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49/64 -15 76% Corrected.

Dental Microbiology
Exam #2
Wednesday, October 10, 2007
1:30-3:30 p.m.
Lecture Hall B and Room 386, 3rd Floor, Old Dental School Building

The Temple University School of Dentistry is guided by an Honor Code. All students are expected to abide by the Honor Code published by the Dental Student Handbook and are expected to maintain a high standard of professionalism and ethics as defined by the Ethical Foundation for Professional Education and Behavior.

There are a total of 64 questions on 13 pages in this exam.

Please use your TUID number on the scan sheet.

DIRECTIONS: For the following questions, select the **ONE BEST** answer in each case.

1. A 19 year old gunshotvictim whose blood type is O, Rh positive is given a transfusion of Type A, Rh negative blood because of a clerical error. The patient experiences a variety of clinical symptoms including headache, nausea, vomiting and a rise in temperature. These are primarily the result of which type of hypersensitivity reaction?

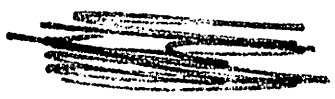
   A. Type I
   B. Type II
   C. Type III
   D. Type IV
   E. All four types

2. A 45 year old woman suffers from hayfever early every summer. With respect to the allergen specific antibodies directly involved in mediating this illness.

   A. IgA is bound to low affinity receptors on eosinophils
   B. IgD is bound to high affinity receptors on B-lymphocytes
   C. IgG is bound to low affinity receptors on macrophages
   D. IgE is bound to high affinity receptors on mast cells
   E. IgE is bound to high affinity receptors on T-lymphocytes

3. Following the administration of a local anesthetic a patient you are treating goes into acute systemic anaphylactic shock. Which of the following should be administered immediately?

   A. more anesthesia
   B. cortisone
   C. blocking antibody
   D. histamine
   E. epinephrine



DIRECTIONS: For the following questions, select the **ONE BEST** answer in each case.

4. Which class of antibody fixes complement most efficiently in the classical pathway?

A. IgA
B. IgD
C. IgE
D. IgG
E. IgM

5. Which of the following relationships regarding components of the complement system is correct?

A. C5b6789 - anaphylatoxic activity
B. C5a - initiation of the alternate pathway
C. C4b - part of the membrane attack complex
D. C1q - chemotactic for neutrophils
E. C3b - opsonization

6. In Antibody Dependent Cell Cytoxicity (ADCC) NK cells bind to the Fc of

A. IgA only
B. IgE and IgG
C. IgE only
D. IgG only
E. IgM and IgG

7. Helper T-lymphocytes (Th):

A. differentiate in the bone marrow
B. express CD4 on their surface
C. which express both CD8 and CD3 are classified as Th1 cells
D. recognize peptides presented by MHC1
E. recognize conformational and linear epitopes

8. Lymph nodes:

A. contain B-lymphocytes, but no T-lymphocytes
B. contain T-lymphocytes, but no B-lymphocytes
C. contain both T and B-lymphocytes
D. are the site of differentiation for T-lymphocytes
E. are primary lymphoid organs

9. Dendritic cells

A. express T-cell receptor (TCR) on their surfaces
B. present peptides to CD4+ lymphocytes
C. present whole proteins to B-lymphocytes
D. include Th1, but not Th2 cells
E. include Th2, but not Th1 cells

DIRECTIONS: For the following questions, select the **ONE BEST** answer in each case.

10. A newborn female child who is blood type O, Rh negative would have which of the following antibodies in her blood?

A. IgM anti A
B. IgM anti B
C. IgM anti A and B
D. IgG anti O
E. No antibodies to ABO antigens

11. The naturally occurring antibodies to the A and B blood group antigens

A. are of the IgE class
B. are of the IgM class
C. are of the IgG class
D. are of the IgA class
E. do not fix complement

12. For a pregnant 27 year old Rh-negative woman who has had two previous miscarriages, which test would be most useful in determining the risk for the development of Hemolytic Disease of the Newborn (HDNB) in her fetus?

A. an indirect Coomb's test on her blood
B. an indirect Coomb's test on the father's blood
C. a direct Coomb's test on the father's blood
D. a direct Coomb's test on her blood

13. At birth a child is jaundiced and has a positive Direct Coomb's Test. What treatment should be administered to this child immediately?

