Winter 2026
Pathogenic Bacteriology
Exam I

1. Normal microbiota primarily benefit the host by:
A. Causing inflammation
B. Producing endotoxins
C. Preventing colonization by pathogens
D. Inducing autoimmune disease
E. Increasing susceptibility to infection

2. Which body site is normally sterile in healthy individuals?
A. Colon
B. Skin
C. Upper respiratory tract
D. Blood
E. Oropharynx

3. Which structure is present in gram-positive bacteria but absent in gram-negative bacteria?
A. Outer membrane
B. Lipopolysaccharide
C. Thick peptidoglycan layer
D. Periplasmic space
E. Porin proteins

4. Lipopolysaccharide (LPS) is a major component of the:
A. Gram-positive cell wall
B. Cytoplasmic membrane
C. Gram-negative outer membrane
D. Bacterial capsule
E. Ribosomal subunit

5. Which organism group lacks a cell wall?
A. Gram-positive bacteria
B. Gram-negative bacteria
C. Mycobacteria
D. Mycoplasma
E. Chlamydia

6. Which disinfectant acts by denaturing proteins and disrupting membranes?
A. Halogens
B. Alcohols
C. Heavy metals
D. Aldehydes
E. Biguanides

7. Antiseptics differ from disinfectants in that antiseptics are:
A. Stronger chemical agents
B. Used on inanimate objects
C. Safe for application to living tissue
D. Effective against spores
E. Used only in laboratories

8. Selective toxicity refers to the ability of an antimicrobial agent to:
A. Kill all microorganisms
B. Inhibit host cell metabolism
C. Target microbial cells without harming host cells
D. Prevent mutation
E. Enhance immune responses

9. Beta-lactam antibiotics primarily act by inhibiting:
A. Protein synthesis
B. DNA replication
C. RNA transcription
D. Cell wall synthesis
E. Cell membrane integrity

10. Which class of antibiotics binds to the 30S ribosomal subunit?
A. Macrolides
B. Tetracyclines
C. Fluoroquinolones
D. Rifamycins
E. Glycopeptides

11. Koch's postulates were developed to establish a relationship between:
A. Host immunity and disease
B. Microorganisms and specific diseases
C. Viruses and cancer
D. Antibiotics and resistance
E. Normal flora and infection

12. The incubation period refers to the time between:
A. Infection and recovery
B. Exposure and symptom onset
C. Symptom onset and diagnosis
D. Diagnosis and treatment
E. Transmission and immunity

13. Which host defense is considered part of innate immunity?
A. Antibody production
B. T-cell activation
C. Complement system
D. Immunologic memory
E. Class switching

14. A 68-year-old man with poorly controlled diabetes develops pneumonia after hospitalization. Cultures grow an organism that rarely causes disease in healthy individuals but readily infects immunocompromised hosts. This organism is best described as a(n):
A. Primary pathogen
B. Opportunistic pathogen
C. Obligate pathogen
D. Commensal organism
E. Environmental contaminant

15. A patient receiving broad-spectrum antibiotics develops severe diarrhea. Stool samples show the presence of pathogenic bacteria. What most likely contributed to this condition?
A. Allegric reaction triggered an induction of fever, allowing the pathogenic bacteria to grow
B. The Antibiotics triggered production of endotoxin to initiate pathogenic bacterial growth
C. The loss of the normal microbiota allowed the pathogenic bacteria to grow
D. The antibiotics suppressed the adaptive immune response
E. The antibiotics suppressed antibody production

16. A patient with septic shock caused by gram-negative bacteremia develops fever and hypotension due to the release of endotoxin. Which component of the bacterial cell wall is primarily responsible?
A. O antigen
B. Peptidoglycan
C. Lipid A
D. Teichoic acid
E. Capsule

17. A strain of bacteria isolated from a patient with meningitis shows enhanced resistance to phagocytosis. Which bacterial structure most directly accounts for this property?
A. Flagella
B. Ribosomes
C. Capsule
D. Pili
E. Endospore

