

MBIO 2815 – Introduction to Microbiology

Final Exam (200 points) -- Form 1 (Blue)

May 9, 2002

Before you begin, do yourself a favor and write the color of your test form somewhere near your name on the scantron form. This may avoid mixups and save us all much grief. I'll put a blank here so you can check it off after you have done this small task: _____.

Part I: Questions from the first part of the course (3 points each)

True-false (mark A for true, B for false):

1. Lipids have diverse molecular structures, but one thing they all have in common is that they are hydrophobic.
2. The chemical structure of the molecules that make up the plasma membrane prevents the free entry of all molecules into cells.
3. All prokaryotic cells have DNA, a plasma membrane, flagella, and endospores.
4. Chemiosmosis requires that a cell generate an H⁺-gradient as part of an electron transport chain.
5. In photosynthesis, light is the direct energy source for the reactions of the Calvin cycle.

Multiple choice / matching:

6. The main difference between archaea and bacteria is:
 - a. archaea have mitochondria; bacteria do not.
 - b. archaea are all eukaryotic; bacteria are all prokaryotic.
 - c. archaea are all heterotrophs; bacteria are all autotrophs.
 - d. archaea all have a cell wall; bacteria never have a cell wall.
 - e. none of the above is correct.
7. Most sexually reproducing organisms are divided into species based on whether or not they have the potential to interbreed and produce fertile offspring. This criterion doesn't work for asexually reproducing organisms such as bacteria. By what criteria, then, are bacteria classified into species?
 - a. morphology (e.g. cell shape)
 - b. the ability to carry out certain biochemical reactions
 - c. cellular structures (e.g. production of a capsule)
 - d. only a and c
 - e. a, b, and c

Match the following (answers may be used more than once):

- | | | | | |
|------------|----------------|----------------|---------|---------|
| a. Pasteur | b. Leeuwenhoek | c. Spallanzani | d. Redi | e. Koch |
|------------|----------------|----------------|---------|---------|
8. First person to use a microscope to look at microorganisms.
 9. Scientist who used a "swan-necked flask" to show that microbes do not arise by spontaneous generation.
 10. First to grow bacteria in pure culture and to identify *Bacillus anthracis* as the cause of anthrax.
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11. If *E. coli* were grown in a medium containing radioactive phosphorus (³²P), the ³²P would be found in all of the following molecules or parts of the cell EXCEPT:
 - a. ATP
 - b. monosaccharides
 - c. DNA
 - d. plasma membrane
12. Water:
 - a. is essential to life.
 - b. includes two polar covalent bonds.
 - c. dissolves hydrophilic molecules.
 - d. two of the above are correct.
 - e. a, b, and c are correct.

13. Which of the following statements about lipids is FALSE?
- A fat (triglyceride) consists of three fatty acids connected to a glycerol molecule.
 - Olestra (Olean) is a fat substitute that contains fatty acids but not glycerol.
 - Butter and margarine, which are typically solid at room temperature, are saturated fats.
 - Olive oil, which is typically liquid at room temperature, is an unsaturated fat.
 - Unlike other lipids, steroids are polymers made of dozens of repeated subunits (monomers).
14. The chemical reaction called dehydration synthesis is the opposite of the chemical reaction called:
- photosynthesis
 - respiration
 - hydrolysis
 - digestion
 - hydration synthesis

 Match the following (answers may be used more than once):

- | | | | | |
|-------------------|---------------|---------------|------------|----------------|
| a. monosaccharide | b. amino acid | c. nucleotide | d. b and c | e. a, b, and c |
|-------------------|---------------|---------------|------------|----------------|
15. Consists only of C, H, and O.
16. Exactly 20 different ones of these nitrogen-containing molecules are found in living cells.
-

