Board Exam Desk

General Microbiology Reviewer

General Microbiology | MICRO | 120 original questions

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Review bacteria, viruses, fungi and parasites, immunology and microbial control. There is no PRC board exam for microbiology; it is also a major subject of the Medical Technology board.

Practice questions

Microbial Cell Structure and Classification

1. Which cell structure is found in most bacteria but is absent from all eukaryotic cells?

A. Ribosomes
B. A plasma membrane
C. Cytoplasm
D. A peptidoglycan cell wall

2. Which part of the lipopolysaccharide in the Gram-negative outer membrane is responsible for endotoxin activity?

A. O-antigen polysaccharide
B. Core polysaccharide
C. Porin proteins
D. Lipid A

3. Teichoic acids are a characteristic component of which structure?

A. Gram-negative outer membranes
B. Mycoplasma cell membranes
C. Fungal cell walls
D. Gram-positive cell walls

4. Which bacterial genus naturally lacks a cell wall?

A. Rickettsia
B. Mycoplasma
C. Streptomyces
D. Clostridium

5. Archaeal cell membranes differ from bacterial membranes because their lipids have

A. Ester-linked fatty acid chains
B. Ether-linked isoprenoid chains
C. Peptidoglycan embedded within them
D. Large amounts of cholesterol

6. The extreme heat resistance of bacterial endospores is linked mainly to

A. A dehydrated core rich in calcium dipicolinate
B. A thick polysaccharide capsule
C. Numerous peritrichous flagella
D. Extra copies of plasmid DNA

7. The ribosomes of prokaryotes are described as

A. 70S, made of 50S and 30S subunits
B. 80S, made of 60S and 40S subunits
C. 70S, made of 60S and 40S subunits
D. 80S, made of 50S and 30S subunits

8. A bacterium with a tuft of several flagella at one pole has which flagellar arrangement?

A. Lophotrichous
B. Monotrichous
C. Amphitrichous
D. Peritrichous

9. Carl Woese's three-domain classification was based mainly on comparisons of

A. Cell wall peptidoglycan content
B. Plasmid DNA profiles
C. Flagellar protein structure
D. Small-subunit ribosomal RNA sequences

10. Spherical bacteria that divide in several planes and form grape-like clusters are called

A. Streptococci
B. Diplococci
C. Tetrads
D. Staphylococci

11. The main role of a bacterial capsule in disease is to

A. Generate ATP for the cell
B. Help the bacterium resist phagocytosis
C. Carry out protein synthesis
D. Rotate and propel the cell

12. Numerous short, hair-like fimbriae on a bacterial surface mainly function in

A. Swimming motility by rotation
B. Storing energy reserves
C. Attaching the cell to surfaces and host tissues
D. Replicating the chromosome

13. Where is the periplasmic space of a Gram-negative bacterium located?

A. Between the cytoplasmic membrane and the outer membrane
B. Between the nucleoid and the ribosomes
C. Inside the core of an endospore
D. Between the capsule and the slime layer

14. The acid-fast property of Mycobacterium is due mainly to which cell wall component?

A. Mycolic acids
B. Teichoic acids
C. Lipopolysaccharide
D. Polysaccharide capsule

15. In the Gram stain, which reagent acts as the mordant?

A. Crystal violet
B. Safranin
C. Acetone-alcohol
D. Gram's iodine

Microbial Growth and Metabolism

16. During which phase of the bacterial growth curve does the population increase at a constant, maximal rate?

A. Log (exponential) phase
B. Lag phase
C. Stationary phase
D. Death phase

17. A culture starts with 100 cells of a bacterium whose generation time is 20 minutes. Assuming continuous exponential growth, how many cells are present after 2 hours?

A. 1,200
B. 3,200
C. 12,800
D. 6,400

18. An organism grows best at about 10 °C and cannot grow above 20 °C. It is best classified as a

A. Psychrophile
B. Mesophile
C. Thermophile
D. Hyperthermophile

19. Many obligate anaerobes are harmed by oxygen because they lack enzymes that detoxify reactive oxygen species, namely

A. DNA polymerase and DNA ligase
B. Beta-lactamase and transpeptidase
C. Superoxide dismutase and catalase
D. Amylase and lipase

20. What is the net ATP yield from substrate-level phosphorylation when one glucose passes through glycolysis (the Embden-Meyerhof pathway)?

A. 2 ATP
B. 4 ATP
C. 36 ATP
D. No ATP

21. In aerobic respiration, the final electron acceptor of the electron transport chain is

A. Molecular oxygen
B. NAD+
C. Pyruvate
D. Nitrate

22. The main purpose of fermentation pathways in cells that cannot respire is to

A. Regenerate NAD+ so that glycolysis can continue
B. Produce large amounts of ATP by electron transport
C. Fix carbon dioxide into sugars
D. Build peptidoglycan precursors

23. Nitrosomonas obtains energy by oxidizing ammonia and uses carbon dioxide as its carbon source. It is best described as a

A. Photoautotroph
B. Chemoorganoheterotroph
C. Photoheterotroph
D. Chemolithoautotroph

24. Microorganisms that require high salt concentrations to grow are called

A. Acidophiles
B. Piezophiles
C. Halophiles
D. Capnophiles

25. Which counting method detects only living cells and reports results as colony-forming units?

A. Direct microscopic count with a counting chamber
B. Viable plate count
C. Turbidity measurement with a spectrophotometer
D. Dry weight determination

26. MacConkey agar contains bile salts, crystal violet, lactose and neutral red. This makes it

A. Selective for Gram-positive bacteria and differential for hemolysis
B. Enriched for fastidious organisms but not differential
C. Selective for Gram-negative bacteria and differential for lactose fermentation
D. A general-purpose medium with no selective agents