18. A Bacillus species survives exposure to boiling water for several minutes. Which structural feature most likely explains this resistance?
A. Capsule
B. Endotoxin
C. Spore formation
D. Plasmid acquisition
E. Efflux pumps

19.A hospital sterilizes surgical instruments using pressurized steam at high temperature. This method is known as:
A. Pasteurization
B. Filtration
C. Autoclaving
D. Ultraviolet irradiation
E. Chemical disinfection

20. A patient is treated with a beta-lactam antibiotic. Which bacterial process is directly inhibited by this drug?
A. Protein synthesis
B. DNA replication
C. RNA transcription
D. Cell wall synthesis
E. Cell membrane integrity

21. The first line of defense against microbial infection includes:
A. Antibodies
B. T lymphocytes
C. Physical and chemical barriers
D. Complement
E. Cytotoxic T cells

22. Which component of innate immunity responds most rapidly to infection?
A. Antigen-specific antibodies
B. Memory T cells
C. Phagocytic cells
D. Plasma cells
E. Class-switched B cells

23. Which cell type is primarily responsible for phagocytosis of bacteria in blood and tissues?
A. Eosinophils
B. Basophils
C. Neutrophils
D. Mast cells
E. Natural killer cells

24. A Pattern recognition receptors (PRRs) on an innate immune cell might recognize:
A. MHC Class I
B. MHC Class II
C. Flagellin
D. T-cell Receptor
E. TNF-alpha

25. Toll-like receptors are primarily involved in:
A. Antibody class switching
B. Antigen presentation
C. Innate immune recognition
D. T-cell receptor rearrangement
E. Complement inhibition

26. Secretory IgA plays its most important role in:
A. Complement activation
B. Placental transfer
C. Mucosal immunity
D. Allergy and hypersensitivity
E. Opsonization in blood

27. Major histocompatibility complex (MHC) class I molecules present antigens to:
A. $CD4^+$ T cells
B. $CD8^+$ T cells
C. B cells
D. Natural killer cells
E. Plasma cells

28. MHC class II molecules are primarily expressed on:
A. Red blood cells
B. All nucleated cells
C. Antigen-presenting cells
D. Neurons
E. Muscle cells

29. Which cell is considered a professional antigen-presenting cell?
A. Neutrophil
B. Eosinophil
C. Dendritic cell
D. Natural killer cell
E. Platelet

30. Activation of $CD4^+$ T helper cells requires antigen presentation in association with:
A. MHC class I
B. MHC class II
C. CD8 molecules
D. Immunoglobulin
E. Complement

31. Which T-cell subset is primarily responsible for killing virus-infected cells?
A. Helper T cells
B. Regulatory T cells
C. Cytotoxic T cells
D. Memory T cells
E. Gamma-delta T cells

32. Which hypersensitivity reaction is mediated by IgE?
A. Type I
B. Type II
C. Type III
D. Type IV
E. Type V

33. Live attenuated vaccines differ from inactivated vaccines because they:
A. Cannot induce memory
B. Require multiple booster doses
C. Mimic natural infection more closely
D. Are safer in immunocompromised patients
E. Contain only purified antigens

34. Conjugate vaccines are especially effective in infants because they:
A. Activate T-cell–independent responses
B. Induce strong IgE responses
C. Convert polysaccharide antigens into T-cell–dependent antigens
D. Avoid the need for boosters
E. Inhibit complement activation

35. Passive immunity differs from active immunity because it:
A. Activates a T-memory-cell response
B. Activates both T- and B-cell memory formation
C. Results from antibody transfer
D. Requires antigen exposure
E. Is slower to develop

36. Complement deficiencies are most often associated with increased susceptibility to:
A. Viral infections
B. Fungal infections
C. Bacterial infections
D. Parasitic infections
E. Prion diseases

37. A 45-year-old man develops a bacterial skin infection. Within hours, neutrophils migrate to the site and begin phagocytosing bacteria before antibodies are detectable. This rapid response is part of which immune system component?
A. Adaptive immunity
B. Humoral immunity
C. Innate immunity
D. Cell-mediated immunity
E. Passive immunity