17. Which polymer is correctly paired with its monomer?
- protein – nucleotide
 - nucleic acid – amino acid
 - polysaccharide – monosaccharide
 - both b and c
 - a, b, and c
18. A good example of a protein would be:
- an enzyme that catalyzes ATP formation
 - ATP
 - glycogen, the stored fuel in both animal and fungal cells
 - DNA
 - RNA
19. Phospholipids are mainly found in:
- ribosomes
 - DNA
 - RNA
 - membranes
 - cell walls
20. You can use a microscope to observe a difference between a gram-negative and a gram-positive cell because of chemical differences in their:
- cell walls
 - plasma membranes
 - genetic material
 - carbohydrates
 - enzymes
21. Endosymbiont theory postulates that mitochondria and chloroplasts originated when prokaryotes began to live in close association with each other. Which of the following is NOT among the lines of evidence for this theory?
- both of these organelles contain their own nuclei.
 - both of these organelles contain their own ribosomes.
 - both of these organelles are surrounded by double membranes.
 - both of these organelles divide independently within eukaryotic cells.
22. Which of the following statements is FALSE?
- Most polar molecules can move freely across the plasma membrane.
 - Simple diffusion results from random molecular motion.
 - Facilitated diffusion requires a special protein channel but does not require the direct expenditure of ATP.
 - Active transport requires both a special protein channel and the direct expenditure of ATP.
 - Water will move into a cell by osmosis if the salt concentration inside the cell is higher than the salt concentration outside the cell.

23. In the light reactions of oxygenic photosynthesis, ___ is the electron source. At the end of the light reactions, the electrons end up in the molecule called ___, which ends up reducing CO₂ to form glucose in the dark reactions.
- a. glucose ... ATP
 b. ATP ... O₂
 c. H₂O ... NADPH
 d. NADH ... ADP
 e. O₂ ... H₂O
24. Which of the following statements is FALSE?
- a. Fermenters may reduce pyruvate to ethanol + CO₂, lactic acid, or propionic acid.
 b. NADH and FADH₂ function as electron carriers in metabolism.
 c. Some organisms can carry out respiration in the absence of O₂.
 d. The ATP produced in respiration comes mostly from chemiosmosis.
 e. The CO₂ produced in respiration comes from glycolysis.
25. Which of the following best describes the relationship between photosynthesis and respiration?
- a. ATP molecules are produced in photosynthesis and used up in respiration.
 b. Autotrophs have no need for respiration because they can carry out photosynthesis.
 c. Photosynthesis stores energy in glucose and respiration releases it.
 d. Respiration is anabolic and photosynthesis is catabolic.
 e. Respiration is the exact reversal of all the biochemical pathways of photosynthesis.

Part II: Questions from the second part of the course (3 points each)

True-false (mark A for true, B for false):

26. Commercial antiseptics and disinfectants usually work by damaging the proteins or plasma membranes of microorganisms.
27. In DNA, the number of cytosine bases is always exactly the same as the number of adenine bases.
28. Operons, which are clusters of related genes under the control of a single promoter, are a feature of prokaryotic cells but not eukaryotic cells.
29. A plasmid is a small portion of a cell's membrane that can enter a cell and alter its genetic characteristics.
30. In a lysogenic infection, a bacteriophage infects a host cell without immediately producing progeny.

Multiple choice / matching:

 Match the following (answers may be used more than once):

- a. obligate aerobe b. facultative anaerobe c. obligate anaerobe d. mesophile

31. Organism that must have abundant oxygen
 32. Organism that grows with or without oxygen
-

33. Which of the following statements about DNA is FALSE?

- a. Enzymes are required for DNA replication.
 b. The two strands of a DNA molecule run in opposite directions ("antiparallel").
 c. When DNA replicates, the two resulting double-stranded DNA molecules each contain one strand from the original DNA molecule.
 d. The two strands of a DNA molecule are fastened to each other by strong, covalent bonds between the nitrogenous bases.
 e. Watson and Crick determined the structure of DNA in the mid-1900s.