27. Chocolate agar, made by heating blood to release X and V factors, is best classified as

A. A selective medium
B. A differential medium
C. A transport medium
D. An enriched medium

28. In bacteria, the electron transport chain is located in the

A. Cytoplasmic (plasma) membrane
B. Outer membrane
C. Mitochondrial inner membrane
D. Ribosomes

29. Which enzyme reduces atmospheric nitrogen to ammonia and is inactivated by oxygen?

A. Nitrate reductase
B. Nitrogenase
C. Urease
D. Catalase

30. In thioglycollate broth, an organism grows throughout the tube but most densely near the top. It is most likely a

A. Obligate aerobe
B. Obligate anaerobe
C. Facultative anaerobe
D. Microaerophile

Microbial Genetics

31. Uptake of free DNA from the environment by a competent bacterial cell is called

A. Transduction
B. Transformation
C. Conjugation
D. Transposition

32. Generalized transduction transfers genes between bacteria by means of

A. A sex pilus joining two cells
B. Free DNA taken up from the medium
C. A bacteriophage that mistakenly packages host DNA
D. A transposon moving within one chromosome

33. An Hfr strain differs from an F+ strain because its F factor

A. Is integrated into the bacterial chromosome
B. Has been lost from the cell
C. Is carried inside a bacteriophage
D. Encodes only antibiotic resistance genes

34. In the lac operon, the inducer allolactose turns on transcription by

A. Binding the operator and recruiting the ribosome
B. Acting as a corepressor that activates the repressor
C. Cutting the promoter sequence
D. Binding the repressor so it can no longer bind the operator

35. The Ames test screens chemicals for mutagenic potential by measuring

A. Loss of lactose fermentation in Escherichia coli
B. The rate of spore formation in Bacillus
C. Antibiotic production by Streptomyces
D. Reversion of histidine-requiring Salmonella mutants to histidine independence

36. Deleting a single nucleotide from within a protein-coding gene most often produces a

A. Frameshift mutation
B. Silent mutation
C. Missense change at only one codon
D. Change with no effect on the reading frame

37. A point mutation that changes a codon for an amino acid into a stop codon is called a

A. Missense mutation
B. Nonsense mutation
C. Silent mutation
D. Frameshift mutation

38. What is the natural function of restriction endonucleases in bacteria?

A. Repairing thymine dimers caused by UV light
B. Initiating plasmid replication
C. Destroying foreign DNA such as that of infecting phages
D. Removing introns from messenger RNA

39. The heat-stable DNA polymerase widely used in PCR was originally isolated from

A. Escherichia coli
B. Thermus aquaticus
C. Bacillus subtilis
D. Saccharomyces cerevisiae

40. Ultraviolet light damages DNA mainly by forming

A. Ribose sugars in place of deoxyribose
B. Covalent dimers between adjacent pyrimidines such as thymine
C. Methyl groups on every adenine
D. Peptide bonds between nucleotides

41. Replication of a typical circular bacterial chromosome proceeds

A. Bidirectionally from a single origin
B. Unidirectionally from many origins
C. Bidirectionally from many origins
D. Only by reverse transcription

42. DNA segments that can move from one location to another within a genome are called

A. Operons
B. Promoters
C. Introns
D. Transposable elements

43. Meselson and Stahl's heavy-nitrogen experiment showed that DNA replication is

A. Conservative
B. Semiconservative
C. Dispersive
D. RNA-templated

44. Replica plating is most useful for

A. Measuring the size of bacterial cells
B. Determining the sequence of a gene
C. Counting virus particles in a sample
D. Identifying auxotrophic mutants that fail to grow on minimal medium

45. In bacterial mRNA, the Shine-Dalgarno sequence serves as the

A. Termination signal for translation
B. Ribosome-binding site just upstream of the start codon
C. Binding site for RNA polymerase
D. Signal for adding a poly-A tail

Bacteriology

46. Which test is commonly used to distinguish Staphylococcus aureus from most other staphylococci?

A. Catalase test
B. Coagulase test
C. Oxidase test
D. Bile solubility test

47. A Gram-positive coccus produces bubbles when mixed with 3% hydrogen peroxide. Which organism fits this result?

A. Streptococcus pyogenes
B. Streptococcus pneumoniae
C. Enterococcus faecalis
D. Staphylococcus epidermidis

48. A beta-hemolytic, catalase-negative, Gram-positive coccus in chains is susceptible to bacitracin. It is presumptively identified as

A. Streptococcus agalactiae
B. Streptococcus pneumoniae
C. Streptococcus pyogenes
D. Enterococcus faecalis

49. Alpha-hemolytic, lancet-shaped Gram-positive diplococci that are optochin susceptible and bile soluble are most likely

A. Viridans streptococci
B. Streptococcus pneumoniae
C. Staphylococcus aureus
D. Neisseria meningitidis

50. Kidney-bean-shaped, Gram-negative diplococci that are oxidase positive belong to the genus

A. Neisseria
B. Streptococcus
C. Escherichia
D. Bacillus

51. Which enteric organism typically forms pink, lactose-fermenting colonies on MacConkey agar?

A. Salmonella enterica
B. Shigella sonnei
C. Escherichia coli
D. Proteus mirabilis

52. On Hektoen enteric agar, a stool isolate forms blue-green colonies with black centers. This suggests

A. Shigella
B. Escherichia coli
C. Klebsiella pneumoniae
D. Salmonella

53. Growth that spreads in waves across the surface of a blood agar plate is characteristic of

A. Klebsiella pneumoniae
B. Staphylococcus aureus
C. Proteus mirabilis
D. Neisseria gonorrhoeae

54. A Gram-negative rod from a burn wound is oxidase positive, does not ferment glucose, and produces a blue-green pigment with a grape-like odor. The most likely organism is

