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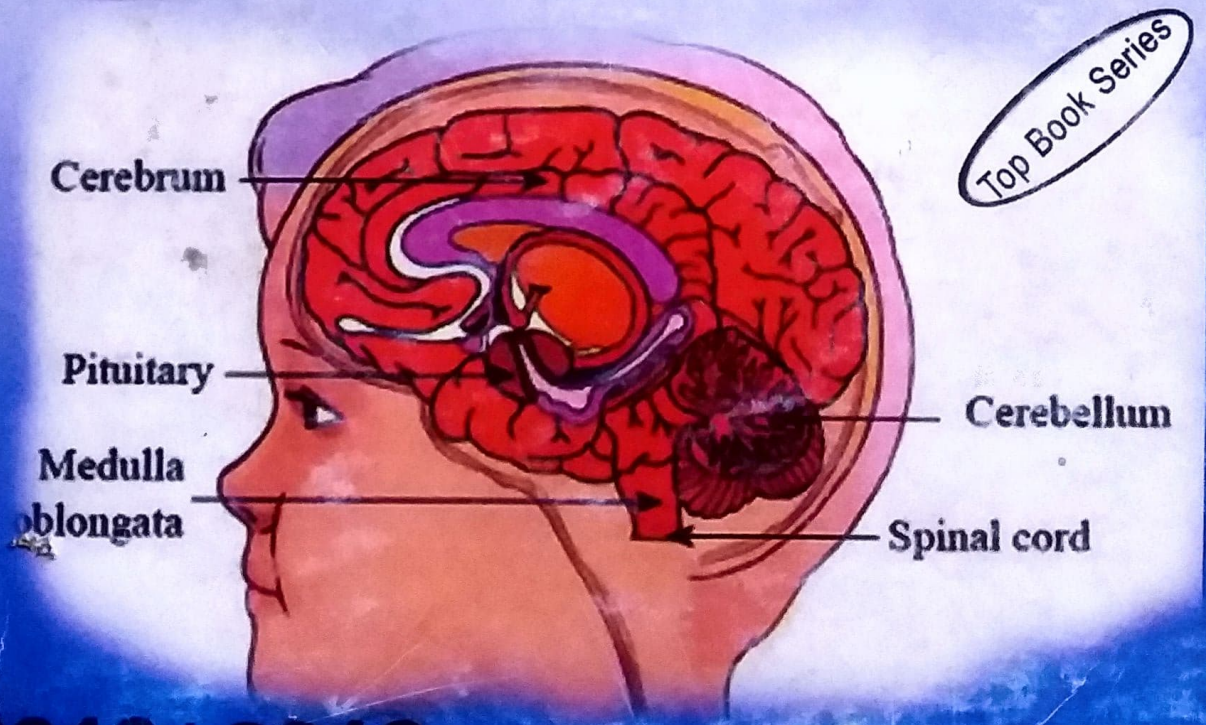
BIOLOGY

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For

Grades 12

Based on the New Revised Curriculum



Top Book Series

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Unit Six
Micro-organisms

6.1 Bacteria

What are micro-organisms?

As the name suggests micro-organisms are very small organisms that can not be seen by our naked eye. Most micro-organisms are unicellular or single celled, although some do contain more than one cell.

There are five main groups of micro-organisms. These groups are:

- protozoa
- some algae
- bacteria
- some fungi
- viruses

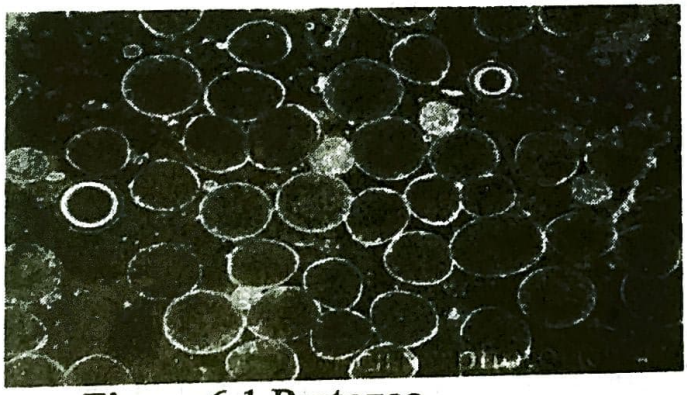


Figure 6.1 Protozoa

Protozoa are unicellular organisms that lack a cell wall. Most of them are motile (able to move). This includes amoeba, plasmodium (the one that causes malaria) and paramecium.

What are bacterial cells look like?

Bacteria have prokaryotic cells. In prokaryotic cells, there is no true nucleus separated from the rest of the cell by a membrane. All bacteria have a cell wall made from peptidoglycan, a cell membrane, cytoplasm, ribosomes and DNA.

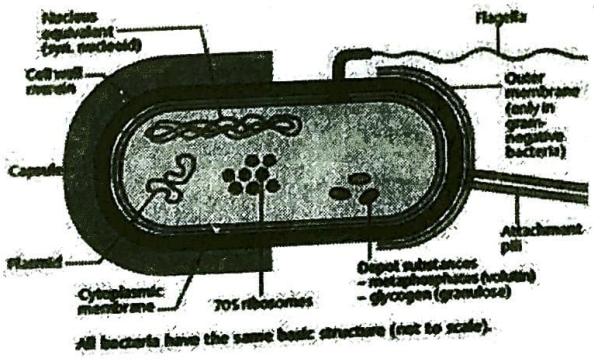


Figure 6.2 Bacteria

What are Eukaryotic cells?

Eukaryotic cell is the type of cell that has a nucleus and the membrane bound organelles. The word eukaryotic is derived from Greek eu (true) and karyos (nuclear).

