BIOL 455 GENERAL MICROBIOLOGY
Final Exam
FALL 2002

MAKE SURE THAT YOU MARK YOUR SOCIAL SECURITY NUMBER CORRECTLY!

EXAM VERSION " **1** "
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- **MARK THE APPROPRIATE CIRCLE TO ALLOW ME TO POST YOUR;**
  FINAL EXAM SCORE,
  SCANTRON MARKING PATTERN
  AND COURSE GRADE.

YOU MAY KEEP THE EXAM QUESTIONS.

In the MULTIPLE CHOICE questions below, a numbered statement will be followed by four items lettered a), b), c) or d). Only one letter should be marked per question, and you are to answer by marking the correspondingly lettered circle on the computer card. Occasionally item d) may be "more correct" and should therefore be the single item marked. **Each correct answer in this section is worth two (2) points.**

1. ATP-mediated transport in bacteria;
   a) is required to move specific molecules across the cell's permeability barrier.
   b) is required to concentrate specific molecule within the cytoplasm.
   c) requires either group translocation proteins or permeases.
   d) all of the above.

2. The dilution plate count;
   a) can be used only during the log phase of the growth curve since it is a viable count.
   b) yields valid results only in those phases of the growth curve in which cells are not dividing.
   c) uses the ability to produce progeny as an indicator of viability.
   d) all of the above.

3. The acute phase of an infectious disease;
   a) is the period between exposure to an infectious agent and the appearance of symptoms in the exposed individual.
   b) begins when the number of replicating organisms in the body reaches 2.0 X 10^9 cells/ml.
   c) ends either when the disease victim dies or the disease victim enters the convalescent phase.
   d) two of the above.

4. A bacillus-shaped bacterium that is exponentially growing, obligately aerobic, and motile;
   a) would likely display the staph cell grouping.
   b) would have perpendicular division planes.
   c) regardless of whether it was Gram (+) or Gram (-) would use its cytoplasmic membrane as its permeability barrier.
   d) two of the above.

5. When a bacterium has a sex pilus;
   a) the pilin subunits of the pilus will be coded for by genes on the sex factor.
   b) you can assume the bacterium is Gram (-).
   c) the cell will use the pili to recognize and attach to cells without sex pili (female cells).
   d) all of the above.

6. A typical Gram (+) bacterial cell could change its antigenic mosaic by which of the following methods?
   a) By using or modifying teichoic acid attached to its peptidoglycan or by producing a simple polysaccharide capsule.
   b) By producing different O antigen side chains on its lipopolysaccharide.
   c) By decreasing or increasing the number of porins in its outer membrane.
   d) Two of the above.

7. Leeuwenhoek;
   a) is credited with discovering microorganisms.
   b) recognized that his animalcules could be Plenciz's "seeds in the air."
   c) discovered the process of attenuation in microorganisms which he scraped from his teeth.
   d) none of the above.

8. The bacterial growth curve;
   a) can only be constructed if microorganism enumeration is done via a total count.
   b) would show a steeper slope during exponential phase when an obligate aerobe is grown with shaking than when the same organism is grown without shaking.
   c) consists of the lag, acceleration, log, deceleration, stationary, and death phases.
   d) two of the above.

9. An obligately aerobic, chemoautotrophic bacterium which is displaying a positive aerotactic response would;
   a) obtain its energy from respiration and its carbon from organic compounds.
   b) most likely collect at the surface of a liquid medium which supports its growth.
   c) not have an electron transport chain.
   d) all of the above.

10. Anabolism in a chemoheterotrophic bacterium;
   a) occurs more rapidly if ATP available to drive it is supplied by respiration than it is if the ATP is supplied by fermentation.
   b) involves a series of oxidative steps.
   c) obtains its carbon from carbon dioxide.
   d) all of the above.

11. Vaccines;
   a) are used to stimulate passive immunity.
   b) typically consist of detoxified toxins, killed cells or viruses, attenuated cells or viruses, and cloned antigens.
   c) are generally ineffective against etiological agents with a stable antigenic mosaic.
   d) two of the above.

12. A bacterium's shape;
   a) is generally considered most typical during exponential growth.
   b) is a function of its peptidoglycan composition.
   c) will be either a coccus or a bacillus.
   d) may be maintained during protoplast formation.

13. Bacterial cells in a medium supporting a doubling time of 45 minutes;
    a) would have I, C, and D periods of 45 (I), 40 (C) and 20 (D) minutes.
    b) would be larger than cells in a medium supporting a doubling time of 20 minutes.
    c) could be made into spheroplasts, but only if they are Gram (+).
    d) two of the above.

14. Koch's postulates;
    a) are the basis of the current debate over teaching evolution in public schools.
    b) were developed by Pasteur but name after Koch because of international treaty.
    c) describe a series of four ordered steps which must be completed to identify the specific etiological agent of an infectious disease.
    d) two of the above.

15. Bacteria which form chains;
    a) have parallel division planes.
    b) could be cocci.
    c) obviously have a form of cell-cell attachment capable of withstanding tremendous hydrodynamic and other shear forces.
    d) all of the above.

