

General Bacteriology

INTRODUCTION TO MICROBIOLOGY

Q. 1. Which of the following organisms **does not** meet all the criteria of Koch's postulates?

- (a) *Streptococcus pneumoniae*
- (b) *Treponema pallidum*
- (c) *Leptospira interrogans*
- (d) *Mycobacterium scrofulaceum*

Ans. (b) *Treponema pallidum*, the causative agent of syphilis, cannot be grown in culture media, while *Streptococcus pneumoniae*, *Leptospira interrogans* and *Mycobacterium scrofulaceum* can be easily grown in culture media. All these four organisms (a to d) produce disease in suitable laboratory animals.

Q. 2. The construction and use of the compound microscope is attributed to:

- (a) Antonie van Leeuwenhoek
- (b) Louis Pasteur
- (c) Robert Koch
- (d) Ferdinand Cohn

Ans. (a) Antonie van Leeuwenhoek was expert in grinding simple magnifying lenses. He constructed many 'microscopes' each containing a single lens ground by himself.

Q. 3. The techniques of sterilization were introduced by:

- (a) Louis Pasteur
- (b) Robert Koch
- (c) Ferdinand Cohn
- (d) John Needham

Ans. (a) Louis Pasteur invented autoclave, hot air oven and steam sterilizer, basic tools in any microbiology laboratory.

Q. 4. The foundations of immunochemistry were laid down by:

- (a) Edward Jenner
- (b) Alexander Fleming
- (c) Gerhard Domagk
- (d) Karl Landsteiner

Ans. (d) Karl Landsteiner discovered blood groups and laid down the foundations of immunochemistry.

Q. 5. Salvarsan was discovered by:

- (a) Karl Landsteiner (b) Paul Ehrlich
- (c) Gerhardt Domagk (d) Howard Florey

Ans. (b) Salvarsan, an arsenical compound, sometimes called magic bullet, was discovered by Paul Ehrlich in 1909.

Q. 6. Robert Koch substituted agar in place of gelatin as solidifying agent for culture media at the suggestion of:

- (a) Pfeiffer (b) Kitasato
- (c) Loeffler (d) Anglina Hesse

Ans. (d) At the suggestion of Anglina Hesse, the American wife of his assistant, Robert Koch substituted agar in place of gelatin as solidifying agent for culture media.

Q. 7. Bacillus of tuberculosis was discovered by:

- (a) Hansen (b) Loeffler
- (c) Robert Koch (d) Bruce

Ans. (c) Bacillus of tuberculosis (*Mycobacterium tuberculosis*) was discovered by Robert Koch in 1882.

Q. 8. Following statement is true about which of the following scientists?

He was originally trained as a chemist, but his studies on fermentation led him to take interest in microorganisms. His discoveries revolutionized medical practice, although he never studied medicine.

- (a) Robert Koch
- (b) Louis Pasteur
- (c) Antonie van Leeuwenhoek
- (d) Edward Jenner

Ans. (b) Louis Pasteur was originally trained as a chemist, but his studies on fermentation led him to take interest in microorganisms.

Q. 9. The term microbiology, as the study of living organisms of microscopic size, was coined by:

- (a) Antonie van Leeuwenhoek
- (b) Robert Koch
- (c) Louis Pasteur
- (d) Edward Jenner

Ans. (c) The term microbiology, as the study of living organisms of microscopic size, was coined by Louis Pasteur.

Q. 10. The term vaccine was coined by:

- (a) Edward Jenner
- (b) Kitasato
- (c) Ehrlich
- (d) Louis Pasteur

Ans. (d) Louis Pasteur coined the term vaccine.

Q. 11. Rabies vaccine was developed for the first time in 1885 by:

- (a) Louis Pasteur
- (b) Semple
- (c) Edward Jenner
- (d) Paul Ehrlich

Ans. (a) The crowning achievement of Louis Pasteur was the successful application of principle of vaccination to the prevention of rabies, or hydrophobia, in human beings and developed Pasteur rabies vaccine.

Q. 12. Who discovered *Mycobacterium tuberculosis* and *Vibrio cholerae*?

- (a) Loeffler
- (b) Welch
- (c) Pfeiffer
- (d) Robert Koch

Ans. (d) Robert Koch discovered *Mycobacterium tuberculosis* in 1882 and *Vibrio cholerae* in 1883.

Q. 13. Who introduced the method of vaccination to prevent smallpox?

- (a) Louis Pasteur
- (b) Edward Jenner
- (c) Paul Ehrlich
- (d) John Hunter

Ans. (b) Method of vaccination to prevent smallpox was introduced by Edward Jenner. In 1997, World Health Organization masterminded a final global plan to eradicate smallpox. Success was announced in 1980 with the declaration: Smallpox is dead. Thanks to Jenner.

Q. 14. Which of the following scientists proposed side chain theory of antibody production in 1898?

- (a) Paul Ehrlich
- (b) Elie Metchnikoff
- (c) John Hunter
- (d) Edward Jenner

Ans. (a) Paul Ehrlich proposed side chain theory of antibody production in 1898.

Q. 15. Living organisms including bacteria and protozoa were first observed by:

- (a) Louis Pasteur
- (b) Robert Koch
- (c) Antonie van Leeuwenhoek
- (d) Christian Gram

Ans. (c) Antonie van Leeuwenhoek observed, drew and measured a large number of living organisms including bacteria and protozoa in rainwater, pond as well as well water, and saliva and the intestinal contents of healthy subjects and communicated them to Royal Society of London in 1683.

Q. 16. Who is known as father of antiseptic surgery?

- (a) Alexander Fleming
- (b) Joseph Lister
- (c) Charles Nicolle
- (d) Christian Gram

Ans. (b) Joseph Lister introduced antiseptics in surgery. By spraying carbolic acid on surgical instruments, wounds and dressings, he reduced surgical mortality due to bacterial infections considerably. He established the guiding principle of antiseptics for good surgical practice. For this work, he is known as Father of Antiseptic Surgery.

Q. 17. Attenuated vaccine was first developed by:

- (a) Louis Pasteur
- (b) Robert Koch
- (c) Landsteiner
- (d) Ehrlich

Ans. (a) Louis Pasteur developed live attenuated anthrax vaccine in 1881.

Q. 18. The event that triggered the development and establishment of microbiology as a science is the:

- (a) Vaccinations
- (b) Spontaneous generation
- (c) Use of disinfectants
- (d) Development of the microscope

Ans. (d) The development of microscope in 1683 by Antonie van Leeuwenhoek triggered the development and establishment of microbiology as a science.

Q. 19. Which of the following pioneers of microbiology is credited with the discovery of microorganisms using high-quality magnifying lenses (early microscopes)?

- (a) Robert Koch
- (b) Louis Pasteur
- (c) Antonie van Leeuwenhoek
- (d) Hooke

Ans. (c) Refer to Q. No. 2 above.

Q. 20. Which of the following is not a condition of Koch's postulates?

- (a) Isolate the causative agent of a disease
- (b) Cultivate the microbe in the laboratory
- (c) Inoculate a test animal to observe the disease
- (d) Produce a vaccine

Ans. (d) Production of vaccine is not one of the criteria of Koch's postulates while the criteria at (a), (b) and (c) are three of the four criteria of Koch's postulates. The fourth criterion is—re-isolate the microorganism in pure culture from the lesions produced in the experimental animal.

Q. 21. Which of the following microorganisms meets the criteria of Koch's postulates?

- (a) *Treponema pallidum*
- (b) *Mycobacterium leprae*
- (c) *Neisseria gonorrhoeae*
- (d) *Staphylococcus aureus*

Ans. (d) *Treponema pallidum* and *Mycobacterium leprae*, causative agents of syphilis and leprosy, respectively, cannot be grown in culture media, however, they produce disease in suitable laboratory animals. In case of *Neisseria gonorrhoeae*, which causes gonorrhoea, there is no animal model even though the bacteria can readily be grown in culture media. *Staphylococcus aureus* can be easily grown in culture media and causes disease by inoculation of suitable laboratory animals (mice and rabbits). Hence, the correct answer is (d).

MORPHOLOGY OF BACTERIA

Q. 1. Which of the following bacteria is cell wall-deficient?

- (a) *Mycoplasma*
- (b) *Treponema*
- (c) *Staphylococcus*
- (d) *Klebsiella*

Ans. (a) *Treponema*, *Staphylococcus* and *Klebsiella* possess well-developed cell wall. *Mycoplasma* is cell wall-deficient bacterium.

Q. 2. Chinese letter arrangement is characteristic of:

- (a) *Mycobacterium tuberculosis*
- (b) *Bacillus anthracis*
- (c) *Corynebacterium diphtheriae*
- (d) *Clostridium tetani*

Ans. (c) In *Corynebacterium diphtheriae* there occurs incomplete separation of the daughter cells after binary fission. The bacilli remain attached to each other at various angles, resembling the letters V or L. This is called Chinese letter arrangement and is characteristic of *Corynebacterium diphtheriae*.

Q. 3. Peptidoglycan is major constituent of cell wall of:

- (a) Gram-positive bacteria
- (b) Gram-negative bacteria
- (c) Fungi
- (d) Protozoa

Ans. (a) Peptidoglycan constitutes 50–90% of the dry weight of the cell wall of Gram-positive bacteria, while it constitutes only 5–10% of the dry weight of the cell wall of Gram-negative bacteria. Peptidoglycan is absent in fungi and protozoa.

Q. 4. Lipopolysaccharide is a constituent of cell wall in:

- (a) Gram-positive bacteria
- (b) Gram-negative bacteria
- (c) Fungi
- (d) Protozoa

Ans. (b) Lipopolysaccharide is unique to Gram-negative bacteria. It is firmly bound to the cell surface and is released only when the cells are lysed. It is, therefore, known as endotoxin.

Q. 5. Sterols are present in the cytoplasmic membrane of:

- (a) *Mycoplasma*
- (b) *Bacillus*
- (c) *Clostridium*
- (d) *Proteus*

Ans. (a) With the exception of *Mycoplasma*, bacterial cytoplasmic membrane lacks sterol.

Q. 6. Mesosomes of bacteria are analogous to:

- (a) Mitochondria of eukaryotes
- (b) Lysosomes of eukaryotes
- (c) Golgi apparatus of eukaryotes
- (d) Nucleolus of eukaryotes

Ans. (a) Mesosomes are analogous to mitochondria of eukaryotes and are more prominent in Gram-positive bacteria.

Q. 7. When flagella are distributed all round the bacterial cell, the arrangement is known as:

- (a) Monotrichous
- (b) Lophotrichous

(c) Amphitrichous

(d) Peritrichous

Ans. (d) The distribution of bacterial flagella all round the cell is known as peritrichous arrangement. Organisms with monotrichous arrangement have a single polar flagellum. Those with lophotrichous arrangement have a tuft of flagella at one pole, and those with amphitrichous arrangement have single polar flagellum or tuft of flagella at both poles.

Q. 8. Ultraviolet light is used in:

(a) Fluorescence microscope

(b) Dark ground microscope

(c) Phase contrast microscope

(d) Interference microscope

Ans. (a) Ultraviolet light is used in fluorescence microscope. In dark ground, phase contrast and interference microscopes visible light is used.

Q. 9. *N*-acetylglucosamine and *N*-acetylmuramic acid are found in:

(a) Cell membrane

(b) Cell wall

(c) Outer membrane

(d) Capsule

Ans. (b) *N*-acetylglucosamine and *N*-acetylmuramic acid are found in peptidoglycan layer of cell wall of bacteria. Peptidoglycan is not found in cell membrane, outer membrane and capsule.

Q. 10. Teichoic acid is present in:

(a) Gram-negative organisms

(b) Gram-positive organisms

(c) *Mycoplasma*

(d) *Rickettsia*

Ans. (b) Membrane teichoic acid and cell wall teichoic acid are present in the cell wall of Gram-positive organisms and not in the cell wall of Gram-negative organisms, *Mycoplasma* and *Rickettsia*.

Q. 11. Cell wall-deficient forms of Gram-positive bacteria are called:

(a) Spheroplasts

(b) Trophozoites

(c) Cysts

(d) Protoplasts

Ans. (d) Cell wall of a Gram-positive bacterium is removed when it is treated with lysozyme. Cell wall-deficient forms of Gram-positive bacteria are called protoplasts.