A. injection with antibodies to D antigen (RhoGam)
B. injection with RhoGam treated RBCs.
C. exchange transfusion with Rh positive blood.
D. exchange transfusion with Rh negative blood.
E. injection with blocking antibodies.

14. A 25 year old woman receives an injection of influenza vaccine in November. She gives birth to a child the following June. The child would have been born with antibodies to influenza virus which were:

A. IgA in saliva
B. IgA bound to B-lymphocytes
C. IgE bound to mast cells
D. IgG in blood
E. IgM in spinal fluid

15. Injection of a protein which is resistant to enzymatic degradation would likely result in:

A. High levels of IgA class antibodies and low levels of IgG class antibodies
B. High levels of IgG class antibodies and low levels of IgA class antibodies
C. High levels of IgM and IgG class antibodies
D. High levels of all Ig class antibodies
E. Little if any antibody of any class

DIRECTIONS: For the following questions, select the **ONE BEST** answer in each case.

16. A man has been identified whose IgM is able to bind antigen but is unable to fix complement. The most likely cause of this defect would be:

A. A mutation in the constant region of the mu chain
B. A mutation in the variable region of the mu chain
C. A mutation in the constant region of the kappa chain
D. A mutation in the variable region of the kappa chain
E. A mutation in the constant region of the lambda chain

17. IgM from a human is injected into a rabbit resulting in the generation of antibodies which recognize IgM from all other humans. These antibodies are directed to which types of determinants on IgM.

A. Haplotypic
B. Allergic
C. Isotypic
D. Allotypic
E. Idiotypic

18. A nonimmune 35 year old man displays symptoms of diphtheria. His physician administers diphtheria antitoxin made in a horse. Ten days later the man begins feeling weak and feverish. He notices that he is developing a rash and pain in his joints. The likely cause of his arthritic symptoms is:

A. Horse IgG binding to IgE coated mast cells
B. Deposition of horse IgG - human antihorse IgG - complement complexes
C. Horse IgG binding to human tissues with subsequent activation of complement
D. Horse IgM binding to human tissues with subsequent activation of complement
E. Deposition of horse IgA - human antihorse IgA - complement complexes

19. Degranulation of mast cells occurs in which type(s) of hypersensitivity?

A. Type I only
B. Type II only
C. Type III only
D. Type IV only
E. Types I, II and III

20. Which class(es) of Ig mediate Type II Hypersensitivity?

A. IgE only
B. IgG only
C. IgM only
D. IgE and IgG
E. IgG and IgM

DIRECTIONS: For the following questions, select the **ONE BEST** answer in each case.

21. In delayed-type hypersensitivity:

A. antigen can be presented by dendritic cells to Th1 cells.
B. Th1 cells make IL-4 which self stimulates the cells.
C. activated Th2 cells produce IFN-γ which stimulates macrophage activity.
D. activated Th1 cells produce IFN-γ which stimulates neutrophil activity.
E. activated Th2 cells produce IL-4 which stimulates macrophage activity.

22. Cytotoxic T-lymphocytes:

A. recognize antigen presented by MHC2.
B. are CD4 positive.
C. receive help from Th-1 lymphocytes in the form of cytokines.
D. release antibodies which cause the death of target cells.
E. are involved in Antibody Dependent Cell Cytotoxicity (ADCC).

23. With respect to histocompatibility antigens:

A. MHC-1 is only found on cells involved in the immune response.
B. MHC-2 is found on all nucleated cells .
C. MHC-1 presents endogenous antigen to CD8 positive cells.
D. MHC-2 presents endogenous antigen to CD4 positive cells.
E. MHC-2 presents exogenous antigen to CD8 positive cells.

24. With respect to the primary and secondary immune responses:

A. IgG levels are highest in the secondary response
B. antibody in the secondary response has lower affinity for antigen
C. memory plasma cells mediate the secondary response
D. IgG appears before IgM in the primary response
E. IgE is the first antibody made in the primary response

25. In the humoral immune response:

A. APC's present antigen to T-lymphocytes which in turn secrete cytokines that activate macrophages.
B. Antigen binds directly to CD8+ T-lymphocytes which in turn secrete IFNγ
C. APC's present antigen to Th2-lymphocytes which then secrete IL-4
D. B-lymphocytes present antigen to dendritic cells
E. APC's present antigen to B-lymphocytes.