A. Escherichia coli
B. Klebsiella pneumoniae
C. Salmonella Typhi
D. Pseudomonas aeruginosa

55. Tetanus toxin (tetanospasmin) causes spastic paralysis by

A. Blocking release of inhibitory neurotransmitters in the central nervous system
B. Blocking acetylcholine release at the neuromuscular junction
C. Inactivating elongation factor 2 in host cells
D. Raising cyclic AMP levels in intestinal cells

56. Flaccid paralysis after eating improperly home-canned, low-acid food is caused by a neurotoxin from

A. Clostridium botulinum
B. Clostridium perfringens
C. Bacillus cereus
D. Staphylococcus aureus

57. Which staining method is standard for detecting Mycobacterium tuberculosis in sputum smears?

A. Gram stain
B. India ink negative stain
C. Ziehl-Neelsen acid-fast stain
D. Endospore stain

58. Which mycobacterium has never been grown on artificial laboratory media?

A. Mycobacterium tuberculosis
B. Mycobacterium bovis
C. Mycobacterium avium
D. Mycobacterium leprae

59. A curved, oxidase-positive Gram-negative rod that forms yellow colonies on TCBS agar and causes profuse rice-water diarrhea is

A. Vibrio parahaemolyticus
B. Campylobacter jejuni
C. Shigella dysenteriae
D. Vibrio cholerae

60. In the Philippines, cases rise after typhoon flooding as people wade through water contaminated with rat urine. The spirochete responsible is

A. Treponema pallidum
B. Leptospira interrogans
C. Borrelia burgdorferi
D. Vibrio vulnificus

61. Which microscopic technique is traditionally used to see Treponema pallidum in fluid from a primary chancre?

A. Gram stain with bright-field microscopy
B. Acid-fast staining
C. India ink preparation
D. Dark-field microscopy

62. A rapid urease test on a gastric biopsy is used to detect

A. Campylobacter jejuni
B. Salmonella Typhi
C. Clostridioides difficile
D. Helicobacter pylori

63. A Gram-positive rod can multiply at refrigerator temperature, shows tumbling motility, and is a risk to pregnant women through soft cheeses and deli meats. It is

A. Bacillus cereus
B. Listeria monocytogenes
C. Clostridium perfringens
D. Corynebacterium diphtheriae

64. What is the typical IMViC pattern (indole, methyl red, Voges-Proskauer, citrate) of Escherichia coli?

A. - - + +
B. + - + -
C. + + - -
D. - + - +

65. During the first week of typhoid fever, which specimen is most likely to yield Salmonella Typhi?

A. Stool
B. Urine
C. Blood
D. Cerebrospinal fluid

Virology

66. A typical virion contains

A. A genome made of both DNA and RNA
B. Its own ribosomes for protein synthesis
C. A genome of either DNA or RNA, but not both
D. Enzymes that generate ATP

67. The protein subunits that assemble into a viral capsid are called

A. Nucleoids
B. Capsomeres
C. Prions
D. Virions

68. Most enveloped animal viruses get their envelope by

A. Building it entirely from viral-coded lipids
B. Taking up fragments of bacterial cell walls
C. Budding through a host cell membrane
D. Folding their capsid proteins into a lipid layer

69. In lysogeny, the phage DNA integrated into the bacterial chromosome is called a

A. Capsomere
B. Plaque
C. Virion
D. Prophage

70. Which enzyme lets HIV make a DNA copy of its RNA genome?

A. Integrase
B. Reverse transcriptase
C. Protease
D. DNA ligase

71. HIV mainly infects cells that carry which surface molecule?

A. CD8
B. CD19
C. CD56
D. CD4

72. In a phage plaque assay, each clear zone on a bacterial lawn ideally comes from

A. One uninfected bacterium
B. One infectious virus particle
C. One antibody molecule
D. One bacterial endospore

73. Dengue virus is transmitted to humans mainly by the bite of

A. Anopheles mosquitoes
B. Aedes aegypti mosquitoes
C. Culex mosquitoes
D. Sand flies

74. Finding which marker in serum shows that a person is currently infected with hepatitis B virus?

A. Anti-HBs
B. Anti-HAV IgG
C. HBsAg
D. Anti-HCV

75. Which hepatitis virus is spread mainly by the fecal-oral route?

A. Hepatitis A virus
B. Hepatitis B virus
C. Hepatitis C virus
D. Hepatitis D virus

76. A bullet-shaped virus causes nearly always fatal encephalitis after an animal bite, with Negri bodies in neurons. The virus is

A. Rabies virus
B. Poliovirus
C. Japanese encephalitis virus
D. Measles virus

77. A major antigenic shift in influenza A viruses results mainly from

A. Gradual point mutations in the hemagglutinin gene
B. Reassortment of genome segments between different strains
C. Integration of the viral genome into host DNA
D. Loss of the viral envelope

78. Prions differ from viruses in that prions

A. Lack nucleic acid and consist of misfolded protein
B. Contain both DNA and RNA
C. Are easily inactivated by ordinary boiling
D. Have a lipid envelope with glycoprotein spikes