Q. 12. Sedimentation coefficient of bacterial ribosomes is:

- (a) 50S
- (b) 60S
- (c) 70S
- (d) 80S

Ans. (c) Bacteria have 70S ribosomes, whereas mammalian cells have 80S ribosomes.

Q. 13. Bacterial structure/s concerned with respiration is/are:

- (a) Mesosomes
- (b) Ribosomes
- (c) Mitochondria
- (d) Golgi apparatus

Ans. (a) Mesosomes develop by invagination of cytoplasmic membrane into the cytoplasm. They provide increased membrane surface and are principal sites of respiratory enzymes in bacteria.

Q. 14. Which of the following bacteria has peritrichous flagella?

- (a) *Vibrio cholerae*
- (b) *Proteus*
- (c) *Pseudomonas*
- (d) *Shigella*

Ans. (b) *Proteus* has peritrichous flagella. *Vibrio cholerae* has a single polar flagellum, *Pseudomonas* has one or more polar or subpolar flagella. *Shigella* does not possess flagella.

Q. 15. Which of the following bacteria has single polar flagellum?

- (a) *Vibrio*
- (b) *Salmonella*
- (c) *Proteus*
- (d) *Citrobacter*

Ans. (a) *Vibrio* has a single polar flagellum while *Salmonella*, *Proteus* and *Citrobacter* have peritrichous flagella.

Q. 16. Which of the following bacterial structures is/are involved in attachment to cell surface?

- (a) Flagella
- (b) Fimbriae
- (c) Capsule
- (d) Mesosomes

Ans. (b) Fimbriae are the organelles of adhesion (attachment), flagella are organelles of locomotion (motility), capsule protects the bacteria from antibacterial agents and inhibits phagocytosis. For mesosomes refer to Q. No. 13 above.

Q. 17. Which of the following are eukaryotes?

- (a) Fungi
- (b) Bacteria
- (c) Chlamydiae
- (d) Mycoplasmas

Ans. (a) Fungi are eukaryotes, and bacteria, chlamydiae and mycoplasmas are prokaryotes.

Q. 18. Which of the following structures is found in Gram-negative and not in Gram-positive bacteria?

- (a) Capsule
- (b) Cytoplasmic membrane
- (c) Spores
- (d) Outer membrane

Ans. (d) Outer membrane is present in Gram-negative bacteria and not in Gram-positive bacteria. Capsule and cytoplasmic membrane are present in both Gram-positive and Gram-negative bacteria. Spores are formed by some species of Gram-positive bacteria only.

Q. 19. Which of the following structures are found in Gram-positive and not in Gram-negative bacteria?

- (a) Capsule
- (b) Cytoplasmic membrane
- (c) Spores
- (d) Outer membrane

Ans. (c) Spores develop in Gram-positive but not in Gram-negative bacteria. Capsule may be present in both Gram-positive and Gram-negative bacteria. Cytoplasmic membrane and peptidoglycan are present in both Gram-positive and Gram-negative bacteria.

Q. 20. Which of the following is a distinctive component of the cell wall of Gram-negative bacteria?

- (a) Capsule
- (b) Lipopolysaccharide
- (c) Peptidoglycan
- (d) Cytoplasmic membrane

Ans. (b) Lipopolysaccharide is a distinctive component of the cell wall of Gram-negative bacteria. Capsule, peptidoglycan and cytoplasmic membrane occur in both Gram-positive and Gram-negative bacteria.

Q. 21. When determining distances and sizes, the smallest unit of measurement is:

- (a) Centimetre
- (b) Millimetre
- (c) Micrometre
- (d) Nanometre

Ans. (d) Nanometre, a billionth part of a metre (m) or a thousandth part of a micrometre (μm), is the smallest unit of measurement.

Q. 22. What function does a condenser serve in light microscope?

- (a) Focuses the light onto our eyes.
- (b) Focuses the light rays on the sample.
- (c) Increases light intensity.
- (d) Reduces glare.

Ans. (b) Condenser of a light microscope, focuses the light rays on the sample.

Q. 23. Bacterial capsules are generally viewed by:

- (a) Albert staining
- (b) Ziehl-Neelsen staining
- (c) Negative staining
- (d) All of the above

Ans. (c) Bacterial capsules are generally viewed by negative staining. They cannot be stained by Albert stain and Ziehl-Neelsen stain.

Q. 24. Which of the following is likely to contain a structure composed of *N*-acetylglucosamine and *N*-acetyl-muramic acid?

- (a) Protoplasts
- (b) Spheroplasts.
- (c) Mycoplasmas
- (d) *Escherichia coli*

Ans. (d) *N*-acetylglucosamine and *N*-acetylmuramic acid are constituents of peptidoglycan. The latter is present in *Escherichia coli* and not in protoplasts, spheroplasts and mycoplasmas.

Q. 25. Fimbriae present on the outer surface of bacteria are used for:

- (a) Inhibition of phagocytosis
- (b) Bacterial motility
- (c) Adherence to surfaces
- (d) Antibiotic resistance

Ans. (c) Fimbriae are the organelles of adhesion. They are not organelles of bacterial motility and antibiotic resistance, and they do not inhibit phagocytosis.

Q. 26. The diameter of the smallest body that can be resolved and seen clearly with naked eye can be:

- (a) 100 μm
- (b) 200 μm
- (c) 300 μm
- (d) 500 μm

Ans. (b) The diameter of the smallest body that can be resolved and seen clearly is 200 μm .

Q. 27. The best resolution that can be obtained with electron microscope is:

- (a) 0.1–0.2 nm
- (b) 0.3–0.5 nm
- (c) 0.6–0.7 nm
- (d) 0.8–0.9 nm

Ans. (b) In practice, the best resolution that can be obtained with electron microscope is 0.3–0.5 nm.

Q. 28. Which of the following statements is **not** correct about dark-ground microscope?

- (a) This microscope renders visible delicate organisms.
- (b) The resolving power of this microscope is significantly improved.
- (c) With this microscope internal structure of the organisms can be easily studied.
- (d) The organisms appear brightly illuminated against a dark background.

Ans. (c) With dark-ground microscope, light passes around rather than through the organisms, making it difficult to study their internal structure.

GROWTH AND NUTRITION OF BACTERIA

Q. 1. Generation time of *Escherichia coli* is:

- (a) 20 seconds
- (b) 20 minutes
- (c) 14–15 hours
- (d) 12–13 days

Ans. (b) The generation time of *Escherichia coli* is about 20 minutes, in tubercle bacilli it is about 14–15 hours and in lepra bacilli it is about 12–13 days.

Q. 2. The period between inoculation of bacteria in a culture medium and beginning of multiplication is known as:

- (a) Lag phase
- (b) Log phase
- (c) Stationary phase
- (d) Decline phase

Ans. (a) The period between inoculation of bacteria in a culture medium and beginning of multiplication is known as lag phase.

Q. 3. Peptone water and nutrient broth are:

- (a) Basal media
- (b) Enriched media
- (c) Selective media
- (d) Enrichment media

Ans. (a) Peptone water and nutrient broth are basal media.

Q. 4. When a substance is added to a solid medium which inhibits the growth of unwanted bacteria but permits the growth of wanted bacteria, it is known as:

- (a) Selective medium
- (b) Enrichment medium
- (c) Enriched medium
- (d) Differential medium

Ans. (a) All selective media are solid media. These inhibit the growth of unwanted bacteria but permit the growth of wanted bacteria.

Q. 5. When a substance is added to a liquid medium which inhibits the growth of unwanted bacteria and favours the growth of wanted bacteria, it is known as:

- (a) Selective medium
- (b) Enrichment medium
- (c) Enriched medium
- (d) Differential medium

Ans. (b) All enrichment media are liquid media. These inhibit the growth of unwanted bacteria and favour the growth of wanted bacteria.

Q. 6. MacConkey medium is an example of:

- (a) Transport medium
- (b) Differential medium
- (c) Enrichment medium
- (d) Enriched medium

Ans. (b) MacConkey medium is a differential medium because on this medium lactose fermenting organisms form red colonies.

Q. 7. Stuart's transport medium is used for transport of specimen containing:

- (a) *Salmonella*
- (b) *Vibrio cholerae*
- (c) *Neisseria gonorrhoeae*
- (d) *Shigella*

Ans. (c) Stuart's transport medium is used for transport of *Neisseria gonorrhoeae*. Buffered 30% glycerol saline is used for transport of *Salmonella* and *Shigella*. Venkatraman-Ramakrishnan medium is used for transport of *Vibrio cholerae*.

Q. 8. Bacteria whose optimum temperature for growth is 37°C are known as:

- (a) Mesophiles
- (b) Psychrophiles
- (c) Thermophiles
- (d) None of the above

Ans. (a) Bacteria whose optimum temperature for growth is 37°C are known as mesophiles. Bacteria with optimum temperature of 20°C and 55–80°C are known as psychrophiles and thermophiles, respectively.

Q. 9. Which of the following bacteria dies quickly after drying?

- (a) *Mycobacterium tuberculosis*
- (b) *Staphylococcus aureus*
- (c) *Pseudomonas aeruginosa*
- (d) *Treponema pallidum*

Ans. (d) *Treponema pallidum* is a delicate organism. It dies quickly after drying. *Mycobacterium tuberculosis*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* are hardier organisms.

Q. 10. Which of the following bacteria can grow in alkaline pH?

- (a) *Lactobacilli*
- (b) *Vibrio cholerae*
- (c) *Salmonella*
- (d) *Shigella*

Ans. (b)

Q. 11. Which of the following bacteria can grow in acidic pH?

- (a) *Lactobacilli*
- (b) *Vibrio cholerae*
- (c) *Salmonella*
- (d) *Shigella*

Ans. (a) *Vibrio cholerae* can grow at alkaline pH (optimum pH 8.2). *Lactobacilli* grow best at acidic pH (pH 6). Optimum pH for growth of *Salmonella* and *Shigella* is 7.4.

Q. 12. All bacteria that inhabit the human body are:

- (a) Autotrophs
- (b) Heterotrophs
- (c) Phototrophs
- (d) Chemolithotrophs

Ans. (b) All bacteria that inhabit the human body are unable to synthesize their own metabolites. They depend upon preformed organic compounds from the host and are known as heterotrophs. Autotrophs can utilize very simple inorganic compounds. They can obtain energy either photosynthetically (phototrophs) or by oxidation of inorganic compounds (chemolithotrophs).

Q. 13. Which of the following is **not** a differential medium?

- (a) Christensen's medium
- (b) MacConkey medium
- (c) Blood tellurite agar
- (d) Mueller-Hinton agar

Ans. (d) Christensen's medium, MacConkey medium and blood tellurite agar are differential media, whereas Mueller-Hinton agar is not.

Q. 14. Chocolate agar is an example of which of the following?

- (a) Basal media
- (b) Selective media
- (c) Differential media
- (d) Enriched media

Ans. (d) Chocolate agar is an enriched medium, whereas basal media, selective media and differential media are not.

Q. 15. Log or exponential phase of bacterial growth is of limited duration because of:

- (a) Exhaustion of nutrients
- (b) Accumulation of toxic metabolic end-products
- (c) Change in pH
- (d) All of the above

Ans. (d) Log or exponential phase of bacterial growth is of limited duration because of factors (a), (b) and (c). Hence the correct answer is (d).

IDENTIFICATION OF BACTERIA AND TAXONOMY

Q. 1. Which of the following organisms is **not** acid-fast?

- (a) Tubercle bacilli
- (b) Lepra bacilli
- (c) *Nocardia*
- (d) *Corynebacterium diphtheriae*

Ans. (d) Tubercle bacilli, lepra bacilli and *Nocardia* are acid-fast bacteria, whereas *Corynebacterium diphtheriae* is not.

Q. 2. Which of the following organisms is Gram-negative?

- (a) *Clostridium*
- (b) *Bacillus*
- (c) *Actinomyces*
- (d) *Bacteroides*

Ans. (d) *Clostridium*, *Bacillus* and *Actinomyces* are Gram-positive, whereas *Bacteroides* is Gram-negative.