26. The cell type which makes and secretes large amounts of antibody is a:

A. mature B-lymphocyte
B. memory B-lymphocyte
C. plasma cell
D. macrophage
E. mature T-lymphocyte

DIRECTIONS: For the following questions, select the **ONE BEST** answer in each case.

27. Acquired Immunodeficiency Syndrome (AIDS):

A. is a primary immunodeficiency.
B. results from a virus infection of CD4+ lymphocytes.
C. primarily affects humoral immunity.
D. is treated with blood transfusions
E. is caused by a defect in B-lymphocyte maturation

28. X-linked Hypogammaglobulinemia

A. is caused by a defect in B-lymphocyte maturation
B. is a congenital athymic disease
C. is caused by a stem cell defect which affects B and T-lymphocytes
D. results from a virus infection
E. results in the production of high levels of antibody

29. You notice scarcity of saliva and extensive caries in a 59 year old female patient. Antibodies to ribonucleoproteins are found in her blood. Which of the following disease states is most likely responsible for these findings?

A. rheumatoid arthritis
B. Graves disease
C. systemic lupus erythematosis
D. Sjogren's syndrome
E. acquired immunodeficiency syndrome (AIDS)

30. B-lymphocyte epitopes:

A. can be linear or conformational.
B. are always linear.
C. are always conformational.
D. are always hydrophobic.
E. are usually the same epitopes recognized by T-lymphocytes.

31. The predominant immunoglobulin in saliva is

A. IgA
B. IgD
C. IgE
D. IgG
E. IgM

32. The site of differentiation of T-lymphocytes in humans is the:

A. bursa
B. bone marrow
C. spleen
D. thymus
E. lymph nodes

DIRECTIONS: For the following questions, select the **ONE BEST** answer in each case.

33. Which of the following occurs only after exposure to antigen

A. deletional recombination of multiple V, D, and J gene segments.
B. junctional diversity in recombination.
C. N-region insertion of nucleotides (heavy chain).
D. combinatorial diversity of light and heavy chain pairing.
E. deletional recombination of C-region gene segments

34. The switch from synthesis of membrane bound to secreted antibody is a result of

A. mutation of V gene segments.
B. N-region insertion of nucleotides (heavy chain).
C. deletional recombination of C-region gene segments
D. RNA processing (splicing).
E. deletional recombination of multiple V, D, and J gene segments.

35. Cytotoxic T-lymphocytes kill virus infected cells by:

A. attaching to them and triggering the complement fixation cascade which results in cell lysis
B. attaching to them and down regulating the Fas ligand leading to apoptosis
C. attaching to MHC1 – peptide on the surface of a cell and releasing perforin and granzymes which induce apoptosis
D. attaching to MHC2 – peptide on the surface of a cell and releasing perforin and granzymes which induce apoptosis
E. attaching to the Fc of cell –bound IgG and releasing perforin and granzymes which induce apoptosis

36. DiGeorge's Syndrome:

A. is treated with gamma-globulin injections..
B. has no effect on the ability to resolve viral infections.
C. results in a lack of B-lymphocytes.
D. is a primary immunodeficiency
E. is a secondary immunodeficiency.

DIRECTIONS: Select the **ONE** lettered word or phrase that best matches the numbered word or phrase. Letters may be used once, more than once, or not at all.

A. *Streptococcus pyogenes* (group A streptococcus)
B. *Staphylococcus aureus*
C. *Streptococcus agalactiae* (group B streptococcus)
D. *Streptococcus pneumoniae* (pneumococcus)
E. *Actinobacillus actinomycetecomitans*
F. *Enterococcus faecalis* (group D enterococcus)
G. *Staphylococcus epidermidis*
H. viridans streptococci
I. *Staphylococcus saprophyticus*
J. non-enterococcal group D streptococcus

For each patient select the microorganism most likely to have caused the illness described.