79. Visible changes such as cell rounding, syncytium formation and detachment in virus-infected cell cultures are called

A. Lysogeny
B. Bacterial transformation
C. Cytopathic effects
D. Antigenic drift

80. Small white spots on the inside of the cheek (Koplik spots) appearing before a rash are characteristic of

A. Rubella
B. Measles
C. Varicella
D. Mumps

Mycology and Parasitology

81. Which is the main sterol in fungal cell membranes and the target of azole and polyene antifungals?

A. Cholesterol
B. Peptidoglycan
C. Ergosterol
D. Chitin

82. Which polysaccharide is a major structural component of most fungal cell walls?

A. Peptidoglycan
B. Chitin
C. Lipopolysaccharide
D. Teichoic acid

83. Thermally dimorphic fungi such as Histoplasma capsulatum typically grow as

A. Yeasts at 25 °C and molds at 37 °C
B. Molds at 25 °C and yeasts at 37 °C
C. Molds at both temperatures
D. Yeasts at both temperatures

84. Germ tubes forming after 2 to 3 hours in serum at 37 °C presumptively identify

A. Cryptococcus neoformans
B. Aspergillus fumigatus
C. Malassezia furfur
D. Candida albicans

85. An India ink preparation of cerebrospinal fluid shows encapsulated budding yeasts. This suggests

A. Candida albicans
B. Histoplasma capsulatum
C. Aspergillus fumigatus
D. Cryptococcus neoformans

86. Tinea (ringworm) infections of the skin, hair and nails are caused by

A. Roundworms of the genus Ascaris
B. Dimorphic fungi such as Histoplasma
C. Dermatophytes such as Trichophyton and Microsporum
D. Protozoa such as Giardia

87. Potassium hydroxide (KOH) is added to skin scrapings before direct microscopy because it

A. Dissolves keratin and host cells so fungal elements are easier to see
B. Stains fungal hyphae a deep purple
C. Selectively kills contaminating bacteria
D. Makes fungi produce spores on the slide

88. Aflatoxin, a potent liver carcinogen found in poorly stored peanuts and corn, is produced by

A. Penicillium notatum
B. Saccharomyces cerevisiae
C. Aspergillus flavus
D. Rhizopus stolonifer

89. Crescent- or banana-shaped gametocytes on a blood smear are characteristic of

A. Plasmodium vivax
B. Plasmodium falciparum
C. Plasmodium malariae
D. Plasmodium ovale

90. In the life cycle of Plasmodium, sexual reproduction takes place in

A. The female Anopheles mosquito
B. Human liver cells
C. Human red blood cells
D. The Aedes mosquito

91. The intermediate host of Schistosoma japonicum in the Philippines is

A. A freshwater snail, Oncomelania hupensis quadrasi
B. The Anopheles mosquito
C. A freshwater crab
D. The domestic pig

92. A pear-shaped flagellate with two nuclei and a ventral sucking disk causes greasy, foul-smelling diarrhea. It is

A. Trichomonas vaginalis
B. Giardia duodenalis (G. lamblia)
C. Entamoeba histolytica
D. Balantidium coli

93. Amoebic trophozoites containing ingested red blood cells in a dysenteric stool point to

A. Entamoeba coli
B. Giardia duodenalis
C. Entamoeba histolytica
D. Cryptosporidium parvum

94. The cellulose tape (Scotch tape) perianal method is the recommended way to detect

A. Ascaris lumbricoides
B. Taenia solium
C. Enterobius vermicularis
D. Trichuris trichiura

95. Human cysticercosis results from

A. Eating undercooked beef containing Taenia saginata larvae
B. Swallowing eggs of Taenia solium
C. Hookworm larvae penetrating the skin
D. The bite of an infected mosquito

Immunology and Host Defense

96. Which antibody class is usually produced first in a primary immune response and circulates as a pentamer?

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

97. Which immunoglobulin class is the only one that crosses the human placenta?

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

98. Which antibody predominates in tears, saliva, breast milk and other mucosal secretions?

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

99. Lysozyme in tears and saliva protects against bacteria by

A. Binding iron so bacteria cannot use it
B. Forming the membrane attack complex
C. Breaking bonds in the peptidoglycan backbone
D. Neutralizing bacterial exotoxins

100. Which phagocytes usually arrive first and in the largest numbers at a site of acute bacterial infection?

A. Neutrophils
B. Eosinophils
C. Basophils
D. Plasma cells

101. Immunity that develops after receiving a vaccine is classified as

A. Artificially acquired active immunity
B. Naturally acquired passive immunity
C. Artificially acquired passive immunity
D. Naturally acquired active immunity

102. Cytotoxic T lymphocytes recognize antigen presented on

A. MHC class II molecules, using CD8
B. Free soluble antigen, using the B-cell receptor
C. MHC class I molecules, using CD8
D. Complement fragment C3b, using CD4

103. Which complement components form the membrane attack complex?

A. C1q, C1r and C1s
B. C3a and C5a
C. C5b through C9
D. C4b and C2a

104. Anaphylaxis and allergic rhinitis are examples of hypersensitivity mediated mainly by

A. Immune complexes deposited in tissues (type III)
B. Sensitized T cells (type IV)
C. IgE bound to mast cells (type I)
D. IgG directed against cell-surface antigens (type II)

105. Type I interferons (alpha and beta) help control viral infections mainly by

A. Lysing bacterial cell walls directly
B. Inducing an antiviral state in neighboring cells
C. Acting as antibodies that neutralize toxins
D. Activating the blood clotting cascade

Control of Microorganisms and Applied Microbiology

106. What are the standard autoclave conditions for routine sterilization of small loads?

A. 100 °C at normal pressure for 5 minutes
B. 160 °C dry heat for 30 minutes
C. 121 °C at about 15 psi for at least 15 minutes
D. 63 °C for 30 minutes