Q. 3. *Nocardia* resists decolourization with:

- (a) 1% sulphuric acid
- (b) 5% sulphuric acid
- (c) 20% sulphuric acid
- (d) 30% sulphuric acid

Ans. (a) *Nocardia* resists decolourization with 1% sulphuric acid. Tubercle bacilli and lepra bacilli resist decolourization with 20% and 5% sulphuric acid, respectively.

Q. 4. Silver impregnation method is used for demonstration of:

- (a) *Treponema pallidum*
- (b) *Vibrios*
- (c) *Shigella*
- (d) *Salmonella*

Ans. (a) The width of *Treponema pallidum* in dried state is 0.13 μm . With light microscope only those organisms which are at least 0.2 μm wide can be seen. Therefore, to be visible it needs to be thickened by silver impregnation method. The width of vibrios, *Shigella* and *Salmonella* is enough to be seen under microscope.

Q. 5. Which test detects the production of sufficient acid by fermentation of glucose so that pH of the medium falls below 4.5?

- (a) Methyl red test (b) Voges-Proskauer test
(c) Indole test (d) Citrate utilization test

Ans. (a) Methyl red test detects the production of sufficient acid by fermentation of glucose so that pH of the medium falls and is maintained below 4.5.

Q. 6. Urease test is positive in:

- (a) *Klebsiella pneumoniae* (b) *Escherichia coli*
(c) *Salmonella* serotype Typhi (d) *Shigella flexneri*

Ans. (a) *Klebsiella pneumoniae* produces urease enzyme whereas *Escherichia coli* *Salmonella* serotype Typhi and *Shigella flexneri* do not.

Q. 7. Oxidase test is negative in:

- (a) *Neisseria* (b) *Pseudomonas*
(c) *Vibrio* (d) *Proteus*

Ans. (d) *Neisseria*, *Pseudomonas* and *Vibrio* produce oxidase, whereas *Proteus* does not.

Q. 8. Catalase production is negative in:

- (a) *Staphylococcus* (b) *Streptococcus*
(c) *Proteus* (d) *Salmonella*

Ans. (b) Catalase enzyme is produced by *Staphylococcus* and family Enterobacteriaceae. *Streptococcus* does not produce catalase. *Proteus* and *Salmonella* belong to the family Enterobacteriaceae.

Q. 9. Which of the following tests detects the production of acetoin?

- (a) Methyl red test (b) Voges-Proskauer test
(c) Indole test (d) Citrate test

Ans. (b) Acetoin production is detected by Voges-Proskauer test.

Q. 10. Phenylalanine deaminase test is negative in:

- (a) *Proteus* (b) *Morganella*
(c) *Providencia* (d) *Escherichia*

Ans. (d) *Proteus*, *Morganella* and *Providencia* produce phenylalanine deaminase enzyme, whereas *Escherichia* does not.

Q. 11. Capsules are generally viewed by:

- (a) Gram staining
- (b) Ziehl-Neelsen staining
- (c) Negative staining
- (d) All of the above

Ans. (c) Capsules are generally viewed by negative staining. These cannot be stained with Gram staining and Ziehl-Neelsen staining.

Q. 12. Which of the following is/are reason(s) to reject a specimen for culture?

- (a) The specimen is preserved in formalin.
- (b) The information on the requisition does not match with the information given on the specimen label.
- (c) A second stool sample is submitted from the same patient on the same day.
- (d) All of the above.

Ans. (d) Specimen preserved in formalin is non-viable. If the information on requisition and specimen label does not match, then the report of another patient may be given. Stool samples are recommended to be submitted on at least three consecutive days and not twice on the same day. Therefore, (d) is the correct answer.

Q. 13. Which of the following stains are used for identification of *Corynebacterium diphtheriae*?

- (a) Ziehl-Neelsen stain
- (b) Albert's stain
- (c) Silver impregnation method
- (d) Negative staining

Ans. (b) *Corynebacterium diphtheriae* can be stained with Albert's stain. Ziehl-Neelsen stain is used for staining tubercle bacilli. Thin bacteria may be rendered visible by light microscope by silver impregnation method which thickens the bacteria. In case of negative staining, encapsulated organisms like cryptococci are mixed with India ink or nigrosin that provides a uniform-coloured background, against which the unstained organisms can be seen. Capsules which do not take simple stains can be seen by negative staining.

STERILIZATION AND DISINFECTION

Q. 1. The process of freeing of an article from living organisms including bacterial and fungal spores and viruses is known as:

- (a) Sterilization
- (b) Disinfection
- (c) Antisepsis
- (d) All of the above

Ans. (a)

Q. 2. Destruction or inhibition of microorganisms in living tissues is known as:

- (a) Sterilization
- (b) Disinfection
- (c) Antisepsis
- (d) None of the above

Ans. (c)

Q. 3. Incineration is an efficient method for:

- (a) Destroying contaminated materials
- (b) Sterilizing points of forceps
- (c) Sterilizing scalpel blades and needles
- (d) Sterilizing all glass syringes

Ans. (a)

Q. 4. Red heat is used for sterilization of:

- (a) Inoculating wires and loops
- (b) All glass syringes
- (c) Soiled dressings
- (d) Glass slides

Ans. (a)

Q. 5. Heating in a hot air oven at 160°C for one hour is used for sterilization of:

- (a) All glass syringes
- (b) Oils and jellies
- (c) Swab sticks
- (d) All of the above

Ans. (d)

Q. 6. In holder method of pasteurization, milk is kept at:

- (a) 63°C for 30 minutes
- (b) 63°C for 60 minutes
- (c) 72°C for 20 seconds
- (d) 72°C for 30 seconds

Ans. (a)

Q. 7. Which of the following organisms can survive on pasteurization by holder method?

- (a) *Mycobacterium*
- (b) *Brucella*
- (c) *Salmonella*
- (d) *Coxiella burnetii*

Ans. (d)

Q. 8. Exposure of material to steam at 100°C for 20 minutes on three consecutive days is known as:

- (a) Tyndallization
- (b) Autoclaving
- (c) Inspissation
- (d) Pasteurization

Ans. (a)

Q. 9. Which of the following articles can be sterilized in an autoclave?

- (a) Dressing material
- (b) Gloves
- (c) Culture media
- (d) All of the above

Ans. (d)

Q. 10. Biological control used in an autoclave is the spores of:

- (a) *Bacillus stearothermophilus*
- (b) *Clostridium perfringens*
- (c) *Bacillus cereus*
- (d) *Clostridium histolyticum*

Ans. (a)

Q. 11. Which of the following organisms is retained in the fluids filtered by Seitz filter?

- (a) *Proteus*
- (b) *Staphylococcus*
- (c) *Clostridium*
- (d) None of the above

Ans. (d) Because of their large size, *Proteus*, *Staphylococcus* and *Clostridium* cannot pass through the Seitz filter. Therefore, the correct answer is (d).

Q. 12. Gamma rays can be used for sterilization of:

- (a) Plastic syringes
- (b) Catheters
- (c) Cannulas
- (d) All of the above

Ans. (d)

Q. 13. Phenol is bactericidal at a concentration of:

- (a) 0.1%
- (b) 0.25%
- (c) 0.5%
- (d) 1%

Ans. (d)

Q. 14. Iodophores are mixture of:

- (a) Iodine and surface active agents
- (b) Iodine and phenols
- (c) Iodine and aldehydes
- (d) Iodine and alcohols

Ans. (a)

Q. 15. Glutaraldehyde is useful for sterilization of:

- (a) Cystoscopes
- (b) Bronchoscopes
- (c) Thermometers
- (d) All of the above

Ans. (d)

Q. 16. Most important surface active disinfectants are:

- (a) Anionic compounds
- (b) Cationic compounds
- (c) Non-ionic compounds
- (d) Amphoteric compounds

Ans. (b)

Q. 17. Which of the following tests is designed to simulate the natural conditions under which the disinfectants are used in hospitals?

- (a) Minimum inhibitory concentration test
- (b) Phenol coefficient test
- (c) Capacity test
- (d) Presumptive coliform count

Ans. (c) In capacity test, the additions of inoculum are made in increments with or without organic matter. This simulates the natural conditions.

Q. 18. The hospital waste is to be collected in different coloured plastic bags. Which of the following bags contains cadmium and is not to be incinerated because it leads to toxic emissions?

- (a) Yellow
- (b) Red
- (c) Blue
- (d) Black

Ans. (b)

Q. 19. Infectious diseases transmitted by consumption of raw milk include all of the following, **except**:

- (a) Q fever
- (b) Brucellosis
- (c) Tuberculosis
- (d) Whooping cough

Ans. (d) The causative agents of Q fever, brucellosis and tuberculosis may be present in raw milk. On the other hand, causative agent of whooping cough, *Bordetella pertussis*, is not present in raw milk. It is acquired by droplet infection. Therefore, the correct answer is (d).

Q. 20. Heat-sensitive materials (rubber and plastic) and bulky materials (mattresses) can be sterilized by using:

- (a) Dry heat
- (b) Autoclaving
- (c) UV radiation
- (d) Ethylene oxide

Ans. (d) Ethylene oxide is useful for sterilization of articles liable to be damaged by heat, e.g. plastic and rubber articles.

Q. 21. Dry heat damages microbes by:

- (a) Destructive oxidation of essential cell constituents
- (b) Denaturing proteins
- (c) Denaturing nucleic acid
- (d) None of the above

Ans. (a)

Q. 22. How is a liquid sterilized without damaging heat-labile proteins in the solution?

- (a) By boiling
- (b) By autoclaving
- (c) By passing the liquid through 0.22 μm filter
- (d) By passing the liquid through 0.5 μm filter

Ans. (c)

Q. 23. Which of the following can destroy prions?

- (a) Exposure to formalin vapour
- (b) Treatment with sodium hydroxide and sodium hypochlorite
- (c) Irradiation
- (d) Boiling

Ans. (b)

Q. 24. Which of the following bacteria is used as control for ethylene oxide sterilization?

- (a) *Bacillus subtilis* subsp. *niger*
- (b) *Bacillus stercorophilus*
- (c) *Bacillus globigii*
- (d) *Bacillus pumilis*

Ans. (c)

Q. 25. Autoclave is ineffective for sterilization of:

- (a) Culture media
- (b) Dressing material
- (c) Gloves
- (d) Powders

Ans. (d) Hot air oven is used for sterilization of sealed materials such as powders, oils and jellies which are impervious to steam. Therefore, the correct answer is (d).

Q. 26. Which of the following disinfectants has little activity against viruses?

- (a) Phenol
- (b) Sodium hypochlorite
- (c) Iodine
- (d) Formaldehyde

Ans. (a)

Q. 27. Formaldehyde is **not active against:**

- (a) Vegetative bacteria
- (b) Bacterial spores
- (c) Viruses
- (d) Prions

Ans. (d)

Q. 28. Glutaraldehyde has high microbicidal activity against:

- (a) Bacteria and their spores
- (b) Mycelial and spore forms of fungi
- (c) Various types of viruses
- (d) All of the above

Ans. (d)

Q. 29. Alcohols are **not active against:**

- (a) Vegetative bacteria
- (b) Fungi
- (c) Lipid-containing viruses
- (d) Spores

Ans. (d)

Q. 30. Alcohols have excellent *in vitro* bactericidal activity against most vegetative Gram-positive and Gram-negative bacteria; however, they are:

- (a) Not fast acting
- (b) Not sporicidal
- (c) Not bactericidal
- (d) None of the above

Ans. (b)

Q. 31. What type of filter does a class II biologic safety cabinet use to filter out infectious agents?

- (a) Millipore filters
- (b) HEPA filters
- (c) Dust filters
- (d) Charcoal filters

Ans. (b) Large volumes of air may be rapidly freed from infection by passage through high efficient particulate air (HEPA) filters.

Q. 32. Which of the following characteristics should be considered when selecting an antimicrobial agent?

- (a) Spectrum of activity
- (b) Rate of action
- (c) Mechanism of action
- (d) All of the above

Ans. (d)

Q. 33. In which of the following situations hand hygiene is indicated?

- (a) Before touching a patient
- (b) Before aseptic procedure
- (c) After body fluid exposure
- (d) All of the above

Ans. (d) Hand hygiene is indicated in situations mentioned in (a), (b) and (c). These help in prevention of transmission of infection. Therefore, correct answer is (d).