37. B — A 20-year-old female motorcyclist suffered a multiple compound fracture of the ankle in an accident. Surgical repair was successful, with an uneventful recovery following extended antimicrobial therapy. Six months later she presented with right ankle pain and tenderness and was admitted to the hospital with a history of spiking fevers. An ankle aspiration of joint fluid revealed many polymorphonuclear leukocytes and many gram-positive cocci. Cultures of the fluid on blood agar also revealed hemolytic gram-positive organisms which were catalase positive and coagulase positive.

38. G — A 25-year-old intravenous drug abuser was admitted to the hospital with a high fever. Cultures of his blood revealed nonhemolytic colonies of gram-positive cocci which were catalase positive and coagulase negative.

39. D — A 50-year-old alcoholic who was found semicomatose on a park bench in Washington Square was admitted to the emergency room and showed x-ray and clinical signs of pneumonia. Gram stain of sputum showed lancet shaped gram-positive cocci. Cultures of the productive sputum grew gram-positive cocci which were obtained from mucoid alpha-hemolytic colonies growing on blood agar. The organisms were catalase negative and sensitive to (inhibited by) optochin. A positive "Quellung" test was also obtained with polyvalent antisera.

40. C — A 3-day-old neonate born prematurely following a difficult delivery developed meningitis and bacteremia. The gram-positive catalase negative coccus isolated from both blood and spinal fluid was also found to be part of the mother's normal vaginal microbial flora when she was cultured.

41. A — A 5-year-old child was seen in the pediatric emergency room with an acute sore throat (pharyngitis) and elevated temperature. A throat swab cultured on blood agar and incubated overnight grew β-hemolytic colonies of gram-positive cocci. These organisms were catalase negative and susceptible to (inhibited by) bacitracin (A disc).

For each statement below, select the microorganism to which it most appropriately applies.

42. A — Antibodies directed against M-protein fragments of this organism have been shown to cross-react with human heart sarcolemma membranes. This is most accepted as the autoimmune basis for the pathogenesis of acute rheumatic fever following infection with this organism.

43. H — These organisms are members of the normal microbial flora of the human oropharynx and can be opportunistic pathogens causing subacute bacterial endocarditis (SBE) in patients with damaged heart valves occurring as a result of transient bacteremia associated with, e.g., extensive oral surgery.

44. F — This organism, found present in the normal microbial flora of the human intestinal tract, can be an opportunistic pathogen and cause urinary tract infections in the human. It is catalase negative, and grows in high concentrations of sodium chloride (6.5-7.5%) and in bile salts.

45. B — Enterotoxins secreted by some members of this organism are heat stable (resist boiling for 30 minutes) and produce acute gastrointestinal symptoms within 2-5 hours following ingestion of food containing preformed toxin produced by growth of the organism in the food.

46. D — A vaccine containing 23 different capsular polysaccharide antigens is available for prophylactic use in preventing disease caused by this organism in persons more susceptible due to age, immunocompromised state or other underlying disease.

DIRECTIONS: For the following questions, select the **ONE BEST** answer in each case.

47. The etiology of toxic shock syndrome was not fully appreciated until the mid 1980s. Which of the following statements about this disease is true?

A. can be caused by a staphylococcal enterotoxin in addition to TSST-1 toxin
B. is due the activation of B lymphocytes by a superantigen
C. is correlated with the production of a hyaluronic acid capsule
D. is dependent on the various anti-phagocytic properties of *Staphylococcus aureus*
E. is the result of an inhibition of pro-inflammatory cytokine production

48. Protein A is a component of the cell coat of *Staphylococcus aureus* and is:

A. able to assist in phagocytosis by binding to the Fc region of IgG
B. able to assist in phagocytosis by binding to teichoic acid
C. able to impair phagocytosis by blocking the production of leukocidin
D. able to impair phagocytosis by reducing the binding of specific anti-*Staphylococcus aureus* antibody
E. able to assist phagocytosis by inducing the production of coagulase

49. With respect to staphylococcal food poisoning, all of the following statements are true EXCEPT:

A. The toxin produced by *Staphylococcus aureus* is heat-stable and not inactivated by boiling for 30 minutes.
B. Food contaminated with *S. aureus*, when eaten, can cause food poisoning following growth in the gut for 24-48 hours.
C. Enterotoxins produced by *S. aureus* act as superantigens with enhanced T cell response and release of cytokines. In addition, they may act on neural receptors in the gastrointestinal tract stimulating the vomiting center in the brain.
D. This poisoning results from an intoxication due to ingestion of preformed toxin in *S. aureus*-contaminated food which has not been properly refrigerated.
E. Onset of food poisoning, with nausea and vomiting, is rapid, usually occurring within 5 hours of ingesting spoiled food.