107. Which biological indicator is used to check steam autoclave performance?

A. Vegetative cells of Escherichia coli
B. Spores of Geobacillus stearothermophilus (formerly Bacillus stearothermophilus)
C. Vegetative cells of Staphylococcus aureus
D. Yeast cells of Saccharomyces cerevisiae

108. High-temperature short-time (HTST) pasteurization of milk uses about

A. 63 °C for 15 seconds
B. 121 °C for 15 minutes
C. 72 °C for 15 seconds
D. 100 °C for 30 minutes

109. Heat-sensitive solutions such as some antibiotic and vitamin preparations are commonly sterilized by

A. Autoclaving at 121 °C
B. Hot-air oven treatment
C. Incineration
D. Membrane filtration through 0.22 µm pores

110. Which term means destroying all forms of microbial life, including bacterial endospores?

A. Disinfection
B. Antisepsis
C. Sanitization
D. Sterilization

111. Why is 70% ethanol generally a more effective disinfectant than absolute (100%) ethanol?

A. 70% ethanol is able to kill bacterial endospores
B. The water present helps alcohol penetrate cells and denature proteins
C. Absolute ethanol evaporates more slowly from surfaces
D. Absolute ethanol cannot dissolve lipids

112. Beta-lactam antibiotics such as penicillin kill bacteria by

A. Binding the 30S ribosomal subunit
B. Inhibiting DNA gyrase
C. Inhibiting the cross-linking (transpeptidation) of peptidoglycan
D. Dissolving the outer membrane

113. Streptomycin and other aminoglycosides inhibit bacteria by binding the

A. 50S ribosomal subunit
B. Cell wall precursor lipid II
C. RNA polymerase
D. 30S ribosomal subunit

114. Ciprofloxacin and other fluoroquinolones act mainly by inhibiting

A. RNA polymerase
B. DNA gyrase and topoisomerase IV
C. Dihydropteroate synthase
D. Peptidoglycan transpeptidases

115. Methicillin resistance in Staphylococcus aureus is mainly due to

A. Efflux pumps that expel methicillin
B. Production of a thicker capsule
C. Loss of outer membrane porins
D. An altered penicillin-binding protein (PBP2a) encoded by mecA

116. What is the standard medium for Kirby-Bauer disk diffusion susceptibility testing of rapidly growing bacteria?

A. MacConkey agar
B. Sabouraud dextrose agar
C. TCBS agar
D. Mueller-Hinton agar

117. Drinking water is routinely tested for coliforms, especially Escherichia coli, because these bacteria

A. Are the only bacteria able to survive in treated water
B. Are the main cause of the chlorine demand of water
C. Signal fecal contamination and the possible presence of enteric pathogens
D. Cause all cases of waterborne viral hepatitis

118. Yogurt is traditionally made by fermenting milk with

A. Streptococcus thermophilus and Lactobacillus delbrueckii subsp. bulgaricus
B. Saccharomyces cerevisiae and Acetobacter aceti
C. Aspergillus oryzae alone
D. Clostridium butyricum

119. Nata de coco, a Philippine dessert, is the cellulose produced by which bacterium?

A. Lactobacillus plantarum
B. Saccharomyces cerevisiae
C. Aspergillus niger
D. Komagataeibacter xylinus (formerly Acetobacter xylinum)

120. In vinegar production, Acetobacter species convert

A. Ethanol to acetic acid
B. Glucose to ethanol
C. Lactose to lactic acid
D. Starch to glucose

Answer key

General Microbiology

1. D. A peptidoglycan cell wall

Peptidoglycan is unique to bacteria. Ribosomes, a plasma membrane and cytoplasm occur in both prokaryotes and eukaryotes.

2. D. Lipid A

Lipid A anchors LPS in the outer membrane and triggers fever and shock when released. The O-antigen mainly determines serotype.

3. D. Gram-positive cell walls

Teichoic and lipoteichoic acids are woven through the thick peptidoglycan layer of Gram-positive bacteria.

4. B. Mycoplasma

Mycoplasma has no cell wall and is stabilized by sterols in its membrane. This is why it is resistant to beta-lactam antibiotics.

5. B. Ether-linked isoprenoid chains

Archaeal membrane lipids join isoprenoid chains to glycerol through ether bonds. Bacteria and eukaryotes use ester-linked fatty acids.

6. A. A dehydrated core rich in calcium dipicolinate

Endospores have a very low water content and contain calcium dipicolinate, which together stabilize their proteins and DNA against heat.

7. A. 70S, made of 50S and 30S subunits

Prokaryotic ribosomes are 70S with 50S and 30S subunits. Svedberg units are not additive, so the subunit values do not sum to 70.

8. A. Lophotrichous

Lophotrichous means a cluster of flagella at one end. Peritrichous flagella cover the whole surface.

9. D. Small-subunit ribosomal RNA sequences

Woese compared 16S and 18S rRNA sequences, which revealed that Archaea form a group separate from Bacteria and Eukarya.

10. D. Staphylococci

Staphylo- refers to grape-like clusters. Streptococci form chains because they divide in one plane.

11. B. Help the bacterium resist phagocytosis

Capsules make it hard for phagocytes to engulf bacteria, so encapsulated strains such as Streptococcus pneumoniae are more virulent.

12. C. Attaching the cell to surfaces and host tissues

Fimbriae are adhesins that let bacteria stick to host cells and surfaces. Flagella, not fimbriae, provide swimming motility.

13. A. Between the cytoplasmic membrane and the outer membrane

The periplasm lies between the inner (cytoplasmic) membrane and the outer membrane and holds the thin peptidoglycan layer and many enzymes.