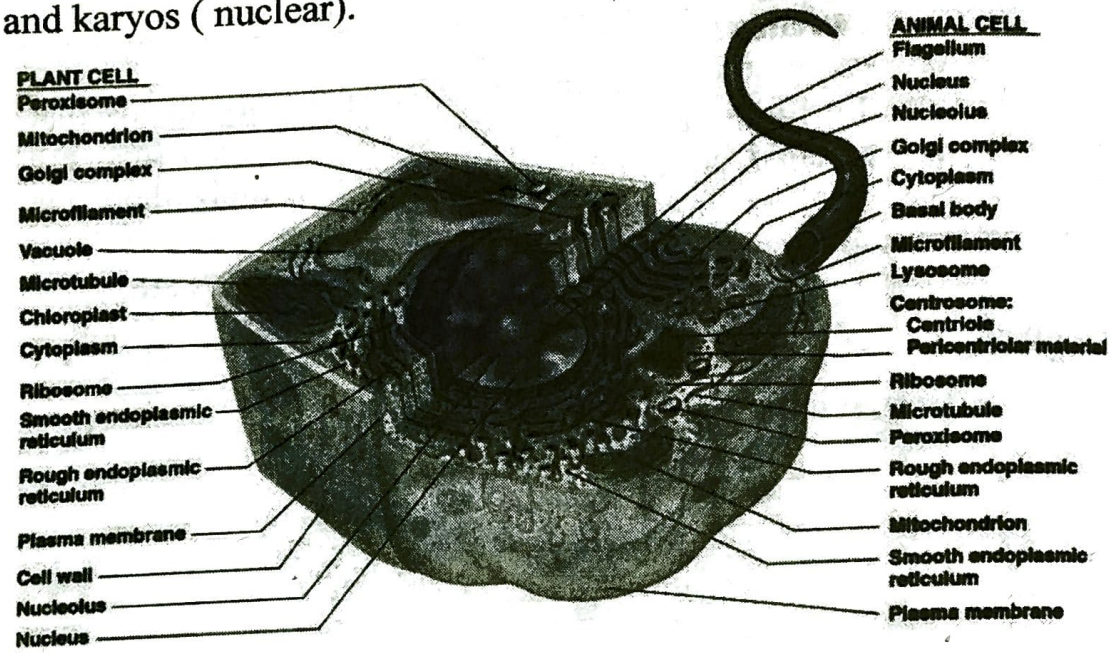


Figure 6.3 Eukaryotic cell

What are Prokaryotic cells?

Prokaryotic cell is the type of cell that does not have a nucleus. The word prokaryotic is derived from Greek pro (before) and karyos (nuclear). There are several shapes, sizes and arrangements of bacteria. However, the three main bacterial shapes are the following:

- Cocci (singular, coccus)- spherical bacteria
- Bacilli (singular, bacillus)-rod-shaped bacteria
- Spirochaetes- spiral or corkscrew-shaped bacteria.

Are there other ways of classifying bacteria?

Beside there shape bacteria can be classified based on whether they are coloured by Gram's stain or not. Gram's staining is a test for classifying bacteria (named after Hans Christian Gram), who developed the techniques in 1884. This test classify bacteria as gram positive and gram negative.

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Table 6.1 Comparison of gram positive and gram negative bacteria

Gram positive bacteria	Gram negative bacteria
Retain crystal violet solution	It does not retain crystal violet solution
Cell wall is thick	Cell wall is thin and coated with lipopolysacharide
Produce exotoxin	Produce endotoxin
More susceptible to antibiotics	Less susceptible to antibiotics
Stained purple	Stained pink

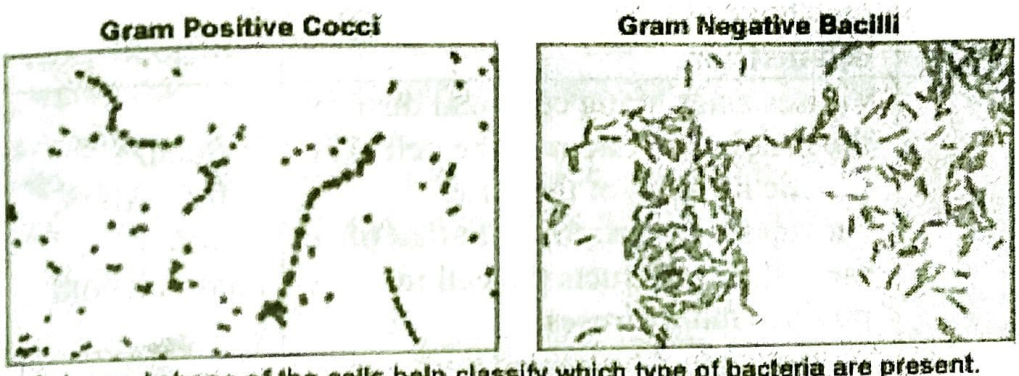


Figure 6.5 a. Gram positive and 6.5 b. Gram negative bacteria

6.2 The Ecology and Use of Bacteria

Where are bacteria found?

We find bacteria in every ecosystem. They are all around us. Bacteria are important as they are used in many industrial processes. They recycle mineral elements such as carbon, nitrogen and sulphur through ecosystem.

What is the role of bacteria and other microorganisms in infectious diseases?

Some diseases are caused by invasion of our body by micro-organisms. Different micro-organisms cause diseases in different ways as shown in table 6.2.

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Table 6.2 How micro-organisms cause disease

Type of Micro-organisms	How the micro-organisms cause disease	Examples of diseases caused
Bacteria	Bacteria release toxins as they multiply. These toxins affect cells in the region of the infection, and sometimes in other regions of the body as well. Bacterial diseases can be treated with antibiotics, as each bacterium is a true cell with its own metabolic system, and is capable of cell division.	Pneumonia, cholera. Pulmonary tuberculosis (TB)
Viruses	Viruses enter living cells and disturb the metabolic system of the cell. The genetic material of the virus becomes incorporated with that of the cell and instructs the cell to produce more viruses. Viruses cannot be treated with antibiotics as they are not true cells and are only active inside cells, which antibiotics cannot enter.	Influenza (flu), AIDS, measles, common cold
Fungi	When fungi grow in or on living organisms, their hyphae secrete enzymes. These digest substances in the tissue, and the substance produced is absorbed. Growth of hyphae also physically damages the tissue. Some fungai also secrete toxins. Others can cause an allergic reaction.(e.g farmer's lung)	Athlete's foot, Farmer's lung
Protozoa	Protozoa cause disease in many different ways	Malaria, sleeping sickness

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What is the Reservoir of infection?