42. Which of the following statements about genetic engineering and DNA technology is FALSE?
- Because the genetic code is different for prokaryotes and eukaryotes, DNA nucleotides must be rearranged for human genes to be expressed in prokaryotic cells.
 - A recombinant plasmid contains information from two different species.
 - Restriction enzymes cut DNA at a particular sequence, which is helpful when splicing together a recombinant plasmid.
 - Genetically engineered bacteria and plants are currently used in the pharmaceutical, agricultural, and other industries.
43. Which of the following statements about viruses is FALSE?
- Viruses contain DNA or RNA.
 - The nucleic acid of a virus is always surrounded by a protein coat.
 - Viruses multiply inside living cells using viral mRNA, tRNA, and ribosomes.
 - Viruses can infect only certain types of cells in certain host species.
 - Viruses need attachment sites to infect a living cell.
44. Viroids and prions:
- are both proteins that can take an infectious or a noninfectious form.
 - are both RNA that can take an infectious or noninfectious form.
 - are tiny cells.
 - can both infect both plants and animals.
 - none of the above is correct.
45. Which of the following is NOT an example of an organism classified in kingdom Protista?
- Plasmodium*, an apicomplexan that causes malaria.
 - Giardia*, a flagellated protozoan that causes hiker's diarrhea.
 - Pfiesteria*, a dinoflagellate that causes red tides and shellfish poisoning.
 - Candida*, which causes vaginal yeast infections and thrush.
 - Paramecium*, a ciliate found in pond water and biology labs around the country.
46. Of the kingdoms in which human pathogens occur (Monera, Protista, Fungi, Animalia), how many contain only eukaryotic organisms?
- one
 - two
 - three
 - four
 - zero
47. Animals are important to microbiologists for all of the following reasons EXCEPT:
- they can be used as models to help us understand the progression of many (but not all) diseases.
 - they can be used in experiments testing the safety and efficacy of new drugs.
 - they can vector diseases to humans.
 - they can act as pathogens and cause infectious disease.
 - all of the above are reasons animals are important to microbiologists.
48. Which of the following statements is FALSE?
- a surgical mask acts as a filter that prevents the spread of germs from the health care provider to the patient.
 - pasteurization uses heat to kill some but not all of the microbes in food.
 - freezing usually kills the pathogens present in food and water.
 - heat kills microbes by denaturing their proteins.
 - desiccation deprives microbes of moisture.
49. All fungi:
- have cell walls of chitin
 - are heterotrophs
 - absorb their food after digesting it externally
 - two of the above are correct.
 - a, b, and c are correct.

50. Viruses:
- are tiny cells.
 - always include genetic material, a capsid, and an envelope.
 - must enter a cell's nucleus for their genetic material to be replicated.
 - may be released from a cell by either lysis or budding.
 - none of the above is correct.

Part III: Questions from the third part of the course (2 points each)

True-false (mark A for true, B for false):

51. An organism is either a pathogen or it isn't, but its degree of virulence may vary.
52. Exotoxins are usually proteins released by actively growing gram-positive cells, whereas endotoxins form the outer membrane of some gram-negative cell walls.
53. Overall, the current best way to prevent disease is to be vaccinated against all known pathogens.
54. The part of an antibody that binds to an antigen is called the constant region.
55. A septic tank routes sewage from a rural home through a settling tank and then out into the soil for treatment by soil bacteria.

Multiple choice / matching:

56. Which of the following INCORRECTLY pairs a word with an example?
- symbiosis – *E. coli* living inside your intestines
 - infection – cold viruses multiplying inside the cells of your respiratory tract
 - commensalism – mites living inside your hair follicles without causing any harm
 - disease – exposure to amoebas causes bloody diarrhea, abdominal pain, and nausea
 - each of the above is a correct pairing of a word with an example
57. Some parts of your body normally harbor a thriving community of bacteria (your resident microflora), but some parts are normally bacteria-free. Therefore, you should be concerned if your doctor finds bacteria thriving:
- in your respiratory tract
 - in your blood
 - in your intestinal tract
 - in your mouth
 - on your skin
58. Koch's postulates are the rules by which scientists prove that a particular organism causes a particular disease. Which of the following does NOT belong with Koch's postulates?
- the suspected pathogen must be present in diseased organisms but not healthy organisms.
 - the suspected pathogen must be isolated from the diseased host.
 - the suspected pathogen must be grown in the presence of oxygen.
 - when a healthy host is inoculated with the suspected pathogen, the host becomes diseased.
 - the suspected pathogen must be reisolated from a newly inoculated but diseased host.
59. Which of the following is NOT a "weapon" that a pathogen might produce to help it multiply inside a host?
- an enzyme that breaks down the "glue" that holds an animal's cells together
 - an endotoxin
 - an exotoxin
 - a fomite
 - a molecule that helps the pathogen bind to host cell receptor molecules

Match the word with its definition:

- a. opportunistic b. contagious c. prodromal d. acute e. latent

60. Stage of disease in which the symptoms first become apparent.

61. Type of disease that develops rapidly and runs its course quickly.

62. In epidemiology, a _____ typically results when many people have contact with a single contaminated substance (such as eating *Salmonella*-infested devilled eggs at a wedding reception).