14. A. Mycolic acids

Waxy mycolic acids hold carbolfuchsin so tightly that acid-alcohol cannot remove it.

15. D. Gram's iodine

Iodine forms a complex with crystal violet that is trapped in thick peptidoglycan. Crystal violet is the primary stain, alcohol the decolorizer and safranin the counterstain.

16. A. Log (exponential) phase

In the log phase cells divide at a steady rate, so cell number doubles every generation time.

17. D. 6,400

Two hours equal six generations, so 100 x 2^6 = 6,400 cells.

18. A. Psychrophile

Psychrophiles have low optimum and maximum temperatures. Mesophiles grow best near 20 to 45 °C.

19. C. Superoxide dismutase and catalase

Superoxide dismutase and catalase remove superoxide and hydrogen peroxide. Without them, toxic oxygen products build up.

20. A. 2 ATP

Glycolysis makes 4 ATP but uses 2, so the net gain is 2 ATP per glucose.

21. A. Molecular oxygen

Aerobic respiration uses O2 as the terminal acceptor, which is reduced to water. Nitrate is used in some anaerobic respiration.

22. A. Regenerate NAD+ so that glycolysis can continue

Fermentation reoxidizes NADH to NAD+ by passing electrons to an organic molecule. This keeps glycolysis running, and glycolysis is the cell's ATP source.

23. D. Chemolithoautotroph

It gets energy from chemicals (chemo-), electrons from an inorganic compound (litho-) and carbon from CO2 (autotroph).

24. C. Halophiles

Halophiles need high NaCl. Extreme halophiles such as Halobacterium need near-saturated brine.

25. B. Viable plate count

Only cells that can multiply form colonies. Direct counts and turbidity include dead cells as well.

26. C. Selective for Gram-negative bacteria and differential for lactose fermentation

Bile salts and crystal violet suppress Gram-positives. Lactose fermenters turn pink because acid changes the color of neutral red.

27. D. An enriched medium

Chocolate agar supplies extra nutrients for fastidious organisms such as Haemophilus and Neisseria but has no selective agents.

28. A. Cytoplasmic (plasma) membrane

Bacteria have no mitochondria, so their respiratory chain is in the cytoplasmic membrane.

29. B. Nitrogenase

Nitrogenase fixes N2 into NH3. It is highly sensitive to O2, so nitrogen fixers have ways to protect it.

30. C. Facultative anaerobe

Facultative anaerobes grow with or without oxygen but grow best where oxygen is available. Obligate aerobes grow only at the top, and obligate anaerobes only at the bottom.

31. B. Transformation

Transformation is the uptake of naked DNA, first shown in Griffith's pneumococcus experiments.

32. C. A bacteriophage that mistakenly packages host DNA

In generalized transduction a phage packages random pieces of host DNA and carries them into the next cell it infects.

33. A. Is integrated into the bacterial chromosome

In Hfr cells the F plasmid is inserted into the chromosome, so chromosomal genes can be transferred at high frequency during conjugation.

34. D. Binding the repressor so it can no longer bind the operator

Allolactose changes the shape of the lac repressor, which releases the operator so RNA polymerase can transcribe the genes.

35. D. Reversion of histidine-requiring Salmonella mutants to histidine independence

More revertant colonies on histidine-free medium means the chemical causes mutations. Liver enzymes are often added to imitate how the body metabolizes the chemical.

36. A. Frameshift mutation

Removing one base shifts the reading frame for every codon after the deletion, which usually ruins the protein.

37. B. Nonsense mutation

A nonsense mutation creates a premature stop codon, so the protein is cut short.

38. C. Destroying foreign DNA such as that of infecting phages

Restriction enzymes cut foreign DNA at specific sites. The cell protects its own DNA by methylating those sites.

39. B. Thermus aquaticus

Taq polymerase comes from the thermophile Thermus aquaticus and survives the repeated denaturation steps near 95 °C.

40. B. Covalent dimers between adjacent pyrimidines such as thymine

UV light links adjacent thymines (or cytosines) into dimers that distort the helix and block replication.

41. A. Bidirectionally from a single origin

Most bacterial chromosomes have one origin (oriC), and two replication forks move in opposite directions from it.

42. D. Transposable elements

Transposable elements, or jumping genes, can move antibiotic resistance genes between plasmids and chromosomes.

43. B. Semiconservative

After one generation in light nitrogen, all DNA had intermediate density. Each new double helix keeps one parent strand.

44. D. Identifying auxotrophic mutants that fail to grow on minimal medium

Colonies are copied onto complete and minimal media. Colonies missing from the minimal plate are auxotrophs.

45. B. Ribosome-binding site just upstream of the start codon

The Shine-Dalgarno sequence pairs with 16S rRNA, which places the ribosome at the AUG start codon.

46. B. Coagulase test

S. aureus is coagulase positive. Most other staphylococci are coagulase negative. All staphylococci are catalase positive.

47. D. Staphylococcus epidermidis

Bubbling means a positive catalase test. Staphylococci are catalase positive, while streptococci and enterococci are catalase negative.

48. C. Streptococcus pyogenes

Bacitracin susceptibility is a classic presumptive test for group A streptococci (S. pyogenes). S. agalactiae (group B) is usually resistant.

49. B. Streptococcus pneumoniae

Optochin susceptibility and bile solubility separate S. pneumoniae from viridans streptococci, which are also alpha-hemolytic.

50. A. Neisseria

Neisseria species, including N. gonorrhoeae and N. meningitidis, are oxidase-positive Gram-negative diplococci.