Infectious diseases are caused by micro-organisms. The origin of microorganisms that infect other people is called reservoir of infection. This is any person, animal, plant, soil or substance in which an infectious agent normally lives and multiplies. Reserviors of infection include

* **human beings**- the reservoir for many diseases, including the common cold, diphtheria and others.
* **other animals**- for example chickens, the reservoir for salmonella infections, mosquito, the reservoir for malaria
* **soil**- the reservoir for tetanus and many other pathogens
* **water**-the reservoir for legionnaire's diseases , amoeba, cholera
* **food**- the reservior for many diseases , including thyphoid
* **contaminated objects**- containing infections such as HIV/AIDS and trachoma

How are disease –causing micro-organisms transmitted?

Table 6.3 How disease can be transmitted

Method of transmission.	How the transmission	Examples of disease
Droplet infection	Many of these diseases are " respiratory diseases"	Common cold, flu, pneumonia
Drinking contaminated water	Microorganisms infect areas of the gut	Cholera, typhoid fever
Eating contaminated food	It is caused by bacteria and viruses. They initially affect the gut.	Salmonellosis, thyphoid fever, listeriosis, botulism
Direct contact	Many skin infections	Athlete's foot, ring worm
Sexual intercourse	Caused by direct body contact, fungus or transmitted in semen or sperm	Candidiasis, syphilis, AIDS, gonorrhoea
Blood-to-blood contact	Drug users sharing infected needles and	AIDS, hepatitis B

	other forms of blood contact	
Animal vector	Many of these diseases are transmitted through the bites of insects	Malaria, sleeping sickness

According to the World Health Organization, health is defined as, "a state of complete physical, mental and social well-being". Disease can be caused by a number of other factors.

- ✓ **Human induced diseases**

  Human induced diseases are diseases that arise as a result of a person's life style and working conditions. Examples include cancer, heart disease and fibrosis.

- ✓ **Degenerative diseases**

  Degenerative diseases often result from ageing. Examples include arthritis and athresclerosis.

- ✓ **Genetic diseases**

  Genetic diseases are diseases that are inherited from parents. Examples haemophilia and sickle cell anemia.

- ✓ **Deficiency diseases**

  Deficiency diseases are diseases that result from a lack of nutrients in our diet.

- ✓ **Social diseases**

  Social diseases are conditions that result from social activities and may lead to socially unacceptable behavior.

- ✓ **Functional diseases**

  Functional diseases are diseases that results from the malfunction of an organ or system, without any obvious damage or physical sign of disease in the organ. Example Heart disease.

- ✓ **Multifactorial disease**

  Multifactorial disease is caused by the interaction of many factors.

The roles of bacteria in the ecosystem

Bacteria are important in recycling of minerals through ecosystem since bacteria are decomposer. When organisms die bacteria decompose dead plants and animals by breaking organic compounds in to simpler inorganic molecules and as aresult of these release some minerals in to the soil

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Table 6.4 The role of bacteria in the nitrogen cycle

Microorganisms	**Process**
Nitrogen-fixing bacteris, e.g Rhizobium	Nitrogen gas is fixed into forms other organisms can use (e.g ammonium ion).
Ammonifying bacteria (decomposers).	The decomposers break down proteins in dead organisms and animals waste releasing ammonium ions.
Nitrifying bacteria e.g Nitrosomonas and Nitrobacter	Nitrification is a two-step process. Ammonia or ammonium ions are oxidized first to nitrites and then to nitrates
Denitrifying bacteria, e.g Pseudomonas	Nitrates are reduced to nitrogen gas, returning nitrogen to the air and reducing the amount of nitrogen in the soil

Table 6.5 The role of bacteria in the sulphur cycle

Reaction	Bacteria involved	Conditions needed	Process
Decomposition	Desulphovibrio	Anaerobic	Sulphur is released from proteins of dead matter as hydrogen sulphide
Oxidation of hydrogen sulphide	Photosynthetic sulphur bacteia	Anaerobic	Hydrogen sulphide is oxidized to release sulphur
Oxidation of sulphur	Non-Photosynthetic sulphur bacteia	Aerobic	Sulphur is oxidized to sulphate ions

6.3. What are Viruses?

Viruses are much smaller than even the smallest bacterium. The particle of a virus is called a virion. All viruses contain at least two components. These are a protein shell or capsid and DNA or RNA as the genetic material. All viruses are intracellular parasites. The only way of existence is to invade cells.

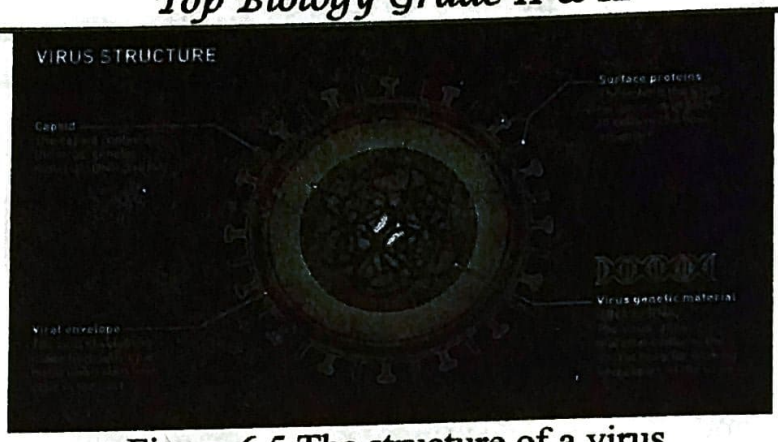


Figure 6.5 The structure of a virus

Table 6.6 Characteristics of viruses

Feature	Virion (virus particle)
Size	0.01 µm
Nucleus	Absent
DNA	Tiny amount of linear DNA in some; others contain RNA but no chromosomes
Other cell organelles	Absent

Classification of Viruses

Viruses are classified into three groups based on the nature of their genetic materials and the way in which it is expressed. These groups are

- DNA viruses- for example, Herpes simplex (causes cold sores)
- RNA viruses- for example, H_1N_1 virus (causes swine flu)
- Retroviruses- for example, HIV (causes AIDS)

Viruses can also be classified by the type of organism they infect.

