YR 2 IMMUNOLOGY/MICROBIOLOGY UNIT EXAM 2 -- September 12, 1997.

CHOOSE THE SINGLE BEST ANSWER FOR QUESTIONS 1 - 59.

1. All of the following are TRUE about metabolism EXCEPT that the:

   A. Reduced form of nicotinamide-adenine dinucleotide phosphate is the usual biosynthetic reducing coenzyme

   B. Hexose monophosphate (pentose phosphate) pathway is a cyclic pathway with independent oxidative and nonoxidative segments

   C. Entner-Doudoroff glycolytic pathway is found both in animal and bacterial cells

   D. Embden-Meyerhof (EM) pathway, with replacement of two EM enzymes, can be used to form glucose-6-phosphate biosynthetically from pyruvate

   E. Most bacterial cells are able to use the EM and hexose monophosphate (pentose phosphate) glycolytic pathways concurrently

2. Which of the following ß-lactams is NOT bactericidal?

   A. Imipenem

   B. Ticarcillin

   C. Sulbactam

   D. Aztreonam

   E. Both A and C

3. Which one of the following remains a worldwide public health problem?

   A. Staphylococcal infections

   B. Streptococcal infections

   C. Intestinal worms

   D. Lyme disease

   E. Western equine encephalitis

4. Which pair of antibiotics is often used in combination for antimicrobial therapy?

   A. Vancomycin - penicillin

   B. Rifampin - quinolone

   C. Penicillin - gentamicin

   D. Penicillin - tetracycline

   E. Trimethoprim - aminoglycoside

5. Choose the CORRECT statement regarding the functions of the following enzymes:

   A. DNA gyrase seals nicks in the phosphodiester backbone

   B. Ligase introduces negative superhelical turns in DNA

   C. RNA polymerase synthesizes the primer for the initiation of replication

   D. DNA polymerase synthesizes the primer for the initiation of replication

   E. None of the above are correct

6. Which of the following statements concerning viruses is FALSE?

   A. Viruses do not have a cellular structure

   B. Viruses range in size from 1 ìm to 5 ìm

   C. Virus particles are metabolically inert

   D. Virus genomes are simpler than the genomes of cellular organisms

   E. Viruses are obligate intracellular parasites

7. Which of the following statements best describes the pharmacodynamic principles of beta-lactam antibiotics such as penicillin?

   A. Concentration dependent bacterial activity, little PAE vs. gram negatives, Peak:MIC correlated with efficacy

   B. Concentration dependent bacterial activity, PAE vs. gram negatives, Time > MIC correlated with efficacy

   C. Time dependent bacterial activity, PAE vs. gram negatives, Peak:MIC correlated with efficacy

   D. Time dependent bacterial activity, little PAE vs. Gram negatives, Time > MIC correlated with efficacy

   E. Concentration and Time independent activity: inoculum size most correlated with efficacy

8. The bacterial chromosome is best described as:

   A. A large circular strand of supercoiled double-stranded DNA

   B. A large strand of supercoiled double-stranded RNA

   C. Fragmented pieces of double-stranded DNA

   D. Strands that contain double-stranded DNA and histone

   E. A large circular strand of double-stranded DNA surrounded by a nuclear membrane

9. After intravenous administration, which of the following has the highest distribution to the cerebrospinal fluid?

   A. Vancomycin

   B. Gentamicin

   C. Oxacillin

   D. Cephlexin

   E. Cefuroxime

10. Which of the following statements regarding the infectious process is INCORRECT?

A. An adhesin is a molecule that mediates adherence or binding of an organism to the host.

B. An opportunistic pathogen generally causes infection when there is a specific host defect.

C. Virulence factors allow the organism to establish itself on or within the host and enhance its ability to produce disease.