51. C. Escherichia coli

E. coli ferments lactose and forms pink colonies. Salmonella, Shigella and Proteus usually form colorless colonies.

52. D. Salmonella

Black centers mean H2S production by a non-lactose fermenter, which is typical of most Salmonella. Shigella forms green colonies without black centers.

53. C. Proteus mirabilis

Proteus is highly motile and swarms across agar in concentric waves.

54. D. Pseudomonas aeruginosa

P. aeruginosa is a non-fermenting, oxidase-positive rod that makes pyocyanin and has a fruity odor. It is a common cause of burn wound infections.

55. A. Blocking release of inhibitory neurotransmitters in the central nervous system

Tetanospasmin blocks the release of glycine and GABA from inhibitory neurons, so muscles contract without control. The other options describe botulinum, diphtheria and cholera toxins.

56. A. Clostridium botulinum

C. botulinum spores survive poor canning and germinate in the airless jar. The toxin they make blocks acetylcholine release, which causes flaccid paralysis.

57. C. Ziehl-Neelsen acid-fast stain

M. tuberculosis stains poorly with the Gram stain. It keeps carbolfuchsin after acid-alcohol and appears as red acid-fast bacilli.

58. D. Mycobacterium leprae

M. leprae cannot be cultured in vitro. It is grown in mouse footpads or armadillos. The other species grow on media such as Lowenstein-Jensen.

59. D. Vibrio cholerae

V. cholerae ferments sucrose, which turns its colonies yellow on TCBS. Its toxin causes massive watery diarrhea. V. parahaemolyticus forms green colonies.

60. B. Leptospira interrogans

Leptospirosis is spread through water or soil contaminated by the urine of infected animals, especially rats, and enters through skin cuts or mucous membranes.

61. D. Dark-field microscopy

T. pallidum is too thin to see with ordinary stains. Dark-field microscopy shows the motile spirochetes shining against a dark background.

62. D. Helicobacter pylori

H. pylori makes large amounts of urease, which raises the pH of the test medium. It is linked to gastritis and peptic ulcers.

63. B. Listeria monocytogenes

Listeria grows in the cold and shows tumbling motility at room temperature. It can cross the placenta and cause miscarriage or newborn infection.

64. C. + + - -

E. coli is indole and methyl red positive and VP and citrate negative. Klebsiella pneumoniae typically shows the reverse pattern, - - + +.

65. C. Blood

Bacteremia is present early in typhoid, so blood culture gives the best yield in week one. Stool and urine cultures become positive later.

66. C. A genome of either DNA or RNA, but not both

Viruses carry only one type of nucleic acid as their genome. They rely on host ribosomes and host energy.

67. B. Capsomeres

Capsomeres are the building blocks of the capsid. A virion is the complete virus particle.

68. C. Budding through a host cell membrane

As enveloped viruses bud out, they wrap themselves in host membrane that contains viral glycoproteins.

69. D. Prophage

A prophage is copied along with the host chromosome until it is induced to enter the lytic cycle.

70. B. Reverse transcriptase

Reverse transcriptase is an RNA-dependent DNA polymerase. Integrase then inserts the DNA copy into the host genome.

71. D. CD4

HIV gp120 binds CD4 on helper T cells, macrophages and dendritic cells, using CCR5 or CXCR4 as a co-receptor.

72. B. One infectious virus particle

Each plaque starts from a single infectious particle, so results are reported as plaque-forming units (PFU).

73. B. Aedes aegypti mosquitoes

Aedes aegypti, a day-biting mosquito, is the main dengue vector in the Philippines. Aedes albopictus is a secondary vector.

74. C. HBsAg

Hepatitis B surface antigen means virus is present, in either acute or chronic infection. Anti-HBs means immunity.

75. A. Hepatitis A virus

HAV spreads through contaminated food and water. HBV, HCV and HDV spread mainly through blood and body fluids.

76. A. Rabies virus

Rabies virus is a bullet-shaped rhabdovirus. Negri bodies are its classic inclusions. Prompt wound washing and post-exposure prophylaxis prevent disease.

77. B. Reassortment of genome segments between different strains

Influenza A has a segmented genome. When two strains infect the same cell, segments can mix and produce a new subtype. Point mutations cause antigenic drift.

78. A. Lack nucleic acid and consist of misfolded protein

Prions are misfolded proteins that cause normal proteins to misfold too. They are unusually resistant to standard sterilization.

79. C. Cytopathic effects

Cytopathic effects are the cell damage caused by viral replication. They help identify viruses grown in cell culture.

80. B. Measles

Koplik spots appear before the measles rash and are a classic early sign of the disease.

81. C. Ergosterol

Azoles block ergosterol synthesis, and polyenes such as amphotericin B bind ergosterol. Human membranes use cholesterol instead.

82. B. Chitin

Fungal cell walls are made largely of chitin and glucans. Peptidoglycan, LPS and teichoic acid are bacterial components.

83. B. Molds at 25 °C and yeasts at 37 °C

These fungi grow as molds in the environment and switch to the yeast form at body temperature.

84. D. Candida albicans

The germ tube test is a quick way to identify C. albicans among yeasts.

85. D. Cryptococcus neoformans

The thick capsule of C. neoformans appears as a clear halo against the dark India ink. It causes meningitis, especially in people with AIDS.

86. C. Dermatophytes such as Trichophyton and Microsporum

Despite the name, ringworm is a fungal infection. Dermatophytes break down keratin in skin, hair and nails.

87. A. Dissolves keratin and host cells so fungal elements are easier to see

KOH clears keratin and host debris, so hyphae and yeast cells stand out under the microscope.

88. C. Aspergillus flavus

Aspergillus flavus and A. parasiticus produce aflatoxins on grains and nuts stored in warm, humid conditions.

