptic surgery.
   D. Barbara McClintock first discovered transposons during her studies on maize genetics in the 1940s and later won the Nobel prize in 1983.
   E. Louis Pasteur is credited with developing vaccines against chicken cholera, anthrax, and rabies.

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

9. Which of the following does not occur with generalized transduction?
   A. could occur by an error in the lysogenic life cycle of phages.
   B. degradation of the host chromosome into randomly sized fragments.
   C. packaging of any DNA fragment of the appropriate size.
   D. transfer of any bacterial gene to the subsequent host.
   E. production of abortive transductants in most of cases.

10. Which of the following is not true of capsules?
    A. They help bacteria escape phagocytosis by host cells.
    B. They retain water and help prevent desiccation of the bacteria.
    C. They prevent entry of many bacterial viruses.
    D. They are one kind of glycocalyx.
    E. They are regularly structured layers of protein.

11. Which of the following is not true about the agent used for control of microorganisms?
    A. 70% ethanol is more effective than 95% ethanol in bacterial killing.
    B. Betapropiolactone (BPL) destroys microorganisms more readily than ethylene oxide but does not pentrate materials well.
    C. Gamma radiation has poor penetrating power than UV radiation.
    D. At 2% buffered concentration, glutaraldehyde is less irritating than formaldehyde.
    E. Chlorine is more suitable than iodine in treatment of water supplies.

12. Which of the following is true about the light microscopy?
    A. An objective with a larger numerical aperture (NA) will have a greater resolution power.
    B. A longer wavelength of light can give a greater resolution.
    C. An objective with a smaller numerical aperture (NA) will have a smaller working distance.
    D. Immersion oil can decrease the refractive index between the specimen and the objective lens.
    E. Parfocal microscopes change the focus when objectives are changed.

13. Acid-fast microorganisms such as *Mycobacterium tuberculosis* resist decolorization by an acid-alcohol wash because of the high concentration of _____ in their cell walls.
    A. proteins
    B. carbohydrates
    C. peptidoglycan
    D. nucleic acids
    E. lipids

14. Differences between mitochondrial and *E. coli* electron transport chains include the following:
    A. The *E. coli* chain is branched and contains a different array of cytochromes.
    B. The fundamental principles on which they operate are different.
    C. Higher P/O values are observed in *E. coli*.
    D. The electron transport change does not involve membranes in *E. coli*.
    E. The *E. coli* chain is longer, resulting in the release of more energy.

15. Which is <u>true</u> for the following comparisons between *Eucarya* and *Archaea*?
    A. Both *Eucarya* and *Archaea* contain membrane-enclosed nucleus with nucleolus.
    B. For the membrane lipid, both *Eucarya* and *Archaea* have ether-linked, branched aliphatic chains.
    C. Both *Eucarya* and *Archaea* do not contain muramic acid in their cell wall.
    D. *Archcaea* is sensitive to rifampicin, while *Eucarya* is insensitive to rifampicin.
    E. Both *Eucarya* and *Archaea* are sensitive to chloramphenicol and kanamycin.

16. Which of the following is <u>not true</u> for techniques to determine microbial taxonomy and phylogeny?

A. Multilocus sequence typing (MLST) can be used to differentiate microbial isolates at the strain and species levels.

B. The comparison of restriction fragments between species and strains is the basis of restriction fragment length polymorphism (RFLP) analysis.

C. Genetic characteristic is used in classical approaches to taxonomy. For example, transformation can occur between prokaryotic species but only rarely between genera.

D. Nucleic acid hybridization can be used to compare DNA or RNA sequences and determine genetic relatedness.

E. The data of G + C content is useful to characterize prokaryotic genera because the variation within a genus is usually more than 50%.

17. Bacteria make important contributions to the nitrogen cycle. Which of the following statement is <u>not true</u>?

A. Both *Nitrosomonas* and *Nitrospira* can oxidize ammonium to nitrite.

B. All the nitrifying bacteria are anaerobic, gram-positive organisms with the ability to get capture energy from oxidation of either ammonium or nitrite.

C. Denitrification is a process by which nitrates are reduced to nitrous oxide (NO) or nitrogen gas (N_2).

D. Most denitrification is performed by *Pseudomonas* species.

E. Nitrous oxide from denitrification can be converted to nitric oxide (NO), which reacts with ozone (O_3) in the upper atmosphere. If enough ozone is destroyed, living things can be exposed to excess ultraviolet rqadiation.