38. A macrophage recognizes bacterial lipopolysaccharide via surface receptors, triggering cytokine release. These receptors are best described as:
A. Antigen-specific receptors
B. Immunoglobulin receptors
C. Pattern recognition receptors
D. Fc receptors
E. MHC molecules

39. A patient with recurrent bacterial infections is found to have impaired opsonization. Deficiency of which complement component most likely explains this finding?
A. C1
B. C3b
C. C5a
D. C9
E. Factor D

40. A laboratory test shows elevated levels of the most abundant immunoglobulin in human serum. Which antibody class is being measured?
A. IgA
B. IgD
C. IgE
D. IgG
E. IgM

41. A patient with no prior exposure to a virus produces antibodies within days of infection. Which immunoglobulin appears first?
A. IgA
B. IgD
C. IgE
D. IgG
E. IgM

42. A virus-infected cell presents endogenous peptides to cytotoxic T cells. This presentation occurs via which molecule?
A. MHC class II
B. CD4
C. MHC class I
D. Immunoglobulin
E. Complement receptor

43. A patient with seasonal allergies experiences sneezing, itching, and bronchoconstriction shortly after pollen exposure. Which hypersensitivity type is responsible?
A. Type I
B. Type II
C. Type III
D. Type IV
E. Type V

44. Gram-positive bacteria differ from gram-negative bacteria by having:
A. An outer membrane
B. Lipopolysaccharide
C. Thin peptidoglycan
D. Thick peptidoglycan and teichoic acids
E. Periplasmic space only

45. Which component of gram-negative bacteria is primarily responsible for endotoxin activity?
A. Capsule
B. Porin proteins
C. Lipid A
D. O antigen
E. Core polysaccharide

46. Teichoic acids are found in the cell walls of:
A. Mycoplasma
B. Gram-negative bacteria
C. Gram-positive bacteria
D. Acid-fast bacteria
E. Spirochetes

47. Capsules enhance bacterial virulence primarily by:
A. Increasing motility
B. Enhancing toxin secretion
C. Inhibiting phagocytosis
D. Improving nutrient uptake
E. Producing endotoxin

48. The outer membrane of gram-negative bacteria contains which type of proteins that allow small molecules to pass?
A. Transport ATPases
B. Porins
C. Penicillin-binding proteins
D. Teichoic acids
E. Flagellin

49. Which bacterium is known for producing endospores?
A. *Escherichia coli*
B. *Staphylococcus aureus*
C. *Clostridium* species
D. *Neisseria meningitidis*
E. *Chlamydia trachomatis*

50. Acid-fast staining is most useful for identifying bacteria with:
A. Mycobacteria
B. Gram-negative bacteria
C. Gram-positive bacteria
D. Spores
E. Spirochetes

51. Which structure is responsible for bacterial motility?
A. Pili
B. Capsule
C. Ribosome
D. Flagella
E. Endospore

52. A bacterium isolated from blood cultures grows in both aerobic and anaerobic environments. Which metabolic classification best describes this organism?
A. Obligate aerobe
B. Obligate anaerobe
C. Facultative anaerobe
D. Microaerophile
E. Aerotolerant anaerobe

53. A microbiologist observes gram-positive cocci with thick peptidoglycan and teichoic acids. Which staining property would be expected?
A. Pink after Acid-fast staining
B. Pink after Gram staining
C. Purple after Acid-fast staining
D. Purple after Gram staining
E. Colorless after Acid-fast staining

54. A bacterium metabolizes glucose to lactic acid in the absence of oxygen and produces limited ATP. Which process is responsible?
A. Oxidative phosphorylation
B. Aerobic respiration
C. Fermentation
D. Pentose phosphate pathway
E. Beta-oxidation

55. A gram-negative bacterium shows high intrinsic antibiotic resistance. Which structural feature contributes most to this?
A. Capsule
B. Thin peptidoglycan
C. Outer membrane permeability barrier
D. Ribosomal differences
E. Flagella