- animal-infecting viruses
- Plant-infecting viruses
- bacteria-infecting viruses or bacteriophages.

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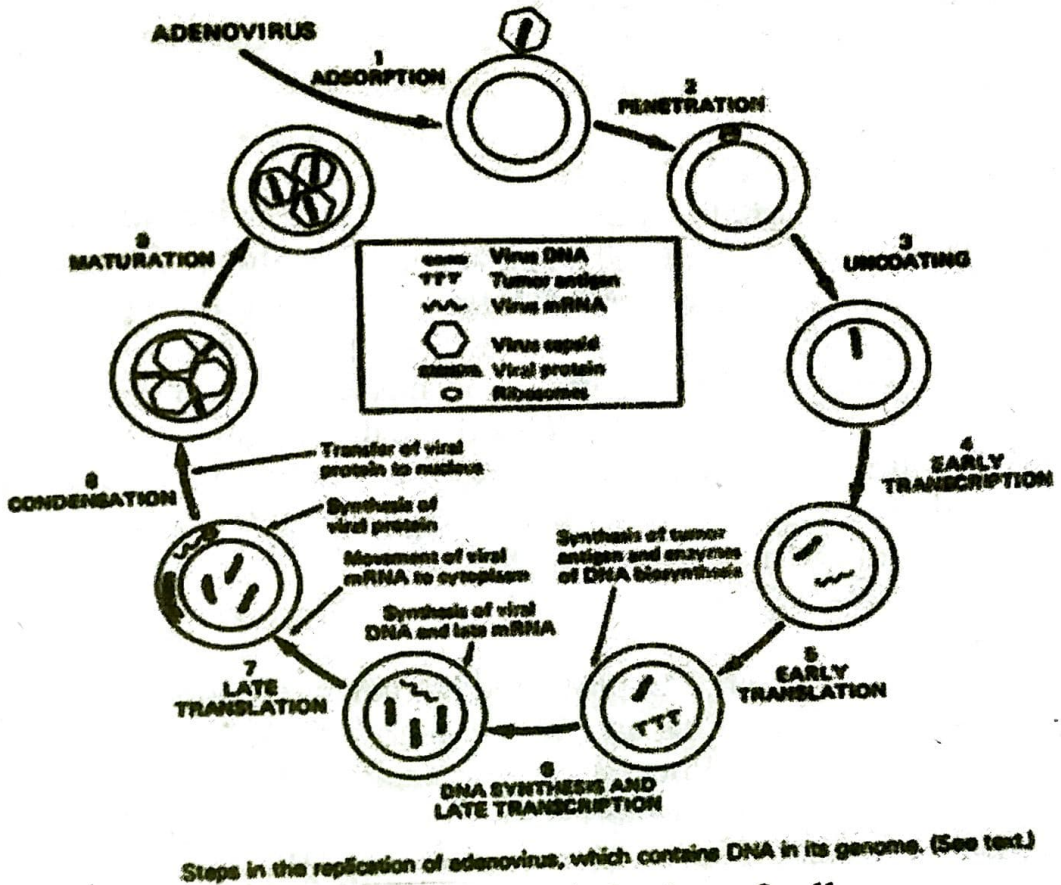


Figure 6.6 Stages of virus infection of cells

What is HIV like?

Human Immunodeficiency Virus or HIV is one of the retroviruses. It targets the cell that forms part of the immune system. Its main target is a type of cell called a CD_4 T-lymphocyte.

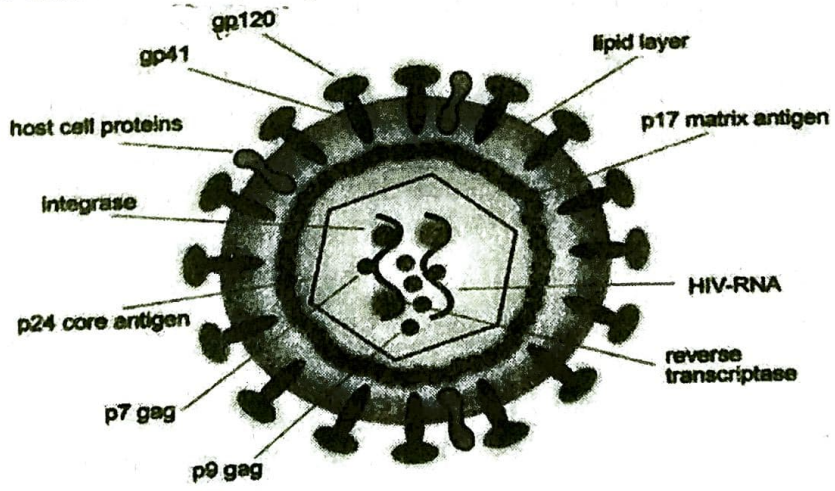


Figure 6.7 The structure of HIV

What is the latency period?
The period when the body keeps replacing the CD_4 lymphocytes as fast as they are destroyed is called latency period and can last many years.

Some facts about HIV/AIDS
HIV, the human immunodeficiency virus, is the virus that causes AIDS. This disease suppresses the body's ability to fight infections and weakens the immune system by killing vital T-cells.

HIV is a global health epidemic and has killed over 39 million people worldwide, according to the World Health Organization. As of 2013, WHO estimates that over 35 million people live with HIV worldwide. Most of these people live in low-income and developing countries. Sub-Saharan Africa accounts for almost 70 percent of new HIV infections.

HIV transmits through unprotected sexual intercourse, through sharing of contaminated needles and between an infected mother and her baby during pregnancy and breastfeeding, according to WHO. People cannot get infected through casual contact, such as kissing, shaking hands or sharing personal objects with a person with HIV.