50. Your patient is a 15-year-old boy with fever, and a new, loud cardiac murmur. You make a clinical diagnosis of rheumatic fever. Which one of the following laboratory results is MOST compatible with this diagnosis?

A. An antistreptolysin O (ASLO) assay is positive with a rise in titer at this time.
B. A blood culture is positive for *Streptococcus pyogenes* at this time.
C. A throat culture is positive for *Streptococcus pyogenes* at this time.
D. A Gram stain of the sputum shows Gram-positive cocci grouped in clusters or short chains at this time.
E. all of the above

DIRECTIONS: For the following questions, select the **ONE BEST** answer in each case.

51. All of the following statements regarding virulence of an organism are true EXCEPT:

A. defined as the degree of pathogenicity
B. frequently correlates with the ability to spread within the body of a host animal
C. may correlate with the ability to attach to and colonize specific cells of the host animal
D. can be correlated with the production of toxin which stimulates phagocytosis
E. may be decreased by continuous culturing on artificial medium in the laboratory over a long period of time

52. All of the following are correct with respect to nosocomial infections EXCEPT:

A. Gram-positive cocci from human reservoirs are common causes of infection in compromised hosts.
B. Gram-negative organisms such as *Pseudomonas* species, which are environmental contaminants, especially of aqueous solutions, are common causes of infection.
C. The majority of such infections occur in patients who are severely immunosuppressed.
D. Most such infections are caused by aerobic or facultative bacteria.
E. Fungi and yeast, especially *Candida albicans*, have shown a dramatic increase in such infections in compromised patients with invasive devices such as indwelling catheters and i.v. tubes.

53. All of the enzymes produced by *Staphylococcus aureus* listed below are considered "spreading factors" in the pathogenesis of infections caused by this organism EXCEPT:

A. staphylokinase
B. lipase
C. penicillinase
D. hyaluronidase
E. deoxyribonuclease

54. All of the following statements are correct with regard to superantigens EXCEPT:

A. are primarily endotoxins released from Gram-negative organisms
B. act directly on T cell receptors and the major histocompatibility complex (MHC) Class II site on other antigen presenting cells activating the release of interleukins and tumor necrosis factor (TNF)
C. may result in toxic shock and death
D. are primarily exotoxins secreted by Gram-positive organisms
E. include the enterotoxins produced by *Staphylococcus aureus*

DIRECTIONS: *For the following questions, select the **ONE BEST** answer in each case.*

55. All of the following statements are true with regard to extracellular parasites EXCEPT:

A. They cause damage to tissue cells of the body only as long as they are outside of phagocytic cells.
B. They are promptly destroyed after being phagocytized (engulfed) by macrophages.
C. They lack biosynthetic systems necessary for growth and require those of the host animal cells.
D. Their presence stimulates production of opsonizing antibodies leading to clearance by phagocytic cells.
E. Diseases produced by them are usually of relatively short duration (acute infection) and are generally associated with humoral immunity.

56. This patient was a 45-year-old male with a past history of heart disease. He presented to the emergency room with chest pains and was found to have a myocardial infarction. Following a cardiac catheterization, he underwent triple coronary artery bypass surgery. Subsequently he suffered septic shock and respiratory complications, with a lung infection as well as a purulent sternal wound infection and evidence of bacteremia. Cultures from these sources all grew a Gram-positive coccus which was catalase and coagulase positive and hemolytic on blood agar plates. The colonies were nonpigmented. All of the following statements are true EXCEPT:

A. The source of this infection was probably opportunistic from skin contamination occurring during surgery or from hands of hospital caregivers.
B. Pyrogenic exotoxins produced by this organism may act as superantigens by enhancement of the T cell response with release of cytokines.
C. An exotoxin produced by this organism is thought to act by direct insertion into the lipid bilayer of mammalian cells, leading to production of transmembrane pores and cell death.
D. Antimicrobial susceptibility tests would most likely show this organism to be resistant to penicillin due to production of penicillinase.
E. The organism is probably *Staphylococcus epidermidis* and found as part of the normal human skin microbial flora.