18. Which of the following is true for bacterial cell wall?

A. Teichoic acid is often present in cell wall of Gram-positive bacteria.

B. Mycolic acid and glycolipids are present in cell wall of Gram-negative bacteria.

C. For Acid-Fast bacteria, outer membrane is located outside of cell wall.

D. Periplasmic space is existed in Gram-positive bacteria.

E. Chloramphenicol is an antibiotic that inhibits bacterial cell wall synthesis.

19. Which of the following is not true for bacterial endotoxin?

A. The lipid A portion of the bacterial endotoxin is toxic.

B. Enditoxin can produce fever by induction of interleukin-1 and TNF.

C. Endotoxin is only found in Gram-negative bacteria.

D. Bacterial endotoxin is heat sensitive and inactivated at 60-80°C.

E. Endotoxin has less potent and less specific than exotoxin.

20. Which of the following statement is not true for the protists?

A. Photosynthetic protists contain both photosystems I and II and perform oxygenic photosynthesis.

B. Chaga's disease is caused by *Trypanosoma cruzi*.

C. Budding is the most common method of asexual reproduction in the protists.

D. One of the morphological hallmarks of amoeboid is the use of pseudopodia for locomotion and feeding.

E. Contractile vacuoles serve as osmoregulatory organells in those protists that live in hypotonic environments such as freshwater lakes.

21. Which is not true for purple-, green-photosynthetic bacteria and cyanobacteria?
   A. Cyanobacteria use phycobiliprotins as accessory pigments.
   B. Most cyanobacteria appear blue-green is due to the presence of phycocyanin.
   C. Green sulfur bacteria (phylum *Chlorobi*) contain chlorosomes that are the most efficient light harvesting complexes found in nature.
   D. Purple sulfur bacteria use water as their photosynthetic electron donors.
   E. Heterocysts of cyanobacteria can be used for nitrogen fixation.

22. Which of the following statement is not true for the fungi?
   A. The study of fungi is called mycology and the diseases caused by fungi in animals are known as mycoses.
   B. Oral thrush is a fairly common disease in newborn babies and is caused by *Aspergillus fumigatus*.
   C. The fungi imperfecti (or Deuteromycota) are called "imperfect" because no sexual stage has been identified in the life cycle.
   D. *Saccharomyces cerevisiae* belongs to the fungi called Ascomycota.
   E. The hyphal cells of most fungi contain one or two nuclei and many of the hyphal cells are separated by septa.

23. Which one of the following statements is not true?
   A. Group A beta-hemolytic streptococci is one of the most important bacterial pathogens.
   B. Streptolysin O & streptolyson S can kill host leukocytes.
   C. Toxic shock-like syndrome is caused by *Staphylococcus epidermidis*.
   D. *Staphylococcus aureus* is coagulase-positive and often produces a yellow pigment.
   E. Slime is a viscous extracellular glycoconjugate that allows certain bacteria to adhere to smooth surface, such as catheters.

24. Which of the following is not true for the comparisons of *Rickettsia* and *Coxiella*?
    A. *Rickettsia* and *Coxiella* are commonly considered together because of their important similarities.
    B. After entering host by phagocytosis, *Rickettsia* can remain and reproduce in phagosome.
    C. *Rickettsia* lack glycolytic pathway and do not use glucose as energy source.
    D. Several *Rickettsia* and *Coxiella* species are important human pathogens.
    E. Both *Rickettsia* and *Coxiella* can enter host by phagocytosis.

II. Term description and short answer (28%)

1. Membrane attack complex in alternative pathway (3%)
2. Dendritic cells (2%)
3. What are the cytokines? (2%) Please describe the biological actions of cytokines on eukaryotic cells? (4%)
4. Latent virus infection (2%)
5. Viable but nonculturable (VBNC) (3%)
6. Photoorganotrophic heterotrophy (3%)
7. Quorum sensing (3%)
8. Beta-lactamase (3%)
9. Opportunistic pathogens (3%)

III. Long answers (36%)

1. Please describe the penetration and uncoating processes in paramyxovirus and HIV, respectively. (8%)
2. How does the avian influenza virus interact with sialic acid receptor? (4%)
3. Plot a microbial growth curve in a closed system and describe the four phases of this curve and discuss the causes of each. (6%)
4. Describe in some details about how Hfr × F^- and F' × F^- conjugation processes proceed, and distinguish between the two in terms of mechanism and the final results. (6%)
5. Please use diphtheria toxin as an example to explain (a) how AB exotoxin can be transported into the host, (b) what happens to the toxin within the host cells and (c) how the toxin can cause host cell death (6 %)
6. Please list any two reasons that can explain rRNAs from small ribosomal subunits as the choice for inferring microbial phylogenies and making taxonomic assignments at the genus level. (6 %)