After a person is infected, there is an incubation period in which there are no symptoms present. This period can last from a few months to 10 years.

Although there is no cure for HIV, combination of antiretroviral drugs control viral replication and help the immune system regain strength. There are different anti-retroviral drugs which are effective in slowing down the progression of AIDS. These drugs effectively prevent the viruses from reproducing in the CD_4. These medicines are effective when they are used in combination. This is called High Activity Anti-Retroviral Treatment (HAART). These drugs drastically improve life expectancy and quality of life for people living with HIV, according to WHO.

The social and economic impacts of AIDS
→ The existence of the feeling of shame because of the infection of HIV/AIDS.
→ Fear of stigma and discrimination.
→ Fearing of losing job.

→The loss of young and productive labor force will have its own impact on the economy.
→ High expense for medication and funeral.
→ Loss of time because of illness etc.

How can we limit the spread of AIDS?
We can limit the spread of HIV/AIDS by limiting the number of sexual partners, using condoms and by having male circumcision. Abstinence and being faithful to our marriage and sexual partner are also other ways of limiting the spread of HIV/AIDS

Unit Six: Review Questions

I. Choose the best answer from the given alternatives

1. The shape of Diplococcus bacteria is
   A. Globular B. Coiled C. rod shaped D. comma shaped
2. The strepto-bacillus bacteria are
   A. Globular B. Coiled C. rod shaped D. Curved like comma
3. The bacteria that ferments milk is called
   A.Clostridium B. Rhizobium C. E.Coli D.Lacto bacillus
4. A bacterium divides in every 20 minutes, how many bacteria will be formed within three hours?
   A. 18 B. 36 C. 256 D. 512
5. Gram positive bacteria stain
   A. Pink B. Purple C.Red D. Black
6. Bacterial DNA is
   A. a close loop B. enclosed in a capsule
   C. linear D. found in the nucleus
7. Plasmids are
   A.Virus B. Extra chromosomal genetic element of bacteria
   C. New type of microbes D. Genetic element of bacteria
8. The main difference in gram positive and gram negative bacteria resides in their
   A. Cell wall B. Cytoplasm C. Cell membrane D. Flagella
9. Most of pathogenic bacteria are
   A. Gram positive B. Gram negative
   C. Both 50% D. Having endospore
10. Genetic information can be transmitted from one bacteria to the other by way of structure called
    A. pili B. plasmid C. flagella D. chromosome
11. A non dividing bacteria cell contains _____chromosomes (s)

and may have extra circle of _____ called plasmids.
A. one; RNA B. two; RNA C. one; DNA D. two; DNA

12. Endospore develop in
A. mucor and bacillus B. saccharomyces and clostridium
C.Monococcusand clostridium D. bacillus and clostridium

13. Gram negative bacteria have an outer covering of
A. phospholipids B. peptidoglycan
C. lipopolysaccharides D. endospore

14. What carries bacteria genes for drug resistance?
A. DNA B. RNA C. Ribosomes D. Plasmid

15. In gram test to ensure a successful combining of the crystal Violet with cell wall,_____ is added
A. 95% alcohol B.Gram's Iodine C. Safranin D. all of them

16. Germ theory of disease was put forth by
A. Pasteur B. R. Koch C.Christen Gram D.Lord Lister

17. Which one of the following sets includes the bacterial disease?
A. Cholera, Typhoid, mumps B. Tetanus, Tuberculosis, measles
C. Malaria, Mumps, polio D. Leprosy, Diphtheria, Tetanus.

18. The relation between disease and pathogen was clearly depicted by
A. Jenner B. Lister C. R. Koch D. Pasteur

19. Which of the following is a direct cause of disease?
A. Living condition B. Age above 30 years
C. Pathogens D. Working in coal mines

20. The best method of preventing faeca- borne infections is:
A. control of flies C. provision of safe water supply
B. chemotherapy
D. sanitary disposal of human feces and strict personal hygiene.

21. In gram-negative bacteria, peptidoglycane layer is covered with an outer membrane known as the
A. capsule B. endospore C. lipopolysaccharides D. pilus

22. Koch's postulates illustrates the principle of:
A.Immunity B. Pasteurization
C. Cause and effect D. disinfection

23. Which disease is caused by try panosomes?
A. Sleeping sickness B. Amoebic dysentery
C. Toxoplasmosis D. Malaria

24. Lister first used _____ as a disinfectant
A. acetic acid B. ethanoic acid
C. carbolic acid D. gentian violet(gv)

25. If Mr. Lemma is advised to take calcium plus vitamin- D, most probably he is victim of
A. Atherosclerosis B. Alzheimer's disease
C. Osteoporosis D. Goiter

26. Canned food poisoning is usually caused by
A.Giardia B. E.coli C. Clostridium D. Agrobacterium

27. All bacteria have the following structures except
A. cell wall B. cell membrane C. ribosomes D. plasmid

28. A genus of bacteria noted for the formation of endospores is
A.streptococcus B. clostridium C. salmonella D. all of them

29. The bacteria that commonly live in animal and human intestine is
A.Vibrio cholera B. Bacillus anthracis
C. Escherichia coli D. None of them

30. The bacteria used for genetic engineering
A. Bacillus B. agro bacterium C. clostridium D. gene gun

31. Molecular scissors or chemical scalpel used in genetic engineering Is:
A. Restriction endonucleas B. DNA ligase
C. DNA grase D. DNA polymerase

32. The enzyme used to seal or join DNA fragment in genetic engineering is
A. DNA polymerase B. DNA ligase
C. DNA grase D. Reverse transcriptase

33. A bacterium act as a vector into plant cell
A. streptomyces aureo facienes B. agrobacterium tumefaciens
C. mycococcus condisans D. streptococcus nigricans

34. A transgenic plant has
A. foreign RNA in its all cells B. foreign DNA in some of its cell
C. foreign DNA in all of its cell D. both A and C