89. B. Plasmodium falciparum

Banana-shaped gametocytes are a classic diagnostic feature of P. falciparum, the species that causes the most severe malaria.

90. A. The female Anopheles mosquito

Gametes fuse in the mosquito gut, so Anopheles is the definitive host. Humans host only the asexual stages.

91. A. A freshwater snail, Oncomelania hupensis quadrasi

Free-swimming forms leave Oncomelania snails and penetrate human skin in infested water. Freshwater crabs are hosts of Paragonimus, a different fluke.

92. B. Giardia duodenalis (G. lamblia)

Giardia trophozoites attach to the small intestine with a sucking disk and interfere with fat absorption.

93. C. Entamoeba histolytica

Swallowing red cells shows that E. histolytica invades tissue. Entamoeba coli is a harmless commensal.

94. C. Enterobius vermicularis

Female pinworms lay eggs on the perianal skin at night, so eggs are collected on tape rather than found in stool.

95. B. Swallowing eggs of Taenia solium

Ingested T. solium eggs hatch, and the larvae spread to tissues such as muscle and brain to form cysticerci. Eating cysts in pork causes the adult tapeworm infection instead.

96. A. IgM

IgM appears first after a new exposure. Its pentameric form makes it effective at agglutination and complement activation.

97. A. IgG

IgG is actively transported across the placenta and gives the newborn passive immunity.

98. A. IgA

Secretory IgA is a dimer with a secretory component that protects mucosal surfaces.

99. C. Breaking bonds in the peptidoglycan backbone

Lysozyme cuts the bonds between NAM and NAG in peptidoglycan, which weakens the wall, especially in Gram-positive bacteria.

100. A. Neutrophils

Neutrophils are the most numerous white blood cells and are the first cells recruited in acute inflammation.

101. A. Artificially acquired active immunity

A vaccine prompts the person's own immune system to respond (active) through deliberate exposure (artificial).

102. C. MHC class I molecules, using CD8

CD8+ cytotoxic T cells recognize peptides on MHC class I, which almost all nucleated cells display, and kill infected cells.

103. C. C5b through C9

C5b, C6, C7, C8 and several C9 molecules form a pore that lyses target cells. C3a and C5a are anaphylatoxins.

104. C. IgE bound to mast cells (type I)

In type I hypersensitivity, an allergen cross-links IgE on mast cells and basophils, which then release histamine and other mediators.

105. B. Inducing an antiviral state in neighboring cells

Virus-infected cells release interferons, which make nearby cells produce proteins that block viral replication.

106. C. 121 °C at about 15 psi for at least 15 minutes

Pressurized steam at 121 °C kills endospores in about 15 minutes. Larger loads need more time.

107. B. Spores of Geobacillus stearothermophilus (formerly Bacillus stearothermophilus)

G. stearothermophilus spores are highly resistant to moist heat. If they are killed, the cycle is considered effective.

108. C. 72 °C for 15 seconds

HTST holds milk at about 72 °C for 15 seconds. This kills pathogens such as Mycobacterium bovis and Coxiella but does not sterilize the milk.

109. D. Membrane filtration through 0.22 µm pores

A 0.22 µm filter physically removes bacteria without heat, so heat-labile ingredients are not damaged.

110. D. Sterilization

Only sterilization removes or kills all microbes, including endospores. Disinfection and antisepsis reduce pathogens but may leave spores.

111. B. The water present helps alcohol penetrate cells and denature proteins

Water is needed for alcohol to denature proteins efficiently. Absolute ethanol also evaporates very quickly. Neither concentration reliably kills spores.

112. C. Inhibiting the cross-linking (transpeptidation) of peptidoglycan

Beta-lactams bind penicillin-binding proteins (transpeptidases), which leaves the cell wall weak and the cell bursts.

113. D. 30S ribosomal subunit

Aminoglycosides bind the 30S subunit and cause misreading of mRNA. Macrolides and chloramphenicol act on the 50S subunit.

114. B. DNA gyrase and topoisomerase IV

Fluoroquinolones block the topoisomerases that bacteria need to replicate DNA. Rifampin targets RNA polymerase, and sulfonamides target dihydropteroate synthase.

115. D. An altered penicillin-binding protein (PBP2a) encoded by mecA

PBP2a binds beta-lactams poorly, so cell wall synthesis continues. S. aureus is Gram-positive and has no outer membrane.

116. D. Mueller-Hinton agar

Mueller-Hinton agar is standardized for disk diffusion. It allows drugs to diffuse evenly and contains few inhibitors of common antibiotics.

117. C. Signal fecal contamination and the possible presence of enteric pathogens

Coliforms are plentiful in feces and easy to detect, so finding them shows that pathogens from sewage may also be present.

118. A. Streptococcus thermophilus and Lactobacillus delbrueckii subsp. bulgaricus

These two lactic acid bacteria acidify the milk and help each other grow. The acid makes milk proteins coagulate.

119. D. Komagataeibacter xylinus (formerly Acetobacter xylinum)

This acetic acid bacterium forms a thick mat of pure cellulose on coconut water, which is cut into nata de coco.

120. A. Ethanol to acetic acid

Acetic acid bacteria oxidize the ethanol from an earlier yeast fermentation into acetic acid, as in traditional sukang Iloko and coconut vinegar.

Topics to review

- Microbial cell structure, growth and genetics
- Bacteriology, virology, mycology and parasitology
- Immunology and host defense
- Control of microorganisms and applied microbiology

Online question banks and study resources

Microbiology - OpenStax (Open textbook)

Independent study material prepared by Board Exam Desk.