Q. 34. What precautions should be taken while using the N95 mask?

- (a) Discard N95 mask when contaminated with blood, respiratory or nasal secretions, etc.
- (b) Consider use of a cleanable faceshield to reduce surface contamination.
- (c) Perform hand hygiene before and after touching or adjusting the N95 mask.
- (d) All of the above.

Ans. (d) Situations mentioned in (a), (b) and (c) help in prevention of transmission of infection. Therefore, correct answer is (d).

CHEMOTHERAPY

Q. 1. Penicillins and cephalosporins interfere with:

- (a) Cell wall synthesis
- (b) Cell membrane function
- (c) DNA function
- (d) Protein synthesis

Ans. (a)

Q. 2. Which of the following penicillins is resistant to β -lactamases?

- (a) Cloxacillin
- (b) Carbenicillin
- (c) Penicillin-G
- (d) Ampicillin

Ans. (a)

Q. 3. Which of the following penicillins is stable in gastric acid and suitable for oral administration?

- (a) Penicillin-G
- (b) Cloxacillin
- (c) Carbenicillin
- (d) Methicillin

Ans. (b)

Q. 4. Resistance to penicillin may be due to:

- (a) Production of β -lactamases by bacteria
- (b) Impermeability of cell envelope
- (c) Alteration or lack of penicillin-binding proteins
- (d) All of the above

Ans. (d)

Q. 5. Which of the following agents is a third generation cephalosporin?

- (a) Cephalexin
- (b) Cephalothin
- (c) Cefotaxime
- (d) Cefoxitin

Ans. (c)

Q. 6. Polymyxin B and amphotericin B interfere with:

- (a) Cell wall synthesis
- (b) Cell membrane function
- (c) DNA function
- (d) Protein synthesis

Ans. (b)

Q. 7. Ciprofloxacin and norfloxacin interfere with:

- (a) Cell wall synthesis
- (b) Cell membrane function
- (c) DNA function
- (d) Protein synthesis

Ans. (c)

Q. 8. Aminoglycosides interfere with:

- (a) Cell wall synthesis
- (b) Cell membrane function
- (c) DNA function
- (d) Protein synthesis

Ans. (d)

Q. 9. Which of the following compounds inhibits bacterial nucleic acid synthesis?

- (a) Ampicillin
- (b) Trimethoprim
- (c) Ciprofloxacin
- (d) Rifampicin

Ans. (b)

Q. 10. Resistance against which of the following drugs may be plasmid-mediated?

- (a) Methicillin
- (b) Rifampicin
- (c) Nalidixic acid
- (d) Ampicillin

Ans. (d)

Q. 11. Resistance against which of the following drugs involves modification of the drug by enzymatic modification or degradation of its active element?

- (a) Penicillins
- (b) Chloramphenicol
- (c) Aminoglycosides
- (d) All of the above

Ans. (d)

Q. 12. Following antibiotics inhibit cell wall synthesis, except:

- (a) Methicillin
- (b) Clindamycin
- (c) Nafcillin
- (d) Oxacillin

Ans. (b) Clindamycin inhibits protein synthesis while methicillin, nafcillin and oxacillin inhibit cell wall synthesis. Therefore, the correct answer is (b).

Q. 13. Infections with β -lactamase-producing *Staphylococcus aureus* can be treated with all of the following antibiotics **except** for which of the following?

- (a) Cephalothin
- (b) Vancomycin
- (c) Ampicillin/sulbactam
- (d) Piperacillin

Ans. (d) Piperacillin is inactivated by β -lactamase produced by *Staphylococcus aureus*. Therefore, infections with β -lactamase-producing *S. aureus* can be treated with cephalothin, vancomycin and ampicillin/sulbactam and not with piperacillin.

Q. 14. Which of the following antibiotics affords a broad-spectrum of antimicrobial coverage against aerobic and anaerobic bacteria, rickettsiae, chlamydiae and mycoplasmas?

- (a) Vancomycin
- (b) Metronidazole
- (c) Tetracycline
- (d) Gentamicin

Ans. (c)

Q. 15. Which of the following antimicrobial agents does not have good activity against Enterobacteriaceae?

- (a) Clindamycin
- (b) Trimethoprim-sulphamethoxazole
- (c) Cefoxitin
- (d) Ciprofloxacin

Ans. (a)

Q. 16. Which of the following antimicrobial agents is not generally clinically useful for *Pseudomonas aeruginosa* infections?

- (a) Ceftazidime
- (b) Piperacillin
- (c) Aminoglycosides
- (d) Trimethoprim-sulphamethoxazole

Ans. (d)

Q. 17. Bacitracin acts on:

- (a) Cell wall
- (b) Cell membrane
- (c) Nucleic acids
- (d) Ribosomes

Ans. (a)

Q. 18. All of the following drugs act on cell membrane, **except**:

- (a) Nystatin
- (b) Griseofulvin
- (c) Amphotericin B
- (d) Polymixin B

Ans. (b)

Q. 19. Bacteria can be killed by antimicrobial agents that:

- (a) Inhibit RNA polymerase
- (b) Inhibit cell wall synthesis
- (c) Inhibit protein synthesis
- (d) All of the above

Ans. (d)

Q. 20. Cephalosporins resemble which antibiotic in their mode of action and their structure?

- (a) Bacitracin
- (b) Penicillin
- (c) Tetracycline
- (d) Polymyxin B

Ans. (b) Penicillin resembles cephalosporins in its mode of action and structure.

Q. 21. An antibiotic that contains β -lactam ring in its structure is:

- (a) Bacitracin
- (b) Penicillin
- (c) Tetracycline
- (d) Polymyxin B

Ans. (b)

Q. 22. Aminoglycoside antibiotics inhibit bacteria by:

- (a) Inhibiting DNA replication
- (b) Disrupting cell membrane
- (c) Interfering cell wall synthesis
- (d) Inhibiting protein synthesis

Ans. (d)

Q. 23. The antibiotics with the widest spectrum of activity are:

- (a) Aminoglycosides
- (b) Cephalosporins
- (c) Polymyxins
- (d) Tetracyclines

Ans. (d)

Q. 24. Synergistic drug combinations are prescribed to treat bacterial infections. The purpose of such treatment is to:

- (a) Use lower doses of antibiotics
- (b) Prevent microorganisms from acquiring drug resistance
- (c) Reduce toxic side effects of the antibiotics
- (d) Reduce treatment time of the disease

Ans. (b)

Q. 25. An antibiotic that has a broad spectrum of activity but may cause aplastic anaemia is:

- (a) Streptomycin
- (b) Cephalosporin
- (c) Bacitracin
- (d) Chloramphenicol

Ans. (d)

Q. 26. Which of the following antibiotics blocks RNA transcription?

- (a) Streptomycin
- (b) Cephalosporin
- (c) Rifampicin
- (d) Bacitracin

Ans. (c)

Q. 27. The target for quinolones is:

- (a) RNA transcription
- (b) DNA transcription
- (c) Protein synthesis
- (d) Cell wall synthesis

Ans. (b)

Q. 28. The drug of choice for treating systemic fungal infection is:

- (a) Amphotericin B
- (b) Griseofulvin
- (c) Flucytosine
- (d) Nystatin

Ans. (a)

Q. 29. Amphotericin B inactivates fungi because it:

- (a) Attacks 30S ribosomes
- (b) Inhibits fungal DNA polymerase
- (c) Inhibits fungal cell wall synthesis
- (d) Binds to sterols in fungal cell membrane

Ans. (d)

Q. 30. An antiviral compound that prevents influenza virus from penetrating cells is:

- (a) Acyclovir
- (b) Amantadine
- (c) Ribavirin
- (d) Vidarabine

Ans. (b)

Q. 31. β -lactam antibiotics are inactive against:

- (a) *Mycoplasma*
- (b) Fungi
- (c) Protozoa
- (d) All of the above

Ans. (d) β -Lactam antibiotics inhibit bacterial cell wall synthesis. *Mycoplasma* is cell wall-deficient organism. Fungi and protozoa have cell walls different from that of bacteria. Therefore, β -lactam antibiotics are inactive against *Mycoplasma*, fungi and protozoa. Therefore, the correct answer is (d).

Q. 32. Which characteristic/s describe/s the origin of antibiotics?

- (a) They are natural molecules
- (b) They are synthetic molecules
- (c) They are semisynthetic molecules
- (d) All of the above

Ans. (d) Antibiotic is a substance produced by a microorganism or a similar substance produced wholly or partially by chemical synthesis. Therefore, the correct answer is (d).

Q. 33. Microorganisms can exhibit antibiotic resistance due to which of the following?

- (a) Intrinsic
- (b) Acquired
- (c) Both
- (d) Neither

Ans. (c) A microorganism may be intrinsically resistant to an antibiotic or may subsequently acquire antibiotic resistance. Therefore, the correct answer is (c).

BACTERIAL GENETICS

Q. 1. Which of the following is nonsense codon?

- (a) UAA
- (b) GGC
- (c) AAG
- (d) CGA

Ans. (a) Codon UAA, does not code for any amino acid and is known as nonsense codon. Therefore, the correct answer is (a).

Q. 2. Plasmids which **do not** possess information for self transfer to another cell are known as:

- (a) Conjugative plasmids
- (b) Cryptic plasmids
- (c) Non-conjugative plasmids
- (d) F plasmids

Ans. (c)

Q. 3. Which of the following properties may be plasmid-mediated?

- (a) Resistance to antibiotics
- (b) Production of enterotoxin
- (c) Fermentation of lactose
- (d) All of the above

Ans. (d)

Q. 4. Lactose fermentation requires which of the following enzymes?

- (a) β -Galactosidase
- (b) Galactoside permease
- (c) Transacetylase
- (d) All of the above

Ans. (d)

Q. 5. Genotypic variations are:

- (a) Stable
- (b) Not heritable
- (c) Temporary
- (d) Influenced by the environment

Ans. (a) Genotypic variations are stable, heritable and are not influenced by the environment. These are not temporary. Therefore, the correct answer is (a).

Q. 6. When mutations involve vital functions so that the mutants are nonviable, it is a:

- (a) Missense mutation
- (b) Nonsense mutation
- (c) Transversion
- (d) Lethal mutation

Ans. (d)

Q. 7. Acquisition of naked DNA by a bacterium from its environment and incorporation in its genome is known as:

- (a) Transformation
- (b) Transduction
- (c) Lysogenic conversion
- (d) Conjugation

Ans. (a)

Q. 8. Fertility factor possessing chromosomal genes is known as:

- (a) F factor
- (b) F' (F prime) factor
- (c) Hfr
- (d) R factor

Ans. (b) F plasmid may get integrated into the cell's chromosome. Such cells are known as Hfr cells. F plasmid may revert from Hfr state to free state. Sometimes, it may carry with it chromosomal genes from near the site of its attachment leaving a part of its own DNA. Such F factor possessing chromosomal genes is known as F' (F prime) factor.

Q. 9. Plasmids which possess both resistance transfer factor (RTF) and resistance (*r*) determinants are known as:

- (a) Conjugative plasmids
- (b) Non-conjugative plasmids
- (c) Nonself-transmissible plasmids
- (d) F plasmids

Ans. (a)

Q. 10. Drug resistance in tuberculosis is due to:

- (a) Mutation
- (b) Conjugation
- (c) Transduction
- (d) Transformation

Ans. (a)

Q. 11. Acquisition of penicillin resistance in staphylococci is due to:

- (a) Mutation
- (b) Conjugation
- (c) Transduction
- (d) Transformation

Ans. (c)

Q. 12. A segment of DNA with one or more genes in the centre and the two ends carrying inverted repeat sequences of nucleotides is known as:

- (a) Insertion sequence
- (b) Transposon
- (c) Plasmid
- (d) None of the above

Ans. (b)

Q. 13. Diagnostic DNA probes have been developed for:

- (a) Hepatitis B virus
- (b) Human immunodeficiency virus
- (c) *Mycobacterium tuberculosis*
- (d) All of the above

Ans. (d)

Q. 14. Polymerase chain reaction is used for the diagnosis of infection/s due to:

- (a) HIV-1 and HIV-2 viruses
- (b) Hepatitis B virus
- (c) *Mycoplasma pneumoniae*
- (d) All of the above

Ans. (d)

Q. 15. Transfer of genetic information from DNA to RNA is called:

- (a) Transduction
- (b) Transcription
- (c) Transformation
- (d) Recombination

Ans. (b)

Q. 16. Transmission of a piece of DNA from one bacterium to another by a bacteriophage is known as:

- (a) Transduction
- (b) Transformation
- (c) Conjugation
- (d) Translation

Ans. (a)

Q. 17. Which of the following processes is **not** involved in transfer of genetic material between bacteria?

- (a) Transformation
- (b) Transduction
- (c) Conjugation
- (d) Mutation

Ans. (d) Mutation is not due to transfer of DNA. It is due to addition, deletion or substitution of one or more bases of DNA.