35. In genetic engineering, DNA can be transferred into Maize using
A. plasmids B. the gene gun C. bacteria D. viruses

36. Which of the following is not a viral disease?
A. mumps B. measles C. chicken pox D. none of them

37. To create bacteria that produce human insulin, scientists insert the human gene of interest into bacterial
A. circular chromosome B. plasmid
C. cell wall D. nucliod

I. Answer for multiple choice questions

1. A	11. C	21. C	31. A
2. C	12. D	22. C	32. B
3. D	13. C	23. A	33. B
4. C	14. D	24. C	34. B
5. B	15. A	25. C	35. B
6. A	16. B	26. C	36. D
7. B	17. D	27. D	37. B
8. A	18. C	28. B	
9. B	19. C	29. C	
10. B	20.D	30. B	

II. Write "TRUE" or "FALSE" based on the statements written below

38. Plasmodium is an organism that cause malaria.
39. AIDS is caused by a virus called HIV.
40. Sources of infectious organisms that spread to infect others are called reservoirs of infections.
41. Eukaryotic cell does not have a nucleus.
42. There is no cure for HIV/AIDS.
43. Scurvy is caused by the lack of protein.
44. Viruses can carry normal metabolic processes..
45. All viruses are parasites.
46. Kwashiorkor is caused by lack of vitamin C.
47. Protozoa are unicellular organism that lack a cell wall.
48. All bacteria do have a cell wall.

Part II: True/ False Answers

38. True	44. False
39. True	45. True
40. True	46. False
41. False	47. True
42. True	48. True
43. False	

III. Fill in the blank Spaces

49. The only unicellular fungi are the _____.
50. _____ can only reproduce inside other cells.
51. Examples of degenerative diseases are _____ and _____.

52 According to Gram staining, bacteria are classified into _____ and _____.

53 . Examples of deficiency diseases are _____ and _____.

54. _____and _____ are the two ways of sewage treatment.

55. Bacterial cells come in three main shapes. These are _____, _____ and _____.

56. Genetically modified bacteria are used to produce _____, _____, _____, _____and _____.

Part III: Fill in the Blank Answers

49. Yeast
50. Viruses
51. Arthritis and atherosclerosis
52. Gram positive and Gram negative
53. Scurvy and Kwashiorkor
54. Percolating filter method and Activated sludge method.
55. Cocci, bacilli and spirochates
56. Insulin, human growth hormone, antibiotics, enzyme for washing powder and human vaccines.
57. Antibiotics
58. Cancer, Heart disease and fibrosis
59. Haemophilia and sickle-cell disease
60. Alcoholism and drug addiction

Unit 6: Selected Questions With Their Explanation

1. Which one of the following is incorrect about bacteria?
   A. None contain cholorplast C. All can respire
   B. All contain ribosomes D. none can photosynthesize
   All are correct except "D" since there are some bacteria that are able to make their own food using sun light such as photosynthetic sulfur bacteria.
   Answer: D
2. All of the following bacteria cannot occur in pairs or in chains except:
   A. Stroptococcus B. Spirilla C. Treponema D. Borrelia
   All are spirochaetes (spiral shaped bacteria) that can't exist in pairs or in chains, but streptococcus are spherical (round) shaped bacteria that are able to exist in pairs or chains. **Answer: A**

3. Which of the following stain used as a counter stain in Gram staining?
   A. Iodine solution
   B. Mythl blue
   C. Safranin
   D. Crystal violet

   In Gram's staining (a test for classifying bacteria) safranin is used as a counter stain.

   Answer: C

4. Gram-positive and Gram-negative bacteria are differentially stained by Gram's stain because of the structural difference in their:
   A. Cell wall
   B. Capsule
   C. Genetic material
   D. Plasma membrane

   They are differentially stained due to the structural difference in their cell wall. Gram-negative bactria have much less peptidoglycan in their cell walls than Gram positive bacteria. This is the part of the cell wall that absorbs the stain.

   Answer: A

5. In which kingdom of life are the unicellular eukaryotes grouped?
   A. Animalia B. Monera C. Protista D. Plantae

   Protista are unicellular eukaryotes such as protozoa and algae.

   Answer: C

6. All of the following are Gram-positive bacteria except:
   A. Streptococci
   B. Escherichia coli
   C. Mycobactrium leprace
   D. clostridium tetani

   All are Gram-positive bacteria except Escherichia coli which is Gram-negative bacteria.

   Answer: B

7. Which of the following is a rod-shaped bacteria?
   A. Streptococcus
   B. Lactobacillus
   C. Borrelia
   D. Treponema

   Lactobacillus which is found in the milk is a rod-shaped bacteria.

   Answer: B

8. Gram-negative bacteria differ from Gram-positive bacteria in all of the following except:
   A. Have much more peptidoglycan in their cell wall
   B. Produce more dangerous endotoxins
   C. Have an exra membrane outside the cell wall
   D. Are less susceptible to antibiotics

   All are correct except "A". Gram-negative bacteria have much less peptidoglycan can in their cell wall than Gram-positive bacteria.

   Answer: A

9. Which one of the following is incorrect about fungi? They:
   A. All are heterotropic
   B. Can be parasitic
   C. Can be chemosynthetic
   D. Can be saprophytic

   All are correct except "C". None of the fungi are chemoautotroph or photoautotraph rather they all are hetrotrophic.

   Answer: C

10. Which of the following cells can be taken as a good example of a cell that lacks nuclear membrane and mitochondria?
   A. Protozoan cell
   B. Fungal cell
   C. Algal cell
   D. Bacterial cell

   Bactria are prokaryotes which lack true nucleus and membrane bounded organelles such as mitochnondria, chloroplast, etc.

   Answer: D

11. Which of the following is not an infection disease?
   A. leprosey
   B. AIDS
   C. Common cold
   D. Haemophilia

   All are infectious diseases (communicable diseases) caused by pathoges except "D". Haemophilia is a genetic disease.