16. The chromosome of an *Escherichia coli* infected with a virulent virus like T-4;
    a) is the physical location of promoters recognized by RNA polymerase modified by virus sigma.
    b) is a covalently-closed double stranded DNA molecule, and is degraded by virus nuclease.
    c) contains the genes coding for virus lysozyme.
    d) all of the above..

17. The peptidoglycan precursor;
    a) in a Gram (+) bacterium consists of N-Acetyl Muramic Acid, N-Acetyl Glucosamine, L-Alanine, D-Glutamic Acid, L-lysine, D-Alanine and D-Alanine.
    b) is manufactured within the cytoplasm via action of autolytic enzyme, transpeptidase, and carboxylase.
    c) has a composition that is dependent upon the morphology of the cell.
    d) two of the above.

In the MULTIPLE CHOICE questions below, a numbered statement will be followed by ***five*** items lettered a), b), c), d) or e). Only one letter should be marked per question, and you are to answer by marking the correspondingly lettered circle on the computer card. Occasionally item e) may be "more correct" and should therefore be the single item marked. **Each correct answer in this section is worth two (2) points.**

18. A bacterial culture fermenting milk to cheese in the dairy processing plant in Call Hall;
    a) is generating ATP via oxidative phosphorylation.
    b) must be an obligate aerobe.
    c) will likely be a photoheterotroph.
    d) would produce cheese with a flavor determined by the culture's fermentation end products.
    e) two of the above.

19. Pseudosexual genetic exchange in microorganisms;
    a) unlike sexual exchanges in higher forms where each parent provides equal contributions of genetic information, the donor provides all the genetic information which ultimately appears in the cell produced by the exchange.
    b) always requires the presence of a sex pilus.
    c) includes transduction, transformation, and conjugation.
    d) is limited to laboratory situations (i.e., it is not observed to occur in nature).
    e) three of the above.

20. A temperate virus which is in the provirus state;
    a) has entered the host cell in a form which results in the virus' nucleic acid remaining within the virus' protein coat.
    b) depending upon the virus type could be autonomously attached to the cell's membrane or be integrated into the host chromosome.
    c) always results in death of the host cell.
    d) is maintained in the provirus state and is prevented from entering the lytic cycle because virus regulator protein(s) prevent transcription of virus early genes.
    e) two of the above.

21. The "stationary phase" of the bacterial growth curve;
    a) is a time in which cells do not divide, but average cell size increases arithmetically.
    b) is the phase in which all cells appear to align at the end of the cell cycle (i.e., all cells are at the end of D).
    c) is the time in which cells equilibrate to the medium they are in and repair any damage they may have experienced.
    d) is the phase in which cells are most susceptible to penicillin.
    e) three of the above.

22. Bacterial motility;
    a) allows bacteria to avoid certain dangerous chemicals and/or to be attracted to certain desirable chemicals.
    b) involves counterclockwise flagellar rotation during runs in Gram (+) bacteria and involves clockwise flagellar rotation during runs in Gram (-) bacteria.
    c) can readily be observed even if flagellar filaments are sheared off.
    d) is dependent upon the presence of the sex factor plasmid.
    e) none of the above.

23. The bacterial cell cycle;
    a) could be expected to be shorter (take less time to complete) in a rich medium than in a poor medium.
    b) has a C period that is 2/3 as long as the I period in cultures with doubling time exceeding 120 minutes.
    c) describes the fact that a cell cannot divide until it has completed events I, C, and D.
    d) recognizes that the length of the I period can never be less than the length of the C period.
    e) three of the above.

24. In the homolactic fermentation;
    a) lactic acid is formed from glucose by a process which is also known as glycolysis.
    b) the fermentation end products are ethyl alcohol, carbon dioxide, and lactic acid.
    c) the net ATP yield is 38 moles of ATP/mole of glucose.
    d) reduction of the pyruvate intermediate occurs via the Kreb's (TCA, citric acid) cycle.
    e) three of the above.

25. A facultatively anaerobic bacterium that is of the +/- type;
    a) will have the genetic information for an electron transport chain even when growing in the absence of oxygen.
    b) will use oxidative phosphorylation only when growing in the presence of oxygen.
    c) will produce some ATP via substrate level phosphorylation regardless of whether it uses fermentation or respiration.
    d) will be procaryotic.
    e) all of the above.

26. The Gram (-) cell envelope consists of;
    a) a single bilayer that is hydrophilic on the bilayer's two outer sides and hydrophobic in the bilayer center.
    b) an outer membrane, a periplasmic space containing the R-layer, and the cytoplasmic or inner membrane.
    c) exclusively lipopolysaccharide, which itself consists of lipid A, a core polysaccharide, and O antigen side chains.
    d) thick, uniform, and dense peptidoglycan which has a 3-D cross-linking pattern.
    e) two of the above.

27. Bacterial capsules;
    a) tend to have no effect on a cell's antigenic mosaic.
    b) are all produced via transglucosylation.
    c) are either simple polysaccharides, simple polypeptides, or complex polysaccharides.
    d) can play a significant role in bacterial virulence.
    e) two of the above.