D. Virulence is a measure of how quickly a microbe can produce disease.

E. Principal pathogens regularly produce disease in susceptible, normal hosts.

11. Which antibiotic binds to a soluble cytoplasmic enzyme in bacteria?

A. Clindamycin

B. Streptomycin

C. Cephalosporin

D. Vancomycin

E. Trimethoprim

12. The size (in base pairs) of a gene which encodes typical 33,000 Dalton protein is:

A. 250

B. 500

C. 750

D. 1000

E. 1250

13. Which of the following viral diseases has been eradicated?

A. Polio

B. Measles

C. AIDS

D. Smallpox

E. Chicken pox

14. Which of the following best characterizes the rationale for once daily aminoglycoside dosing?

A. Aminoglycosides have time dependent activity and a huge safety margin (eg. relatively free of toxicity)

B. Aminoglycosides have time dependent activity; therefore, single daily dosing optimizes killing activity.

C. Aminoglycosides have concentration dependent activity and toxicity most often related to elevated Cp min.

D. Aminoglycosides have no defined levels which have been shown to correlate with efficacy; therefore, monitoring levels is not necessary and dosing q 24h is the most convenient regimen.

E. Aminoglysosides have the most PAE vs gram positive organisms and should only be used once daily vs. these organisms.

15. Bacterial H antigen is derived from:

A. Microtuble

B. Hemolysin

C. Haptenic oligosaccharide

D. Endotoxin

E. Fagellin

16. Patients treated for Staphylococcal infections with oxacillin are most likely to have which of the following untoward effects?

A. Disulfiram-like reactions to alcohol

B. Mild to severe allergy

C. Bleeding disorders

D. Dizziness

E. Deafness

17. Which of the following statements regarding the infectious process is CORRECT?

A. Principal pathogens always produce disease in susceptible hosts.

B. Most infections are asymptomatic.

C. Infection is almost always detrimental to the host.

D. Adhesins determine the virulence of the pathogen.

E. The host must either eliminate the organism or die.

18. Which antibiotic kills bacteria by blocking ribosomal protein synthesis?

A. Gentamicin

B. Penicillin

C. Rifampin

D. Amantadine

E. Quinolone

19. An F episome integrates at 25 min. to form the Hfr chromosome shown below. Conjugal transfer to an F^- recipient is in the clockwise orientation as indicated. Select the proper assignment of mating times which would be required to transfer each marker.

A. His 5 min., Phe in 25 min., Leu too distant for transfer

B. Leu in 10 min., Phe in 75 min., His too distant for transfer

C. Leu in 15 min., His in 30 min., Phe in 50 min.

D. His in 5 min., Phe in 25 min., Leu in 95 min.

E. Leu in 85 min., His in 70 min., Phe in 50 min.

20. Susceptibility to inactivation by ether indicates that a virus is:

A. Enveloped

B. An RNA virus

C. A DNA virus

D. HIV-1

E. Encapsulated

21. Which of the following statements regarding vancomycin is TRUE?

A. Adequate dosing is best accomplished by monitoring peak and trough levels daily to attain therapeutic levels.

B. The dose limiting toxicity of vancomycin is nephrotoxicity which may be prevented by maintaining trough levels <5 mcg/ml.

C. Concentration dependent activity warrants peak concentrations of 30-40 mcg/ml for efficacy.

D. Time dependent activity warrants trough concentrations >MIC of the organism being treated.

E. Vancomycin is rapidly bactericidal vs. Staphylococcus aureus and is therefore the drug of first choice.

22. All of the following compounds are found in the cell walls of certain bacteria EXCEPT:

A. Teichoic acid

B. Diaminopimelic acid

C. Dideoxyhexose

D. Glycogen

E. Peptidoglycan

23. Which of the following anti-fungals causes a depression of bone marrow that can be relieved by co-administration of uracil:

A. Amphotericin B

B. Ketoconazole

C. Clotrimazole

D. Flucytocine

E. All of the above

24. A 37 year old man was admitted with full thickness burns over 85% of his body. He was given the usual dose of penicillin to prevent early infection. An intravenous catheter was placed in his femoral vein at admission 12 days ago. Today he is spiking temperatures to 102.3 degrees Fahrenheit. On examination the burn wounds appear stable and the remainder of the exam is unremarkable except for purulent drainage from the intravenous catheter site. Which of the following statements regarding the infecting organism is INCORRECT?

A. Hospital-acquired infections caused by this organism are frequently resistant to methicillin.

B. This organism rarely causes catheter-related infections.

C. This organism very commonly causes skin and skin-structure infections.

D. Spread of this organism from patient to patient is most often due to the failure of health care personnel to wash their hands.