Q. 18. Which of the following are referred to as 'jumping genes'?

- (a) Plasmids
- (b) Transposons
- (c) Bacteriophages
- (d) Operons

Ans. (b) Because of the ability of transposable elements to move from one plasmid to another or to a phage or to a bacterial chromosome, they (transposons) have assumed the popular name of 'jumping genes'.

Q. 19. What type of RNA is involved in protein synthesis?

- (a) Messenger RNA
- (b) Ribosomal RNA
- (c) Transfer RNA
- (d) All of the above

Ans. (d)

Q. 20. The process used in the laboratory to produce millions of copies of DNA is:

- (a) *In situ* polymerization
- (b) Polymerase chain reaction
- (c) Reverse transcription
- (d) Fluctuation test

Ans. (b)

Q. 21. Transfer of genetic material through direct contact between donor and recipient bacteria is called:

- (a) Transformation
- (b) Conjugation
- (c) Transduction
- (d) Sexduction

Ans. (b)

Q. 22. When a temperate phage incorporates its DNA into the host cell's genome, it is called a:

- (a) Lysophage
- (b) Lytic phage
- (c) Prophage
- (d) Coliphage

Ans. (c)

Q. 23. The first vaccine for human use produced using DNA technology was:

- (a) Polio vaccine
- (b) MMR vaccine
- (c) AIDS vaccine
- (d) Hepatitis B vaccine

Ans. (d)

Q. 24. Who is the father of genetics?

- (a) Gregor Mendel
- (b) Griffith
- (c) Hargobind Khurana
- (d) Jacob

Ans. (a)

Q. 25. The helical structure of DNA was discovered by:

- (a) James Watson and Francis Crick
- (b) Oswald Avery and Colin McLeod
- (c) Paul Ehrlich
- (d) Edward Tatum

Ans. (a)

BACTERIA IN HEALTH AND DISEASE

Q. 1. Tetanus is transmitted by:

- (a) Inoculation
- (b) Inhalation
- (c) Ingestion
- (d) Insect bite

Ans. (a) Spores of *Clostridium tetani* are present in the soil. These get inoculated into the host tissues following severe wounds leading to tetanus.

Q. 2. Exotoxins do not have which of the following characteristics?

- (a) They are produced extracellularly.
- (b) They are produced by both Gram-positive and Gram-negative bacteria.
- (c) Cannot be converted into toxoids.
- (d) They are heat-labile.

Ans. (c) Exotoxins are produced extracellularly by both Gram-positive and Gram-negative bacteria and are heat-labile. These can be converted into toxoids by treatment with formaldehyde. Toxoids lack toxicity but retain antigenicity inducing protective immunity when used as vaccines. Therefore, the correct answer is (c).

Q. 3. Which of the following bacteria is not invasive?

- (a) *Streptococcus pyogenes*
- (b) *Salmonella* serotype Typhi
- (c) *Vibrio cholerae*
- (d) *Neisseria meningitidis*

Ans. (c) *Vibrio cholerae* enters orally by the ingestion of faecally contaminated food or drink. They multiply in the small intestine and produce cholera enterotoxin which causes diarrhoea. They do not invade intestine. *Streptococcus pyogenes*, *Salmonella* serotype Typhi and *Neisseria meningitidis* are invasive.

Q. 4. Which of the following infections is acquired from animals?

- (a) Plague
- (b) Diphtheria
- (c) Meningococcal meningitis
- (d) Poliomyelitis

Ans. (a) Plague is a zoonosis. Rat flea transmits plague bacilli from diseased rat to man. Diphtheria and meningococcal meningitis are transmitted from person-to-person by droplet infection. Poliomyelitis is a water-borne infection.

Q. 5. Which of the following is not a congenital infection?

- (a) Toxoplasmosis
- (b) AIDS
- (c) Poliomyelitis
- (d) Cytomegalovirus infection

Ans. (c) Poliomyelitis is acquired by ingestion of faecally-contaminated food or drink. Toxoplasmosis, AIDS and cytomegalovirus infection may be acquired congenitally.

Q. 6. Japanese encephalitis is transmitted by:

- (a) *Anopheles* (b) *Culex*
- (c) *Aedes* (d) *Mansonia*

Ans. (b)

Q. 7. Which of the following bacteria is **not** capsulated?

- (a) *Haemophilus influenzae*
- (b) *Streptococcus pneumoniae*
- (c) *Neisseria meningitidis*
- (d) *Corynebacterium diphtheriae*

Ans. (d)

Q. 8. Which of the following bacteria **does not** produce enterotoxin?

- (a) *Vibrio cholerae*
- (b) *Escherichia coli*
- (c) *Bacillus cereus*
- (d) *Bacillus anthracis*

Ans. (d)

Q. 9. Which of the following infections is **not** spread by the respiratory route?

- (a) Common cold (b) Measles
- (c) Mumps (d) Hepatitis B

Ans. (d) Hepatitis B is acquired by parenteral, sexual and perinatal routes, and not by respiratory route. Common cold, measles and mumps are spread by the respiratory route.

Q. 10. A carrier who acquires the organisms from another carrier is known as:

- (a) A contact carrier
- (b) A paradoxical carrier
- (c) A convalescent carrier
- (d) A chronic carrier

Ans. (b)

Q. 11. Which of the following fungi forms part of the normal flora, but may cause disease also?

- (a) *Histoplasma* (b) *Blastomyces*
- (c) *Candida* (d) *Aspergillus*

Ans. (c) *Candida* is a human commensal. It resides primarily in gastrointestinal tract. It may cause endogenous infection.

Q. 12. Large number of bacteria forming normal flora are found:

- (a) In the mouth
- (b) On the skin
- (c) In the large intestine
- (d) In the nose

Ans. (c)

Q. 13. Majority of microorganisms on the surface of human skin are:

- (a) Gram-positive bacteria
- (b) Gram-negative bacteria
- (c) Endospore-forming bacteria
- (d) Coliform bacteria

Ans. (a)

Q. 14. Which of the following pathogens is/are transmitted by rat flea?

- (a) *Yersinia pestis*
- (b) *Rickettsia typhi*
- (c) *Hymenolepsis diminuta*
- (d) All of the above

Ans. (d)

Q. 15. Infectious agents can enter the body through which of the following routes?

- (a) Inhalation
- (b) Ingestion
- (c) Inoculation
- (d) All of the above

Ans. (d)

IMMUNITY

Q. 1. To which of the following diseases immunity is **not** long-lasting?

- (a) Diphtheria
- (b) Influenza
- (c) Whooping cough
- (d) Mumps

Ans. (b) In case of influenza, short-lived immunity is due to the ability of influenza virus to undergo antigenic variation, so that immunity following first infection is not effective against second infection due to an antigenically different virus.

Q. 2. Passive immunization is indicated in:

- (a) Tuberculosis
- (b) Enteric fever
- (c) Diphtheria
- (d) Rubella

Ans. (c)

Q. 3. Which of the following vaccines is live?

- (a) Salk
- (b) Sabin
- (c) TAB
- (d) Human diploid cell rabies vaccine

Ans. (b)

Q. 4. Which class of immunoglobulins can cross the placenta?

- (a) IgG
- (b) IgM
- (c) IgD
- (d) IgA

Ans. (a) IgG is the only class of immunoglobulins that can cross the placenta and is responsible for the protection of the infant during first few months of life. IgM, IgD, IgA and IgE cannot cross the placenta.

Q. 5. Lysozyme is present in:

- (a) Tears
- (b) CSF
- (c) Sweat
- (d) Urine

Ans. (a)

Q. 6. Large parasites such as helminths may be killed extracellularly by the action of:

- (a) Neutrophils
- (b) Eosinophils
- (c) Basophils
- (d) Monocytes

Ans. (b) Eosinophils are not efficient phagocytic cells. However, their granules possess molecules that are toxic to parasites. Large parasites such as helminths cannot be internalized. Therefore, they must be killed extracellularly.

Q. 7. Which of the following cells are implicated in immunity against cancers?

- (a) Natural killer cells
- (b) Neutrophils
- (c) Eosinophils
- (d) Platelets

Ans. (a) Natural killer cells are large lymphocytes containing azurophilic granules in the cytoplasm. They are implicated in immunity against cancers.

Q. 8. Clinical infection leads to:

- (a) Active natural immunity
- (b) Active artificial immunity
- (c) Passive natural immunity
- (d) Passive artificial immunity

Ans. (a)

Q. 9. Concomitant immunity is seen in:

- (a) Tuberculosis
- (b) Whooping cough
- (c) Enteric fever
- (d) Malaria

Ans. (d) In some infections like malaria and syphilis immunity lasts only till original infection remains active. This is known as concomitant immunity (previously called premunition or infection-immunity).

Q. 10. Which of the following characteristics is **not** associated with live vaccines?

- (a) Single dose is immunogenic
- (b) Dose is less
- (c) Strict conditions of storage are essential
- (d) Only humoral response is elicited

Ans. (d) Live vaccines elicit both cellular and humoral responses. Therefore, the correct answer is (d).

Q. 11. Phagocytes are potent non-specific host defences. Which of the following are the major phagocytic cells in the body?

- (a) B lymphocytes
- (b) T lymphocytes
- (c) Neutrophils
- (d) Basophils

Ans. (c)

Q. 12. Inflammation is influenced by histamine, which is released by:

- (a) Basophils
- (b) Eosinophils
- (c) Erythrocytes
- (d) Platelets

Ans. (a)

Q. 13. Which of the following microorganisms resist intracellular digestion and may actively multiply inside the phagocyte?

- (a) *Corynebacterium diphtheriae*
- (b) *Mycobacterium tuberculosis*
- (c) *Clostridium tetani*
- (d) *Staphylococcus aureus*

Ans. (b) Some microorganisms such as mycobacteria and brucellae resist intracellular digestion and may actively multiply inside the phagocyte. Therefore, the correct answer is (b).

Q. 14. The cells responsible for killing intracellular viruses are:

- (a) Natural killer cells
- (b) Eosinophils
- (c) Basophils
- (d) Platelets

Ans. (a) Residing in the peripheral lymphoid organs, natural killer cells recognize virus-infected cells, bind to them and subsequently lyse them.

Q. 15. Naturally acquired active immunity would be most likely acquired through which of the following processes?

- (a) Vaccination
- (b) Drinking colostrum
- (c) Injection of antiserum
- (d) Infection with disease-causing organism followed by recovery.

Ans. (d) Naturally acquired active immunity results from infection with disease-causing organism followed by recovery. It is the longest-lasting immunity to an infectious agent. Immunity acquired following vaccination is artificial active immunity and is of lower order than that acquired following subclinical or clinical infection. Immunity following drinking colostrum and administration of antiserum is natural passive immunity and artificial passive immunity, respectively.

Q. 16. Which of the following leads to longest-lasting immunity to an infectious agent?

- (a) Naturally acquired passive immunity
- (b) Artificially acquired passive immunity
- (c) Naturally acquired active immunity
- (d) None of the above

Ans. (c) Refer to Q. No. 15 above.

Q. 17. Immunity due to genetic and constitutional make-up of an individual is known as:

- (a) Innate immunity
- (b) Acquired immunity
- (c) Passive immunity
- (d) Active immunity

Ans. (a) In case of innate immunity, prior contact with microorganisms or their products is not essential.

ANTIGENS

Q. 1. The chemical nature of an antigen may be:

- (a) Protein
- (b) Polysaccharide
- (c) Lipid
- (d) All of the above

Ans. (d)

Q. 2. The example of a serological test based on heterophile antigens is:

- (a) Paul-Bunnell test
- (b) Widal test
- (c) VDRL test
- (d) Antistreptolysin O test

Ans. (a) In patients with infectious mononucleosis heterophile antibodies appear in the serum of the patient. These antibodies agglutinate sheep erythrocytes. This test is known as Paul-Bunnell test.