   Answer: D

12. Which one of the following can't be functional disease?
   A. Irritable Bowel syndrome
   B. Heart disease
   C. Fibrosis
   D. Chronic fatigue syndrome

   All except "C" are functional diseases that can be caused by malfunction of an organ or system without there being an obvious damage or physical sign of disease in the organ. Fibrosis is a human-induced disease. Which may result due to a person's lifestyle and working condition. **Answer: C**

13. Which one of the following type of disease and its example is wrongly paired?
   A. Genetic disease – sickle-cell anaemia
   B. Deficiency disease – atherosclerosis
   C. Human-induced disease – cancers
   D. Social disease – drug addiction

   All are correctly paired except "B". Atherosclerosis is a degenerative disease which result due to ageing process or it can also be a multifactorial. **Answer: B**

14. Agrobacterium can't be used to genetically modify all types of plant because:
   A. Agrobacterium tumefaciens can infect all plant cells
   B. All plant cells will not accept plasmid
   C. It will not infect cereals

D. It's only effective to modify plants such as tobacco, carrot, and apple.

Since Agrobacterium tumefaciens cannot infect some plants such as maize, tobacco, carrot, etc, so those plants which can't be genetically engineered using agrobacterium can be modified by using gene gun.

Answer: C

15. Which of the following is the mode of replication in HIV virus?
    A. RNA → DNA → RNA
    B. DNA → RNA
    C. RNA → RNA
    D. DNA → DNA

    HIV is a retrovirus that reverse transcribe its RNA into DNA after it infected a host, then the new viral DNA is transcribe into viral RNA.

    Answer: A

16. DNA can be transferred into soybean and apple using:
    A. Agrobacterium
    B. Plasmids
    C. Viruses
    D. The gene gun

    The gene gun has made it possible to genetically modify plants that can't be modified using agrobacterium such as apple, tobacco, soybean, maize, ete.

    Answer: D

17. Which one of the following bacteria release sulphur from proteins of dead matter as hydrogen sulphide that smell like a rotten egg.
    A. Photosynthetic sulphur bacteria
    B. Non- photosynthetic sulphur bactria
    C. Desulphovibrio
    D. Sulphate oxidizing bacteria

    Sulphur is released from proteins of dead matter in anaerobic conditions as hydrogen sulphide (H_2S) which smell like a rotten egg by desulphovibrio.

    Answer: C

18. All virus contain the following components except:
    A. DNA or RNA as the genetic material
    B. A protein shell
    C. A lipoprotein membrane (envelop)
    D. Capsid

    All virus share the above features except "C", a lipoprotein membrane (envelop) outside the capsid found in some virions.

    Answer: C

19. All of the following are an RNA- Viruses except:
A. H_1N_1 B. Retroviruses
C. Myxoviruses D. Herpes simplex
All are an RNA-viruses except "D". Herpes simplex that causes cold sores is a DNA viruse.
Answer: D

20. The enzyme that the virus produces to degrade the cell wall of host is:
A. Acrosome B. Transductase
C. Lysozyme D. Bacteriophage
In some viruses the capsid possesses specific number of enzymes (Lysozyme) so that the virus can enter the host cell penetrating the cell wall.
Answer: C

21. Which of the following is the correct sequence of the steps in the process of viral infection?
A. Regeneration → replication→ assembly →release
B. Assembly → replication →penetration →release →regeneration
C. Attachment →penetration →replication →assembly →release
D. Attachment →penetration →assembly →replication→ release
Choice "C" is the correct sequence of the steps in the process of viral infection.
Answer: C

22. Viruses are called acellular due to all of the following reasons except:
A. Lack of power to grow independently
B. Absence of enzymes, cytoplasm and other cell organelles
C. Absence of response to external stimuli
D. They do code for some proteins by themselves
All are the reasons why viruses are called acellular except "D". Since viruses have no metabolic activity, they do not code for any proteins.
Answer: D

23. Which of the following is not part of a bacteriophage?
A. Head B. Neck C. Arm D. Tail and base plate
Bacterial viruses are called bacteriophages (phage virus) which consist of head, neck, tail and base plate.
Answer: C

24. In DNA cloning technology, which of the following molecules serves as a vector of gene of interest to be transferred to bacterial host?
A. Bacterial DNA C. Nuclear DNA
B. Plasmid DNA D. Mitochondirual DNA

Plasmid DNA is a small pieces of circular DNA found in bacteria that act as vector to transfer genes from one organism to another organism.

Answer: B

25. The level of HIV-virus, HIV-antibodies and T-lymphocytes relatively stay constant during.
    A. window period
    B. disease stage
    C. acute stage
    D. latency period

    Latency period is the period in the infection of HIV when the body keeps replacing the CD_4 lymphocytes as fast as they are destroyed. So that HIV-virus, HIV-anti bodies and T-lymphocytes relatively can stay constant for many years.

    Answer: D

26. Despite many clinical trials there is no effective AIDS vaccine because of all of the following reasons except:
    A. HIV infects the immune system
    B. Live attenuated virions cannot re-acquire their virulence
    C. HIV mutated regularly
    D. HIV can remain hidden in the host cell DNA for many years

    All are correct except "B". Live attenuated (harmless) virons will re-acquire their virulence.

    Answer: B

27. Which of the following is the major killer of AIDs patients?
    A. Malnutrition
    B. Pneumonia
    C. Oportunistic infections
    D. Anaemia

    Opportunistic infections such as pneumocystosis or cancers such as kaposi's sarcoma are the major killer of AIDs patients and can signal the final stage of HIV infection, AIDS.

    Answer: C

28. Which of the following comparisons between viruses and cellular organisms is incorrect?

Virus	**Cellular organism**
A. Cell division is absent	A. Cell division is present
B. Can multiply outside host cell	B. Can't multiply outside host cells
C. No nucleus	C. Nucleus present
D. Chromosome absent	D. chromosome present

    Choice "B" is wrong since viruses cannot multiply outside the host cell (they are obligate intracellular parasites).