E. This pathogen rarely causes disease in healthy hosts.

25. Active efflux from the cell can produce resistance to which one of the following antibiotics?

A. Vancomycin

B. Quinolone

C. Rifampin

D. Cephalosporin

E. Aminoglycosides

26. Which of the following IS NOT a function of the RecA enzyme during DNA repair?

A. Pairing of homologous DNA strands

B. Endonucleolytic nicking of damaged DNA

C. Activation of the *uvr* genes

D. DNA synthesis to fill in excised region

E. Proteolytic cleavage of the LexA repressor

27. The smallest nondefective viral genomes contain approximately:

A. 3,000 base pairs

B. 30,000 base pairs

C. 300,000 base pairs

D. 3,000,000 base pairs

E. 30,000,000 base pairs

28. The tolerance of facultative anaerobic bacteria to superoxide is caused by the:

A. Lack of cytochrome C oxidase

B. Presence of cytochrome C oxidase

C. Lack of peroxidase

D. Presence of superoxide dismutase and catalase

E. Inability to form the superoxide radical

29. Which of the following might be usefully combined with a cephalosporin in treating peritonitis caused by a puncture of the large bowel:

A. Metronidazole

B. Acyclovir

C. Gentamicin

D. Nafcillin

E. Both A and C

30. A 6 year old child is sent home from school because the teacher noticed him scratching a rash which appeared on his face. By the time he arrives home the rash has spread widely and lesions can be seen on his extremities and trunk. They appear to be small vesicles on an erythematous base. The next day some of the lesions are umbilicated and new lesions have appeared. Lesions went on to crust over as the illness ran its course. Which one of the following statements regarding this case study is INCORRECT?

A. The differential diagnosis includes impetigo, disseminated herpes simplex infection and enteroviral infection.

B. Hepatitis, arthritis, renal disease and central nervous system involvement are all potential complications of this infection.

C. Zoster may occur at a later stage due to latency of this organism.

D. The child can safely be sent to school the day after he was initially sent home if he is feeling well enough to go.

E. A vaccine is available and could have prevented this child's illness.

31. Enzymatic acetylation is a major mechanism of resistance to which one of the following antibiotics?

A. Tetracycline

B. Trimethoprim

C. Quinolone

D. Methicillin

E. Chloramphenicol

32. Choose the CORRECT function of general (homologous) recombination in bacteria:

A. Formation of a specialized transducing particle

B. Merozygote recombination

C. Genesis of a transposon

D. Intergenic suppression of a mutation

E. Host resistance to incoming foreign DNA

33. Which of the following is NOT a phase of the viral lytic replication cycle?

A. Uncoating

B. Morphogenesis

C. Latency

D. Attachment

E. Penetration

34. Bacterial proteins that are involved in murein assembly, expansion, shaping and septum formation are:

A. Heat-shock protein

B. Penicillin-binding proteins

C. Braun's lipoprotein

D. c-AMP binding protein

E. Porin protein

35. Saquinavir:

A. Inhibits the reverse transcriptase

B. Blocks a proton channel

C. Must be phosphorylated to be an active antiviral

D. Prevents processing of viral proteins

E. Both A and C

36. Which of the following statements about dermatophyte infections is INCORRECT?

A. Typically, infection is confined to keratinized, non-living tissue.

B. Most infections are easily treated with topical agents.

C. Systemic therapy is usually required for treatment of nail infection.

D. Chronic infection may be associated with poor cell-mediated immunity against *T. rubrum*.

E. Woods lamp can be used to distinguish between trichophyton infection and streptococcal infection.

37. A major mechanism of resistance to which of the following is by mutational decline in production of a specific outer-membrane porin protein, resulting in limitation of entry of the drug into the cell?