57. *Streptococcus pyogenes* (Group A streptococcus) is correctly described by each of the following statements, EXCEPT:

A. M protein elicits a strong antibody response from the host.
B. Not all strains can cause rheumatic fever.
C. Capsular polysaccharides exist in over 80 antigenic types.
D. M protein prevents phagocytosis.
E. Some strains produce erythrogenic toxin.

DIRECTIONS: For the following questions, select the **ONE BEST** answer in each case.

58. Regarding exotoxins and endotoxins, all of the following statements are true, EXCEPT:

A. Exotoxins are heat-labile proteins and are lethal and/or exert their effects in small amounts when they are secreted by both Gram-positive and Gram-negative bacteria.
B. Endotoxins are produced by Gram-negative bacteria and are heat-stable lipopolysaccharides (Lipid A) associated with the cell wall.
C. Many exotoxins consist of A and B subunits. The B unit binds to a host cell and the A unit enters the cell and exerts its effect.
D. Exotoxins can be converted by formaldehyde treatment into toxoids useful as vaccines to stimulate protective antibody formation in susceptible hosts.
E. Endotoxins have highly specific pharmacologic action and are immunogenic in low concentrations.

59. Which one of the following diseases does NOT usually occur as a result of toxin production at a local infected site with systemic distribution to distal sites?

A. streptococcal scalded skin syndrome (SSSS)
B. staphylococcal enterocolitis
C. toxic shock syndrome (TSS)
D. botulism
E. diphtheria

60. The local health department was notified that eight persons who had patronized a local pastry shop had developed severe vomiting and diarrhea 4-6 hours after eating cream pies they had purchased. Cultures isolated from the pies yielded gram-positive cocci of the same phage type, suggesting a common source for the illness.

Subsequent investigation revealed that, about a week beforehand, the pastry chef had cut his forearm. He had noted swelling, redness and warmth at the site. After about four days he had developed fever with shaking chills, and came to the emergency room with severe back pain. Physical examination showed that he had a fever of 39.4°C, his forearm was swollen with an area of central softness, indicating an abscess. Cultures of the pus aspirated from the abscess yielded gram-positive cocci. The organisms were of the same phage type as those recovered from the cream pies, indicating that the pastry chef was likely the index case.

The causative organism was:

A. *Streptococcus pyogenes* (Group A Streptococci)
B. *Salmonella typhi*
C. *Streptococcus agalactiae* (Group B Streptococci)
D. *Clostridium perfringens*
E. *Stapylococcus aureus*

DIRECTIONS: For the following questions, select the **ONE BEST** answer in each case.

61. With regard to Koch's Postulates, all of the following statements are correct EXCEPT:

(A.) In dental caries the disease is of multiple etiology; however, the postulates are easily satisfied by using mixed cultures of organisms isolated from the infected site.

B. A microorganism must be regularly associated with a given disease.

C. The organism responsible for a disease must be isolated in pure culture on artificial media.

D. A given disease must be reproduced in a susceptible animal host following inoculation with the pure culture of the organism.

E. For viral diseases, Koch's postulates can be partially satisfied by using tissue cultures for isolation of the organism from an infected host.

DIRECTIONS: Select the **ONE** lettered word or phrase that best matches the numbered word or phrase. Letters may be used once, more than once, or not at all.

A. transmission
B. virulence
C. adherence
D. invasiveness
E. colonization

With regard to pathogenicity of microorganisms, match the <u>one best</u> mechanism or property above with the most appropriate statement below.

62. B degree of pathogenicity, i.e., capacity of a particular genus and/or species of microorganism to induce disease

63. E normal microbial flora of healthy humans

64. C the possession by *Streptococcus mutans* of extracellular high-molecular-weight polyglycans and lipoteichoic acids