- a. propagated epidemic d. common source outbreak
b. secondary infection e. nosocomial infection
c. pandemic

63. Which of the following INCORRECTLY pairs an epidemiological term with an example?

- a. zoonosis – canine distemper, a disease that occurs in dogs but never humans.
b. parenteral – rabies viruses deposited directly beneath the skin by a dog bite.
c. portal of exit – body fluid such as semen carries infectious HIV particles.
d. vehicle – water carries *Vibrio cholerae* (the bacterium that causes cholera).
e. mechanical vector – a fly's feet carry bacteria from *Salmonella*-infested devilled eggs to a wedding cake.

64. Patients often become ill as a result of a hospital stay. Such illnesses:

- a. may spread via the hospital's ventilation system or when patients contact contaminated hospital staff, equipment, or insects.
b. are especially likely to occur in patients with weakened immune systems.
c. are often caused by antibiotic-resistant, opportunistic, gram-negative bacteria.
d. only two of the above are correct.
e. a, b, and c are correct.

65. The purpose of a vaccine is to:

- a. destroy immune cells that would react to an infection.
b. activate the digestive system to remove harmful organisms.
c. trigger the production of memory cells that can respond quickly to an invading germ.
d. alter a microorganism and make it harmless.
e. expose people to diseases they would otherwise never encounter.

Match the following (answers may be used more than once):

- a. amebiasis b. Creutzfeldt-Jakob disease c. herpes d. influenza e. leprosy

66. Pathogen primarily infects tissues of the central nervous system (e.g. the brain); transmitted by contact with infected nervous tissue.

67. To prevent this disease, you need to be vaccinated every year because antigens on this pathogen change frequently.

68. B cells are the only cells directly involved in the _____ immune response.

- a. inflammatory d. cell-mediated
b. innate e. acquired
c. humoral

69. Which of the following is NOT considered a nonspecific defense against pathogens?

- a. intact skin d. cell-mediated immunity
b. inflammation e. fever
c. normal microbiota

70. Which of the following statements about the immune system is FALSE?
- Antibodies bind to specific sites (antigenic determinants) on antigens.
 - In clonal selection, a B cell that binds an antigen begins to divide, producing effector cells and memory B cells.
 - In clonal deletion, maturing B cells that react with your own molecules are destroyed before they can be released to patrol the body.
 - The primary immune response to a pathogen is always faster and more substantial than the secondary immune response.
 - T cells are activated when they detect a macrophage that is presenting antigens on its surface, triggering a series of effects including stimulating B cells to make antibodies.
71. Bacteria and fungi play vital roles in ecosystems, because many of them are decomposers. Decomposers are important because they:
- return elements such as C and N from organic molecules to inorganic forms.
 - carry out photosynthesis and therefore form the base of food chains.
 - convert nitrogen gas (N_2) to forms plants can use.
 - take up elements from their inorganic reservoirs and convert them to organic forms.
 - allow for the continual rotation of the earth and for its movement in its orbit around the sun.
72. Of the diseases covered by student groups during this last part of the semester (herpes, Creutzfeldt-Jakob disease, Hansen's disease (leprosy), influenza, and amebiasis), how many are caused by an acellular infectious agent?
- a. one b. two c. three d. four e. five
73. Which of the following statements about municipal sewage treatment is/are true?
- Primary sewage treatment removes nearly all the dissolved organic matter from raw sewage.
 - Secondary sewage treatment requires the action of living microorganisms.
 - Tertiary sewage treatment is the same thing as disinfection.
 - both a and b are true.
 - a, b, and c are true.
74. Biochemical oxygen demand (BOD):
- measures of the amount of degradable organic matter in sewage.
 - should decrease as sewage goes through primary and secondary treatment.
 - is a result of bacteria consuming oxygen as they break down organic matter.
 - only two of the above are true.
 - a, b, and c are true.
75. IMPORTANT! What color is your test form? I need this information to make sure your exams are scored against the correct key. (And this time it's even worth 2 points!)
- a. blue b. green

😊😊 Hooray! You've made it through a whole semester of microbiology! 😊😊
Have a fun and relaxing summer!