A. Imipenem

B. Vancomycin

C. Rifampin

D. Methicillin

E. Trimethoprim

38. In a two-component bacterial signal transduction system, the sensor and regulator communicate to each other via:

A. Phosphorylation by a protein kinase

B. Transcription by RNA polymerase

C. Attenuation at a secondary structure in mRNA

D. Site specific recombination causing inversion of the promoter sequence

E. The stringent response

39. The "Central Dogma of Molecular Biology" describes how information encoded in cellular genes is transferred from those genes to proteins. The Central Dogma has had to be extended and revised to accommodate the mechanisms used by viruses to store and express their genes. The viruses which most closely resemble cells in this respect are:

A. Viruses with single-stranded RNA genomes with positive polarity, such as the picornaviruses.

B. Viruses with double-stranded DNA genomes, such as the herpesviruses.

C. Viruses with double-stranded RNA genomes, such as the reoviruses.

D. Viruses whose envelopes are derived from the cell plasma membrane, such as the orthomyxoviruses.

E. Viruses whose virions contain reverse transcriptase, such as the retroviruses.

40. Microorganisms that can grow best at low O_2 concentrations and can also grow without O_2 are called:

A. Aerobes

B. Strict anaerobes

C. Aerotolerant anaerobes

D. Microaerophilic

E. Facultative anaerobes

41. A female patient is treated with tetracycline in an attempt to control gastric ulcers attributed to <u>H. pylori</u>. She develops a vaginal yeast infection. This is an example which of the following?

A. Plasmid mediated transfer multiple resistances

B. Hypersensitivity to tetracyclines

C. Superinfection

D. Resistance due to point mutation

E. None of the above

42. The pathogenesis of toxic shock syndrome can best be described as the result of:

A. Staphylococcal bacteremia

B. Superantigen-induced cytokine production

C. The release of interleukin-1 from antigen presenting -toxin.

D. The combined effects of numerous different staphylococcal toxins.

E. An allergic response to protein A

43. Some persons are subject to frequent recurrences of Herpes Simplex Virus infections. These frequent recurrences are the result of:

A. Reactivation of latent virus residing in the skin or mucous membranes near the site of infection.

B. Reactivation of latent virus residing in the ganglia innervating the site of infection.

C. Repeated reinfections from an external source.

D. Lack of memory cytotoxic T lymphocytes.

E. Lack of memory B cells.

44. Vancomycin:

A. Is effective when given orally to combat penicillin resistant septicemia

B. Inhibits cross linking of the bacterial cell wall

C. Is both ototoxic and nephrotoxic

D. Is the principal cause of <u>C. dificile</u> enterocolitis

E. A, B and C above

45. The following virulence factors are paired based on common mechanisms of action. Select the set that is IMPROPERLY PAIRED.

A. á-toxin and Streptolysin O

B. Streptococcal pyrogenic exotoxin and Toxic shock syndrome toxin

C. Streptococcal protein G and Staphylococcal protein A

D. Exfoliative toxin and Streptolysin S

E. Staphylokinase and Streptokinase

46. Which of the following statements concerning varicella-zoster virus infections IS NOT TRUE?

A. Varicella (chickenpox) is usually acquired by the respiratory route.

B. A live attenuated varicella-zoster vaccine is available.

C. Recurrent varicella-zoster infection (shingles) is caused by reactivation of latent virus.

D. Latent varicella-zoster virus resides in B cells.

E. Primary varicella-zoster virus infections in adult are more likely to result in serious complications than those in children.

47. Which of the following is a possible adverse effect of aminoglycosides?

A. Ototoxicity and nephrotoxicity

B. Yellow-brown discoloration of teeth

C. Bone marrow depression

D. Cholestatic hepatitis

E. Drug fever

48. *Streptococcus pyogenes* is a:

A. Gram positive coccus, ß-hemolytic, catalase negative

B. Gram negative coccus, ß-hemolytic, catalase negative

C. Gram positive rod, ß-hemolytic, catalase negative

D. -hemolytic, catalase negative

E. Gram positive coccus, ß-hemolytic, catalase positive

49. Infectious mononucleosis can result from infection with:

A. Epstein-Barr virus

B. Burkitt's lymphoma virus

C. Human herpesvirus 6

D. Cytomegalovirus

E. Human papillomavirus 16

50. The therapeutic target of fluoroquinolones, such as ciproflaxicin, is:

A. 50S ribosomal subunit

B. 30S ribosomal subunit

C. 70S ribosomal subunit

D. Gyrase

E. DNA-dependent RNA polymerase

51. Acute glomerulonephritis:

A. May follow Streptococcal respiratory tract infections but not impetigo.

B. May follow Streptococcal impetigo but not respiratory tract infections.

C. May follow Streptococcal impetigo or respiratory tract infections.

D. May follow Staphylococcal scalded skin syndrome.

E. May follow Staphylococcal toxic shock syndrome.

52. Genital warts are caused by:

A. Some types of human papilloma viruses

B. Molluscum contagiosum virus

C. Herpes simplex virus type 2

D. Vaccinia virus

E. JC virus

53. Which of the following description regarding sulfonamides is INCORRECT?

A. Sulfonamides are competitive inhibitors that affect folate biosynthesis.

B. Folate biosynthesis occurs in bacteria but not in mammals.

C. Drug-resistance is not a problem with sulfonamides, so the drugs can be repeatedly used in the treatment of urinary tract infections in a patient.

D. Sulfonamides are competitive inhibitors which block the enzyme activity of dihydropteroate synthase.

E. Trimethoprim inhibits dihydrofolate reductase (DHFR) which is part of the folate biosynthesis pathway.

54. Of the following gram positive anaerobes, which is a causative agent of gas gangrene?

A. *Streptococcus pyogenes*

B. *Pseudomonas aeruginosa*

C. *Sporothrix schenckii*

D. *Pasteurella multocida*

E. *Clostridium perfringens*

55. Sporotrichosis is an occupational hazard of:

A. Dishwashers

B. Gardeners

C. Chicken breeders

D. Dog breeders

E. None of the above

56. The most common cause of hematogenous osteomyelitis and septic arthritis is:

A. *Streptococcus pyogenes*

B. *Neisseria gonorrheae*

C. *Pseudomonas aeruginosa*

D. *Streptococcus pneumoniae*

E. *Staphylococcus aureus*

57. Gram positive lancet-shaped diplococcus, optochin susceptible, primary cause of dacrocystitis:

A. *Streptococcus pneumoniae*

B. *Streptococcus pyogenes*

C. *Staphylococcus aureus*

D. *Haemophilus influenzae*

E. *Moraxella lacunata*

58. *Pseudomonas aeruginosa* exotoxin A catalyzes which of the following reactions?

A. Proteolytic degradation of elastin

B. Hydrolysis of phospholipid membranes

C. ADP-ribosylation of elongation factor 2

D. ADP-ribosylation of G protein

E. Depurination of 28S ribosomal RNA

59. The causative agent for Ocular larva migrans:

A. Undergoes a sexual stage in the intestinal tract of cats

B. Is a tissue nematode which normally infects dogs

C. Exists in the environment as an ameba which can invade injured ocular tissue

D. Forms arthroconidia which initiate a pulmonary infection that disseminates to the eye

E. Is sexually transmitted in humans

MATCHING ITEMS

In each of the following groups there are two numbered lists. Mark on the answer sheet in the line corresponding to each question number in the lower list (60-64) the letter of the related item of the upper list.

The following diagram shows the moieties of a typical bacterial endotoxin that contains the items A through J. Repeating Outer Core, Inner Core, Inner Core Unit, O-Specific Chain, Core, Lipid A

DIRECTIONS: Select the option (A-J below) which best fits the descriptions numbered 60-61.

A. 2-keto-3-deoxyoctonate(KDO)
B. 1-glycero-D-manno-heptose
C. Ethanolamine
D. D-glucosamine
E. Phosphate
F. Lipid A
G. Outer core
H. Inner core
I. O-specific chain
J. 3-hydroxy-tetradecanoic acid

60. Component responsible for the induction and/or production of fever, hypotension, production of tumor necrosis, and interleukin-1.

61. Component to be used as antigen for the diagnosis of a gram-negative bacterium that causes disseminated intravascular coagulation.

DIRECTIONS: Select the option (A-E below) which best fits the descriptions numbered 62-64.

A. Inhibits glucose-6-phosphate dehydrogenase

B. Is used in the "radical cure" for malaria

C. Inhibits ATP production in anaerobes

D. Inhibits sterol synthesis in yeast

E. Binds to sterols in the plasma membrane of yeast

62. Ketoconazole

63. Metronidazole

64. Primaquine