Q. 3. The determinants of antigenicity is/are:

- (a) Size of the antigen
- (b) Foreignness
- (c) Chemical nature
- (d) All of the above

Ans. (d)

Q. 4. Isoantigens are:

- (a) Antigens found in all members of a species
- (b) Antigens found in some members of a species
- (c) Antigens found in all members of different species
- (d) Antigens found in some members of different species

Ans. (b) Isoantigens are found in some but not all members of a species. On the basis of isoantigens, a species may be divided into different groups. The best example of isoantigens is human blood group antigens on the basis of which all humans can be divided into different groups—A, B, AB and O. Each of these groups may be further divided into Rh-positive or Rh-negative.

Q. 5. An antigen that occurs in various tissues of different species is referred to as:

- (a) Heterophile antigen
- (b) Isoantigen
- (c) Autoantigen
- (d) Hapten

Ans. (a) Same or closely-related antigens occurring in different biological species, classes and kingdoms are known as heterogenic or heterophile antigens.

ANTIBODIES

Q. 1. The function/s of Fc fragment of IgG is/are:

- (a) It binds complement.
- (b) It is related to passage of IgG across the placental barrier.
- (c) It determines catabolic rate.
- (d) All of the above.

Ans. (d)

Q. 2. Phylogenetically, the oldest immunoglobulin class is:

- (a) IgA
- (b) IgM
- (c) IgG
- (d) IgE

Ans. (b) Phylogenetically, IgM is the oldest immunoglobulin class. It is usually the first antibody to appear following stimulation by an antigen.

Q. 3. Most efficient complement fixing antibody class is:

- (a) IgG
- (b) IgE
- (c) IgM
- (d) IgA

Ans. (c) IgM is much more efficient than IgG in its ability to fix complement, promoting lysis and death of most Gram-negative bacteria. This greater activity is due to the fact that

complement may bind to several Fc regions of pentameric IgM simultaneously, thus initiating complement cascade and target lysis with a single molecule.

Q. 4. Type I hypersensitivity reaction is mediated by:

- (a) IgE (b) IgG (c) IgM (d) IgD

Ans. (a)

Q. 5. Which immunoglobulin class is heat-labile?

- (a) IgG (b) IgM (c) IgA (d) IgE

Ans. (d)

Q. 6. Which class of immunoglobulin can bind to mast cells and basophils?

- (a) IgA (b) IgM (c) IgD (d) IgE

Ans. (d)

Q. 7. IgG participates in which of the following reactions?

- (a) Complement fixation
(b) Precipitation
(c) Neutralization of toxins and viruses
(d) All of the above

Ans. (d)

Q. 8. First antibody to appear following stimulation by an antigen is:

- (a) IgM (b) IgG (c) IgA (d) IgE

Ans. (a)

Q. 9. Most abundant class of immunoglobulin in the body is:

- (a) IgG (b) IgM (c) IgD (d) IgE

Ans. (a)

Q. 10. J chain is present in:

- (a) IgG (b) IgM (c) IgD (d) IgE

Ans. (b)

Q. 11. J chain is present in:

- (a) secretory IgA
(b) IgM
(c) Both of the above
(d) None of the above

Ans. (c) There is an additional peptide chain called the joining (J) chain in IgM and secretory IgA. The J chain may be largely responsible for the polymerization process. Therefore, the correct answer is (c).

Q. 12. The earliest immunoglobulin to be synthesized by the foetus is:

- (a) IgA (b) IgD (c) IgG (d) IgM

Ans. (d)

Q. 13. Which of the following is a strong agglutinating antibody?

- (a) IgA (b) IgD (c) IgG (d) IgM

Ans. (d)

Q. 14. Isohaemagglutinins and antibodies to *Salmonella* serotype Typhi O antigen and Wasserman reaction antibodies in syphilis are usually:

- (a) IgA (b) IgD (c) IgG (d) IgM

Ans. (d)

Q. 15. IgM is the earliest class of immunoglobulin to be synthesized by foetus beginning by about:

- (a) 15 weeks of age (b) 20 weeks of age
(c) 25 weeks of age (d) 30 weeks of age

Ans. (b)

Q. 16. Which subclass of immunoglobulin G (IgG) does not cross the placental barrier?

- (a) IgG1 (b) IgG2 (c) IgG3 (d) IgG4

Ans. (b) There are four subclasses of human IgG (IgG1, IgG2, IgG3 and IgG4). Of the four subclasses, IgG2 does not cross the placenta.

Q. 17. Which subclass of immunoglobulin G (IgG) is the most effective in binding complement in classical pathway?

- (a) IgG1 (b) IgG2 (c) IgG3 (d) IgG4

Ans. (c)

THE COMPLEMENT SYSTEM

Q. 1. Classical pathway of the complement system is activated by:

- (a) IgG (b) IgM
(c) Both of the above (d) None of the above

Ans. (c)

Q. 2. Alternative pathway of the complement system is activated by:

- (a) Yeast cell walls
(b) Bacterial endotoxins
(c) Snake venom proteins
(d) All of the above

Ans. (d)

Q. 3. Number of proteins in the complement system is:

- (a) Five (b) Seven (c) Nine (d) Eleven

Ans. (d) Complement consists of nine different proteins denoted C1 to C9. The fraction C1 occurs in serum as calcium-dependent complex, which on chelation with EDTA yields three protein subunits called C1q, C1r and C1s. Thus, complement is made-up of 11 different proteins.

Q. 4. Complement participates in:

- (a) Type II hypersensitivity reactions
(b) Type III hypersensitivity reaction
(c) Both of the above
(d) None of the above

Ans. (c)

Q. 5. C1, C2 and C4 are components of:

- (a) Classical pathway of complement
(b) Alternative pathway of complement
(c) Both of the above
(d) None of the above

Ans. (a)

Q. 6. Chemical nature of components of the complement system is:

- (a) Lipid (b) Polysaccharide
(c) Protein (d) Nucleic acid

Ans. (c)

Q. 7. Factor B, factor D and properdin are components of:

- (a) Classical pathway of complement
(b) Alternative pathway of complement
(c) Both of the above
(d) None of the above

Ans. (b)

Q. 8. First component of complement which binds to Fc portion of antibody molecule is:

- (a) C1q (b) C1r (c) C1s (d) C2

Ans. (a)

Q. 9. Potent mediator/s of inflammation is/are:

- (a) C3a (b) C5a
(c) Both of the above (d) None of the above

Ans. (c)

Q. 10. Which type of bacteria are killed without lysis due to complement-mediated damage?

- (a) Gram-positive
- (b) Gram-negative
- (c) Both of the above
- (d) None of the above

Ans. (a)

Q. 11. Which of the following is C3 convertase of classical pathway of complement activation?

- (a) $\overline{C4b2a}$
- (b) $\overline{C3bBb}$
- (c) $\overline{C4b2a3b}$
- (d) $\overline{C3bBb3b}$

Ans. (a)

Q. 12. Which of the following is C3 convertase of alternative pathway of complement activation?

- (a) $\overline{C4b2a}$
- (b) $\overline{C3bBb}$
- (c) $\overline{C4b2a3b}$
- (d) $\overline{C3bBb3b}$

Ans. (b)

Q. 13. Which of the following is C5 convertase of classical pathway of complement activation?

- (a) $\overline{C4b2a}$
- (b) $\overline{C3bBb}$
- (c) $\overline{C4b2a3b}$
- (d) $\overline{C3bBb3b}$

Ans. (c)

Q. 14. Which of the following is C5 convertase of alternative pathway of complement activation?

- (a) $\overline{C4b2a}$
- (b) $\overline{C3bBb}$
- (c) $\overline{C4b2a3b}$
- (d) $\overline{C3bBb3b}$

Ans. (d)

Q. 15. A membrane attack complex that can lyse microorganisms is produced by components of:

- (a) Complement
- (b) Interferon alpha
- (c) Interferon gamma
- (d) Antibodies

Ans. (a)

Q. 16. Which complement component is involved in alternative pathway of complement activation?

- (a) C1
- (b) C2
- (c) C3
- (d) C4

Ans. (c) The activation of C3, without the prior participation of C1, C4 and C2, is known as alternative or properdin pathway of complement activation.

ANTIGEN–ANTIBODY REACTIONS

Q. 1. A large lattice is formed when:

- (a) Antigen is in excess
- (b) Antibody is in excess
- (c) Antigens and antibodies are in optimal proportion
- (d) All of the above

Ans. (c)

Q. 2. Precipitation reaction is relatively less sensitive for detection of:

- (a) Antibodies
- (b) Antigens
- (c) Antigen–antibody complexes
- (d) Complement

Ans. (a)

Q. 3. Ring test is used for:

- (a) Typing of streptococci and pneumococci
- (b) C-reactive protein test
- (c) Ascoli's thermoprecipitation test
- (d) All of the above

Ans. (d)

Q. 4. VDRL test is an example of:

- (a) Ring test
- (b) Slide flocculation test
- (c) Tube test
- (d) None of the above

Ans. (b)

Q. 5. Amount of various immunoglobulin classes can be measured by:

- (a) Single diffusion in one dimension
- (b) Double diffusion in one dimension
- (c) Single diffusion in two dimensions
- (d) Double diffusion in two dimensions

Ans. (c)

Q. 6. Counterimmunoelectrophoresis is used for detection of:

- (a) Hepatitis B surface antigen
- (b) Alpha-fetoprotein
- (c) Meningococcal antigen
- (d) All of the above

Ans. (d)

Q. 7. Agglutination reaction is more sensitive than precipitation for detection of:

- (a) Antigen
- (b) Antibody

- (c) Antigen–antibody complex
- (d) Complement

Ans. (b) Precipitation reaction is relatively less sensitive than agglutination reaction for detection of antibodies.

Q. 8. Slide agglutination reaction is useful for identification of culture/s of:

- (a) *Salmonella*
- (b) *Shigella*
- (c) *Vibrio cholerae*
- (d) All of the above

Ans. (d)

Q. 9. Incomplete antibodies may be detected by doing the test:

- (a) In hypertonic saline
- (b) In albumin saline
- (c) By the antiglobulin test
- (d) All of the above

Ans. (d)

Q. 10. Tube agglutination is employed for serological diagnosis of:

- (a) Enteric fever
- (b) Brucellosis
- (c) Typhus fever
- (d) All of the above

Ans. (d)

Q. 11. Anti-Rh antibodies are:

- (a) IgG type
- (b) IgD type
- (c) IgA type
- (d) IgE type

Ans. (a)

Q. 12. A precipitation reaction can be converted into agglutination reaction by coating soluble antigen onto:

- (a) RBCs
- (b) Latex particles
- (c) Bentonite particles
- (d) All of the above

Ans. (d)

Q. 13. Example/s of passive agglutination is/are:

- (a) RA factor test
- (b) C-reactive protein test
- (c) *Treponema pallidum* haemagglutination test
- (d) All of the above

Ans. (d)

Q. 14. Test employing complement is:

- (a) Widal test
- (b) VDRL test
- (c) *Treponema pallidum* immobilization test
- (d) None of the above

Ans. (c)

Q. 15. The test/s based on the principle of toxin neutralization is/ are:

- (a) Schick test
- (b) Nagler's reaction
- (c) Both of the above
- (d) None of the above

Ans. (c) Schick test is *in vivo* neutralization test and Nagler's reaction is *in vitro* neutralization test. Therefore, the correct answer is (c).

Q. 16. Supplemental test for the diagnosis of AIDS is:

- (a) Southern blot
- (b) Western blot
- (c) Northern blot
- (d) Eastern blot

Ans. (b) Western blot test detects anti-HIV antibodies. It is a supplemental test for the diagnosis of AIDS. It is not a confirmatory test because it detects anti-HIV antibodies and not HIV or its antigens.

Q. 17. ELISA kits are commercially available for detection of:

- (a) Anti-HIV antibodies
- (b) Hepatitis B surface antigen
- (c) Rotavirus
- (d) All of the above

Ans. (d)

Q. 18. Quelling reaction is used for typing of:

- (a) *Streptococcus pneumoniae*
- (b) *Klebsiella pneumoniae*
- (c) Both of the above
- (d) None of the above

Ans. (c) Both *Streptococcus pneumoniae* and *Klebsiella pneumoniae* are capsulated organisms. Treatment of these organisms with the specific antibodies causes a characteristic swelling of the capsule. It is known as Quelling reaction. Therefore, the correct answer is (c).