28. Viruses;
    a) are obligate intracellular parasites consisting of a protein coat within which is found a single type of nucleic acid.
    b) depending upon the virus type may contain DNA or RNA.
    c) are generally categorized as virulent or temperate.
    d) are considered vegetative during the eclipse phase of the latent period.
    e) all of the above.

29. Active immunity in humans;
    a) typically is not observed in someone who has survived an infectious disease.
    b) is identical in form and function to passive immunity.
    c) involves both humoral and cellular components and includes a specific anamnestic (memory) response.
    d) is the only mechanism available to humans for avoiding infectious disease.
    e) two of the above.

30. Characteristics of exponentially-growing bacterial cells include which of the following?
    a) When forming the tetrad cell grouping, cells will have two division planes, each of which is perpendicular to the former.
    b) The cells can be expected to be eucaryotic.
    c) The cells will double their mass before division by doubling their length.
    d) Cells will have a average cell size which is intermediate between the cell's minimum (1X) and maximum (2X) masses in the given growth condition.
    e) Three of the above.

In the following TRUE/FALSE statements, mark circle "**A**" if the statement is true, and mark circle number "**B**" if the statement is false. **Two (2) points per numbered item.**

31. T(A) F(B) The nucleus (nucleoid) of a motile bacterial cell contains the genetic information determining the amino acid sequence of its flagellin subunits.

32. T(A) F(B) The bacterial cell cycle is operative only during the log phase of the growth curve

33. T(A) F(B) During the eclipse phase of T-4 virus replication, multiple copies of host DNA are replicated and inserted into newly synthesized virus heads.

34. T(A) F(B) In general, binary fission occurs more rapidly in respiring organisms than in fermenting organisms.

35. T(A) F(B) Chemoheterotrophic microorganisms generate ATP, reducing power, and intermediates through photosynthesis, or fermentation and respiration.

36. T(A) F(B) Chemoautotrophic bacteria obtain energy by passing electrons obtained from reduced inorganics through the electron transport chain.

37. T(A) F(B) Common pili are made up of pilin subunits, are present only on Gram (-) bacteria, and are coded for via genes contained on the sex plasmid.

38. T(A) F(B) During replication of a virulent virus, messenger-RNA for virus early enzymes is transcribed from genes on virus DNA which have cell-type promoters.

39. T(A) F(B) Water activity is a mathematical expression of the available water in a material and is routinely used by food microbiologists to predict susceptibility of aqueous food materials to bacterial contamination and/or decomposition.

40. T(A) F(B) Holmes is called the father of epidemiology because he determined that cholera in a section of London was being spread among human inhabitants via water from the Broad Street pump.

41. T(A) F(B) The faster microorganism cells divide, the smaller the average mass of the cells will be.

42. T(A) F(B) An energy-yielding metabolic processes in which organic compounds or reduced inorganic compounds serve as electron donors and oxygen or oxidized inorganics serve as electron acceptors is the definition of "respiration."

43. T(A) F(B) Bacterial virulence is generally considered to be a result of microorganism anatomical features, endo and exotoxins, and production of enzymatic or enzyme-like activities.

44. T(A) F(B) Total count enumeration procedures used by microbiologists include the Petroff-Hausser counting chamber, turbidity, electronic particle counter, and dry weight.

45. T(A) F(B) Killed cells or viruses are typically much better at inducing an immune response than are attenuated cells or viruses.

46. T(A) F(B) Bacteria in a given growth condition increase mass before division by increasing cell length and width.

47. T(A) F(B) In a Gram (-) bacterial cell which is virulent because of endotoxin (LPS) production, the LPS is found within the inner (cell or cytoplasmic) membrane.

48. T(A) F(B) The latent period of virulent virus replication is the period between nucleic acid injection and the appearance of the first mature virus particle inside the intact cell.

49. T(A) F(B) The attachment of a virus to a specific host involves the interaction of attachment site(s) on the virus surface, and receptor site(s) on the cell surface.

50. T(A) F(B) A male bacterium designated as F' can be presumed to contain an autonomous sex factor which also contains some integrated cellular derived (nuclear or nucleoid) DNA.

NON-CREDIT QUESTION--Do not use the scantron for this one!!!!!!

Why is a cat on the beach like Christmas?

a) The cat is inherently immune to smallpox.
b) The cat has weapons of mass destruction.
c) Sandy claws.
d) The cat is 'absent without leave' from General Microbiology.

The end!!!!!!!!!!!

Have a safe and happy holiday and a great 2003.

ANSWERS::::::::::::1-d; 2-c; 3-c; 4-c; 5-d; 6-a; 7-a; 8-d(bc); 9-b; 10-a; 11-b; 12-a; 13-a; 14-c; 15-d; 16-b; 17-a; 18-d; 19-c; 20-e(bd); 21-b; 22-a; 23-e(abc); 24-a; 25-e; 26-b; 27-e(cd); 28-e; 29-c; 30-e(acd); 31-a; 32-b; 33-b; 34-a; 35-b; 36-a; 37-b; 38-a; 39-a; 40-b; 41-b; 42-a; 43-a; 44-a; 45-b; 46-b; 47-b; 48-b; 49-a; 50-a.