Q. 19. Widal test is an example of:

- (a) Agglutination test
- (b) Precipitation test
- (c) Flocculation test
- (d) Complement-fixation test

Ans. (a)

Q. 20. An agglutination reaction which makes use of *Staphylococcus aureus* bound IgG as a reagent, is known as:

- (a) Passive agglutination
- (b) Reversed passive agglutination

- (c) Coagglutination
- (d) Flocculation

Ans. (c) Most strains of *Staphylococcus aureus* (especially Cowan strain 1) possess protein A on their surface. Protein A binds IgG molecules, non-specifically, through Fc region leaving specific Fab sites free to combine with specific antigen. When suspension of such sensitized staphylococcal cells is treated with homologous (test) antigen, antigen combines with free Fab sites of IgG attached to staphylococcal cells leading to visible clumping of staphylococci. This is known as coagglutination.

Q. 21. Coombs' test is:

- (a) Complement fixation test
- (b) Antiglobulin test
- (c) Agglutination test
- (d) Precipitation test

Ans. (b)

Q. 22. Inactivation of a toxin by an antibody is known as:

- (a) Opsonization
- (b) Neutralization
- (c) Attenuation
- (d) Lyophilization

Ans. (b)

Q. 23. Which of the following is a flocculation reaction?

- (a) Widal test
- (b) Coagglutination reaction
- (c) VDRL test
- (d) C-reactive protein test

Ans. (c) When, instead of sedimenting, the precipitate remains suspended as floccules, the reaction is called flocculation reaction. VDRL test is flocculation reaction.

ARCHITECTURE OF THE IMMUNE SYSTEM

Q. 1. Primary lymphoid organ/s is/are:

- (a) Thymus
- (b) Bursa of Fabricius
- (c) Bone marrow
- (d) All of these

Ans. (d) Primary lymphoid organs create special immune system cells called lymphocytes.

Q. 2. Secondary lymphoid organ/s is/are:

- (a) Lymph nodes
- (b) Spleen
- (c) Mucosa-associated lymphoid tissue
- (d) All of the above

Ans. (d) In secondary lymphoid organs, the cells of the immune system do their actual job of fighting off germs and foreign substances.

Q. 3. Stem cells arise from:

- (a) Yolk sac
- (b) Foetal liver
- (c) Bone marrow
- (d) All of the above

Ans. (d) During embryonic development, blood cell precursors are found in foetal liver and in postnatal life, stem cells reside in bone marrow. In birds, stem cells arise from yolk sac.

Q. 4. Lymphoid follicles of lymph nodes are:

- (a) Bursa-dependent areas
- (b) Bursa-independent areas
- (c) Thymus-dependent areas
- (d) None of the above

Ans. (a) Lymphoid follicles of lymph nodes are bursa-dependent areas, while paracortex (paracortical area) which contains T lymphocytes constitutes thymus-dependent areas.

Q. 5. CD3 surface antigen is expressed only by:

- (a) T cells
- (b) B cells
- (c) monocytes
- (d) granulocytes

Ans. (a)

Q. 6. CD8 surface antigen is present in:

- (a) Helper T cells
- (b) Delayed-type-hypersensitivity T cells
- (c) Both of the above
- (d) None of the above

Ans. (b)

Q. 7. CD8 surface antigen is present in:

- (a) Suppressor T cells
- (b) Cytotoxic T cells
- (c) Both of the above
- (d) None of the above

Ans. (c)

Q. 8. EAC rosettes are formed by:

- (a) T cells
- (b) B cells
- (c) Monocytes
- (d) Granulocytes

Ans. (b) Receptors for C3 component of complement (CRs) are found on most B cells. Because of the presence of CRs on the surface of B cells they bind to sheep RBCs which have been coated with antibody and complement forming EAC (erythrocyte-antibody-complement) rosettes. Therefore, the correct answer is (b).

Q. 9. Blast transformation on treatment with bacterial endotoxins occurs in:

- (a) T cells
- (b) B cells
- (c) Monocytes
- (d) None of the above

Ans. (b) B cells undergo blast transformation on treatment with bacterial endotoxins.

Q. 10. Natural killer cells are involved in:

- (a) Allograft rejection
- (b) Tumour rejection
- (c) Non-specific killing of virus transformed target cells
- (d) All of the above

Ans. (d)

Q. 11. Which of the following immune cells/molecules are most effective in destroying intracellular pathogens?

- (a) Th cells
- (b) Tc cells
- (c) B cells
- (d) Antibodies

Ans. (b) Cytotoxic T (Tc) cells are involved in cell-mediated immune responses and lyse target cells by direct cell-cell contact.

Q. 12. B cells that produce and release large amounts of antibody are called:

- (a) Memory cells
- (b) Killer cells
- (c) Basophils
- (d) Plasma cells

Ans. (d) Upon contact with antigen, B lymphocytes differentiate into antibody-producing plasma cells. They release large amounts of antibody.

IMMUNE RESPONSE

Q. 1. CMI participates in:

- (a) Allograft rejection
- (b) Graft versus host reaction
- (c) Delayed hypersensitivity reaction
- (d) All of the above

Ans. (d)

Q. 2. Negative phase is observed in:

- (a) Primary humoral response
- (b) Secondary humoral response
- (c) Both of the above
- (d) None of the above

Ans. (b) If the same animal, after first injection of the antigen, is subsequently exposed to the same antigen, there occurs temporary fall in the level of antibodies due to combination of the antigen with pre-existing antibody.

Q. 3. Most widely accepted theory of antibody production is:

- (a) Direct template theory (b) Indirect template theory
- (c) Side chain theory (d) Clonal selection theory

Ans. (d)

Q. 4. The requirement/s for monoclonal antibody production is/are:

- (a) Mouse myeloma cells
- (b) Mouse splenic lymphocytes
- (c) Both of the above
- (d) None of the above

Ans. (c) Lymphocytes from the spleen of a mouse immunized with desired antigen are fused with mouse myeloma cell to produce hybrid cells (hybridoma). Among the two cell types chosen for fusion, one provides the hybrid immortality (myeloma cell) while the other (splenic lymphocyte) provides the antibody-producing capacity. Therefore, the correct choice is (c).

Q. 5. Immunosuppressive agent/s is/are:

- (a) Methotrexate (b) Cyclosporine
- (c) Anti-lymphocytic serum (d) All of the above

Ans. (d)

Q. 6. Delayed-type hypersensitivity cells secrete which of the following lymphokines?

- (a) Migration-inhibiting factor
- (b) Macrophage-activating factor
- (c) Macrophage-stimulating factor
- (d) All of the above

Ans. (d)

Q. 7. Interleukin-2 promotes:

- (a) B cell differentiation (b) Bone marrow stem cells
- (c) Maturation of eosinophils (d) Growth of fibroblasts

Ans. (a)

Q. 8. Interferon- γ is produced by following cells, except:

- (a) Td cells (b) Th cells
- (c) Macrophages (d) NK cells

Ans. (c)

Q. 9. Interleukin-1 promotes growth and expression of:

- (a) Fibroblasts
- (b) NK cells
- (c) B and T cells
- (d) All of these

Ans. (d)

Q. 10. CMI can be detected by which of the following methods?

- (a) Skin test for delayed hypersensitivity
- (b) Migration inhibition factor test
- (c) Target cell destruction
- (d) All of the above

Ans. (d)

Q. 11. Mechanism/s of induction of tolerance is/are:

- (a) Clonal deletion
- (b) Clonal anergy
- (c) Suppression
- (d) All of these

Ans. (d)

Q. 12. Fusion between a plasma cell and a tumour cell produces:

- (a) Hybridoma
- (b) Lymphoma
- (c) Myeloma
- (d) Natural killer cell

Ans. (a) Refer to Q. 4, above.

Q. 13. Monoclonal antibodies recognize a single:

- (a) Antigen
- (b) Epitope
- (c) Paratope
- (d) None of these

Ans. (b) A single antibody-forming cell or clone produces antibodies directed against specific epitope of the antigen. Therefore, monoclonal antibodies recognize a single epitope.

Q. 14. Which of the following antibodies would most likely be found in body secretions such as tears, milk, saliva and mucus?

- (a) IgA
- (b) IgG
- (c) IgD
- (d) IgM

Ans. (a) Secretory IgA is synthesized by plasma cells as a dimer containing four heavy chains, four light chains and one J chain. Therefore, the correct answer is (a).

IMMUNODEFICIENCY DISEASES

Q. 1. Thymic hypoplasia leads to:

- (a) Humoral immunodeficiency
- (b) Cellular immunodeficiency
- (c) Complement deficiency
- (d) All of the above

Ans. (b) Pleuripotent stem cells in the bone marrow give rise to precursor T cells, which migrate to the thymus for further development. Since T cells mediate cell-mediated immunity, thymic hypoplasia leads to cellular immunodeficiency.

Q. 2. Swiss-type agammaglobulinaemia is due to:

- (a) B cell defect
- (b) T cell defect
- (c) Both B and T cell defects
- (d) Complement deficiency

Ans. (c)

Q. 3. DiGeorge's syndrome is due to:

- (a) T cell defect
- (b) B cell defect
- (c) Both of the above
- (d) None of the above

Ans. (a)

Q. 4. Systemic lupus erythematosus is associated with deficiency of:

- (a) C1
- (b) C4
- (c) Both of the above
- (d) None of the above

Ans. (c) Systemic lupus erythematosus is associated with deficiency of C1 and C4. Therefore, the correct answer is (c).

Q. 5. Myeloperoxidase deficiency is a defect of:

- (a) B cells
- (b) T cells
- (c) Complement
- (d) Phagocytes

Ans. (d)

Q. 6. Polymorphonuclear leucocytes in patients with which condition possess large lysosomes?

- (a) Chediak-Higashi syndrome
- (b) Chronic granulomatous disease
- (c) Myeloperoxidase deficiency
- (d) Leucocyte G6PD deficiency

Ans. (a) Polymorphonuclear leucocytes in patients with Chediak-Higashi syndrome possess large (giant) lysosomes. These abnormal lysosomes do not fuse readily with cytoplasmic phagosome.

Q. 7. Immunodeficiency with elevated IgM results in:

- (a) Recurrent pyogenic infections
- (b) Autoimmune disorders
- (c) Both of the above
- (d) None of the above

Ans. (c)

Q. 8. Due to the deficiency of secretory IgA (sIgA), infections occur predominantly in:

- (a) Respiratory tract (b) Gastrointestinal tract
- (c) Urogenital tract (d) All of the above

Ans. (d) On mucous surfaces, sIgA forms an antibody paste and is believed to play an important role in local immunity against respiratory, gastrointestinal and urogenital tracts. Therefore, due to deficiency of sIgA, infections occur predominantly in these organs. Therefore, the correct answer is (d).

Q. 9. Chronic granulomatous disease is due to deficiency of:

- (a) NADPH oxidase (b) MPO
- (c) G6PD (d) None of the above

Ans. (a) Chronic granulomatous disease is a frequently fatal disorder in which there is a deficiency of NADPH oxidase.

Q. 10. The most common immunoglobulin deficiency is of:

- (a) IgA (b) IgD (c) IgE (d) IgM

Ans. (a) Absence or near absence of serum and secretory IgA is thought to be the most common well-defined immunodeficiency disorder.

HYPERSENSITIVITY

Q. 1. Anaphylactic reactions are mediated by which class of immunoglobulins?

- (a) IgE (b) IgM (c) IgA (d) IgD

Ans. (a) IgE immunoglobulins mediate anaphylactic reactions (type I hypersensitivity).

Q. 2. Pharmacologically, active agent/s released during anaphylactic reaction is/are:

- (a) Histamine
- (b) Bradykinin
- (c) Eosinophil chemotactic factor of anaphylaxis
- (d) All of the above

Ans. (d)

Q. 3. Wheal and flare response is a characteristic of:

- (a) Type I hypersensitivity reaction
- (b) Type II hypersensitivity reaction
- (c) Type III hypersensitivity reaction
- (d) Type IV hypersensitivity reaction

Ans. (a) Wheal and flare response is a characteristic of type I hypersensitivity. Type IV hypersensitivity leads to erythema due to increased blood flow to the damaged area and induration due to infiltration with a large number of mononuclear cells mainly T lymphocytes and about 10–20% macrophages.

Q. 4. Which of the following reactions is/are complement-dependent?

- (a) Type II hypersensitivity (b) Type III hypersensitivity
- (c) Both of the above (d) None of the above

Ans. (c)

Q. 5. Raised level of immune complexes can be demonstrated in:

- (a) Poststreptococcal glomerulonephritis
- (b) Lepromatous leprosy
- (c) Hepatitis B
- (d) All of the above

Ans. (d)

Q. 6. Delayed hypersensitivity reaction is mediated by:

- (a) T lymphocytes (b) B lymphocytes
- (c) Killer cells (d) Natural killer cells

Ans. (a) Delayed hypersensitivity is the outcome of cell-mediated immune reaction. It is mediated by sensitized T lymphocytes.

Q. 7. Thyroid hyperactivity in Graves' disease is due to:

- (a) Type I hypersensitivity reaction
- (b) Type II hypersensitivity reaction
- (c) Type III hypersensitivity reaction
- (d) Type V hypersensitivity reaction

Ans. (d) Thyroid hypersensitivity in Graves' disease is due to type V hypersensitivity reaction. This is an antibody-mediated hypersensitivity. Here, antibody (thyroid-stimulating antibody) reacts with hormone receptor and stimulates the cell, thus secreting thyroxine.

Q. 8. Schwartzman reaction is:

- (a) Antibody-mediated reaction
- (b) Cell-mediated reaction
- (c) Complement-dependent reaction
- (d) None of the above

Ans. (d)

Q. 9. Drug-induced immune haemolytic anaemia is due to:

- (a) Type I hypersensitivity reaction
- (b) Type II hypersensitivity reaction
- (c) Type III hypersensitivity reaction
- (d) Type IV hypersensitivity reaction

Ans. (b) Drugs such as antibiotic penicillin can bind to surface of red cells and form an antigenic complex with the surface of these cells. This can lead to production of complement-fixing antibodies to the drug. Reaction of this antibody with the RBC-bound drug activates the complement system resulting in RBC lysis and anaemia (type II hypersensitivity).

Q. 10. Allergic rhinitis is mediated by which class of antibody?

- (a) IgG
- (b) IgM
- (c) IgA
- (d) IgE

Ans. (d) Allergic rhinitis or hay fever affects the mucosal surfaces of upper respiratory tract. It is mediated by IgE antibody.

Q. 11. Erythema and induration are characteristic of:

- (a) Type I hypersensitivity reaction
- (b) Type III hypersensitivity reaction
- (c) Type IV hypersensitivity reaction
- (d) Type V hypersensitivity reaction

Ans. (c) Refer to Q. No. 3 above.

Q. 12. Schultz-Dale phenomenon is a type of:

- (a) Type I hypersensitivity
- (b) Type II hypersensitivity
- (c) Type III hypersensitivity
- (d) Type IV hypersensitivity

Ans. (a) Schultz-Dale phenomenon is anaphylaxis *in vitro* (type I hypersensitivity). It is mediated by IgE antibody.

Q. 13. Prausnitz-Kustner reaction is a type of:

- (a) Type I hypersensitivity
- (b) Type II hypersensitivity
- (c) Type III hypersensitivity
- (d) Type IV hypersensitivity

Ans. (a) Prausnitz-Kustner reaction is type I hypersensitivity. It can be demonstrated by injecting intracutaneously serum containing IgE antibodies from allergic person followed 24 hours later by intracutaneous injection of the allergen to which the allergic person is allergic. This leads to wheal and flare response.

Q. 14. Which hypersensitivity reaction is T cell-mediated?

- (a) Type I
- (b) Type II
- (c) Type III
- (d) Type IV

Ans. (d)

Q. 15. A positive tuberculin test is an example of:

- (a) Type I hypersensitivity
- (b) Type II hypersensitivity
- (c) Type III hypersensitivity
- (d) Type IV hypersensitivity

Ans. (d)

Q. 16. An example of type III immune complex disease is:

- (a) Contact dermatitis
- (b) Atopy
- (c) Serum sickness
- (d) Graft rejection

Ans. (c)

Q. 17. Pollen would most likely evoke which type of hypersensitivity response?

- (a) Type I
- (b) Type II
- (c) Type III
- (d) Type IV

Ans. (a)

Q. 18. Which subclass of immunoglobulin G (IgG) can bind to mast cells?

- (a) IgG1
- (b) IgG2
- (c) IgG3
- (d) IgG4

Ans. (d) IgE and IgG4 can bind to mast cells.

AUTOIMMUNITY

Q. 1. Overactivity of Th cells may lead to:

- (a) Optimal antibody response
- (b) Optimal cell-mediated response
- (c) Autoimmunity
- (d) Immunodeficiency

Ans. (c) Overactivity of helper T (Th) cells or decreased activity of suppressor T (Ts) cells causes abnormal immune responses as seen in autoimmunity. Diminished Th cell function or increased activity of Ts cell leads to immunodeficiency.

Q. 2. Which of the following is/are example/s of autoimmune disease/s?

- (a) Rheumatoid arthritis
- (b) Systemic lupus erythematosus
- (c) Polyarteritis nodosa
- (d) All of the above

Ans. (d)

Q. 3. Pathogenesis of rheumatic fever is due to immunological injury caused by:

- (a) Cross-reacting antigens
- (b) Neoantigens
- (c) Forbidden clones
- (d) Hidden antigens

Ans. (a) Cross-reacting antigens exist in some group A streptococci and the heart. In this case, antibodies synthesized in response to the streptococcal infection could react with antigens in the heart causing cellular destruction and permanent damage.

Q. 4. Lens antigens of the eye are:

- (a) Sequestered antigens
- (b) Cross-reacting antigens
- (c) Neoantigens
- (d) None of the above

Ans. (a) Lens protein is enclosed (sequestered) in its capsule and does not circulate in the blood. Therefore, immunological tolerance against this antigen does not develop during foetal life. When the lens protein antigen leaks out, following cataract surgery or injury to the eye, it leads to immune response and damage to the other eye (sympathetic ophthalmia).

Q. 5. Immunopathological lesions seen in ulcerative colitis are possibly due to:

- (a) Cross-reacting antigens
- (b) Neoantigens
- (c) Forbidden clones
- (d) Hidden antigens

Ans. (a) *Escherichia coli* O14 possesses cross-reacting antigen with human colon. It occurs as commensal in the intestine. Antibodies raised against this organism may damage human colon cells leading to ulcerative colitis.

HISTOCOMPATIBILITY SYSTEMS

Q. 1. Grafts between members of the same species but of different genetic constitution are known as:

- (a) Autografts
- (b) Isografts
- (c) Allografts
- (d) Xenografts

Ans. (c)

Q. 2. Application of a skin allograft for the second time from the same donor will result in:

- (a) First-set reaction
- (b) Second-set reaction
- (c) Both of the above
- (d) None of the above

Ans. (b) Application of a skin graft for the first time leads to first-set reaction and application of a skin graft from the same individual second time leads to second-set reaction.

Q. 3. Major histocompatibility complex in man is known as:

- (a) H-2 complex
- (b) HLA complex
- (c) Both of the above
- (d) None of the above

Ans. (b) Major histocompatibility complex (MHC) in mouse is referred to as H-2 complex, and the MHC in humans is known as human leucocyte antigen (HLA) complex.

Q. 4. Class I histocompatibility antigens are products of:

- (a) HLA-A locus
- (b) HLA-B locus
- (c) HLA-C locus
- (d) All of the above

Ans. (d)

Q. 5. Class II histocompatibility antigens are encoded by:

- (a) HLA-DP locus
- (b) HLA-DQ locus
- (c) HLA-DR locus
- (d) All of the above

Ans. (d)

Q. 6. Which of the following disease/s is/are associated with particular HLA antigens?

- (a) Graves' disease
- (b) Ankylosing spondylitis
- (c) Rheumatoid arthritis
- (d) All of the above

Ans. (d)

Q. 7. The first line of defence against many tumours is:

- (a) Natural killer cells
- (b) Polymorphs
- (c) Monocytes
- (d) None of the above

Ans. (a) Natural killer cells are capable of non-specific killing of virus-transformed target cells and are involved in allograft and tumour rejection.

Q. 8. Example/s of immunomodulator/s is/are:

- (a) *Mycobacterium bovis* cell wall
- (b) *Corynebacterium parvum* cell wall
- (c) Interferon
- (d) All of the above

Ans. (d)

Q. 9. A transplant between individuals of different animal species is known as:

- (a) Xenograft
- (b) Isograft
- (c) Homograft
- (d) Allograft

Ans. (a) • **Autograft:** Graft from one part of the body to another in the same individual.
• **Isograft:** Graft between genetically identical individuals (twins).
• **Allograft:** Graft between members of the same species but of different genetic constitution.
• **Xenograft:** Grafts between members of different species.

IMMUNOHAEMATOLOGY

Q. 1. An individual with blood group A possesses:

- (a) Antigen A on RBCs
- (b) Anti-A antibodies in serum
- (c) None of the above
- (d) Both of the above

Ans. (a)

Q. 2. An individual with blood group B possesses:

- (a) Antigen B on RBCs
- (b) Anti-B antibodies in serum
- (c) Both of the above
- (d) None of the above

Ans. (a)

Q. 3. An individual with blood group AB possesses:

- (a) A and B antigens on RBCs
- (b) Neither anti-A nor anti-B antibodies in serum
- (c) Both of the above
- (d) None of the above

Ans. (c) An individual with blood group AB possesses A and B antigens on RBCs. Because of the immune tolerance to self antigens (A and B) neither anti-A nor anti-B antibodies develop in the serum of the individual with AB group. Therefore, the correct answer is (c).

Q. 4. An individual with blood group O possesses:

- (a) Neither A nor B antigens on RBCs
- (b) Both anti-A and anti-B antibodies in serum
- (c) Both of the above
- (d) None of the above

Ans. (c) Anti-A and anti-B isoantibodies appear in the serum of infants by the age of 6 months and persist thereafter. It is believed that they develop as a result of cross-immunization with bacteria of Enterobacteriaceae that colonize the infant's gut. Since O group individuals possess neither A nor B antigen, there is no immune tolerance. Therefore, they develop anti-A and anti-B antibodies. Therefore, the correct answer is (c).

Q. 5. The commonest ABO blood group in Indian individuals is:

- (a) O
- (b) A
- (c) B
- (d) AB

Ans. (a)

Q. 6. Least common ABO blood group in Indian individuals is:

- (a) O
- (b) A
- (c) B
- (d) AB

Ans. (d)

Q. 7. Haemolytic disease of newborn may occur when:

- (a) An Rh-negative woman carries an Rh-positive foetus
- (b) An Rh-positive woman carries an Rh-negative foetus
- (c) Both of the above
- (d) None of the above

Ans. (a) Haemolytic disease of newborn may develop when an Rh-negative woman carries an Rh-positive foetus. She may be immunized against Rh antigen by the passage of foetal (Rh-positive) cells into maternal circulation. During subsequent pregnancy, Rh antibodies of the IgG class pass from the mother to the foetus, through the placenta, and damage its erythrocytes.

Q. 8. Which of the following infectious agents can be transmitted by blood transfusion?

- (a) Hepatitis B virus
- (b) Human immunodeficiency virus
- (c) *Plasmodium*
- (d) All of the above

Ans. (d)

Q. 9. Immunological complications of blood transfusion may be due to:

- (a) Red cell incompatibility
- (b) Leucocyte incompatibility
- (c) Platelet incompatibility
- (d) All of the above

Ans. (d)

Q. 10. Individuals with Bombay blood group lack:

- (a) A antigen
- (b) B antigen
- (c) H antigen
- (d) All of the above

Ans. (d) Red blood cells of all ABO groups possess a common antigen, the H antigen, which is the precursor antigen for the formation of A and B antigens. In Bombay blood group, the precursor (H) antigen for the formation of A and B antigens is absent. Therefore, such individuals lack H, A and B antigens. Therefore, the correct answer is (d).