    Answer: B

29. Why are T-lymphocytes more vulnerable to HIV infection because they possess:
A. HIV receptor protein
B. Large pores in their membrane
C. Thin cell membrane
D. Gp-120 on their surface
T-lymphocytes (T-helper cells) which coordinate the immune system have HIV-receptor proteins called CD_4, on their surface.
Answer: A

30. In which of the following viral life cycle where the host cell continues reproducing for a period without producing more viruses, but copying the viral DNA ?
A. Lytic
B. Lysogenic
C. Chronic release
D. Ongoing release
In lysogenic life cycle infection causes the virus to enter a latent state where its DNA is reproduced with the host DNA, but new viruses will not be formed.
Answer: B

31. Acetobacter is used industrially in the production of :
A. Pencillin B. Insulin C. Vinegar D. Ethanol
Acetobacter is a special cultur of a bacterium which is used to produce vinegar (a dilute solution of ethanoic acid).
Answer: C

32. Choose the disease that is caused by what is known as the "droplet-infection".
A. Flu B. AIDS C. Cholera D. Malaria
Air is the reservoir for airborne droplet infections such as flu, pneumonia, tuberculosis, etc. **Answer: A**

33. Which of the following method of transmission of diseases and its example is wrongly paired?
A. Blood-to-blood contact → hepatitis B
B. Animal vectors → sleeping sickness
C. Direct contact → ringworm
D. Eating infected food → candidiasis
All are correctly paired except "D". Candidiasis is a fungal disease which is not transmitted by eating contaminated food.
Answer: D

34. The gene for insulin can be transferred from human DNA to a bacterium. Which enzymes is used to cut out the gene from human DNA?
A. Polymerase
B. Restriction endonuclease
C. Helicase
D. DNA Ligase

Restriction endonuclease is an enzyme that cutsequence of DNA at specific site

Answer: B

35. Which bacterial species is used to transfer recombinant DNA to plants?
    A. Denitrifying bacteria
    B. Nitrogen fixing bacteria
    C. Agrobacterium
    D. Escherichia coli

    Since Agrobacterium tumefaciens can regularly infects plant, it act as a vector to carry genes that have been inserted into a genetically modified Agrobacterium into plants.

    Answer: C

36. Which of the following is not true about bacteriophage?
    A. It's tadpole shaped DNA virus
    B. It's head is polygonal, the tail is spirally symmetrical
    C. Its protein sheath and DNA separate within the host cell
    D. It cause lysis of the host cell.

    All are correct except "C". When bacteriphages infect bacteria they inject only their DNA, their protein sheath left behind.

    Answer: C

37. Which of the following definitions is wrong?
    A. Temperate infection – infection caused by alytic phase.
    B. Prophage - part of viral DNA that attach with host DNA
    C. Mycophage - virus that attacks fungi
    D. Cyanophage – virus that attacks blue-green algae

    All are correctly defined except "A". Virulent infection is infection caused by alytic phase whereas, Temperate infection is a non-virulent infection.

    Answer: A

38. A single, infective virus particle is referred to as a:
    A. Capsomere B. Capsid C. Phage D. Virion

    The particle of a virus is called a virion. All virions contain at least two components: Capsid and genetic material (DNA or RNA).

    Answer: D

39. Tobacco mosaic virus differ from a bacterophage in all of the following except:
    A. does not cause lysis of the host cell
    B. It's a rod shaped RNA virus
    C. Its nucleic acid enters the host body as injection
    D. It's capsid and RNA separated within the host cell.

All are correct except "C". In Tobacco Mosaic virus infection occurs by means of Phage nucleic acid enters the host body as injection.

Answer: C

40. In the sequence of viral synthesis ,which of the following will be synthesized last?

A. Base plate
B. Capsid
C. Protein
D. Nucleic acid

In the sequence of viral synthesis viral nucleic acid is synthesized first, then protein followed by capsid.

Answer: B

41. Who was the first person to report the existence of viruses?

A. Delbruk
B. Dimitric Iwanowski
C. Edward Jenner
D. W.M. Stanley

Scientist Edward Jenner in the year 1796 first reported the existence of viruses, the causative agent of small pox. But the first scientific evidence of the very existence of a virus was given by a Russian botanist Dimitric Iwannowski during his studies on the mosaic disease of tobacco.

Answer: C

42. The structures on T-helper cells which bind to the gp-120 of HIV during infection are:

A. Glycolipids
B. Macrophages
C. CD4 receptors
D. GP- 41

The shape of HIV spikes (gp120 and gp41) allows them to bind with CD4 receptors on the T-helper cells.

Answer: C

43. Which of the following viral life cycle involves the incorporation of the DNA of the virus into the DNA of the host cell?

A. Chronic relaease cycle
B. Lysogenic cycle
C. Transduction cycle
D. Lytic cycle

In Lysogenic cycle the viral DNA is incorporated in host cells' DNA and it replicate as the host cell reproduce.

Answer: B

44. If AIDS patients are given anti-retroviral drugs that targeted against the protease enzyme, which one of the following stage of the HIV life cycle would be inhibited?

A. Entry phase
B. Reverse transcription
C. Integration of viral DNA into host DNA

D. Assembly of viral parts into a whole virus
Protease inhibitors prevents the assembly of new viral particle.
Answer: D

45. What is the advantage of using HAART(highly active anti-retroviral therapy) for the treatment of HIV?
A. It gives lasting immunity to HIV
B. It prevents mutation of HIV
C. It prevents re-infection by HIV
D. It helps to break the life cycle of HIV
HAART break the life cycle of HIV since the drug targets different stages of the life cycle of the viruses.
Answer: D

46. Choose the one that is different from all the others.
A. Transgenic organisms
B. Cloned organisms
C. Genetically engineered organisms
D. Genetically modified organism
A clone of an organism is a group of organisms that are genetically identical to each other and to the organism from which they were derived. All are similar except "B".
Answer: B

47. If a new anti-HIV drug is to be developed to prevent the virus from entering the host cell, which one of the following processes should the drug target?
A. Reverse transcription
B. Binding of GP-120 and CD4
C. Integration of viral DNA into host DNA
D. Assembly of viral parts into a whole virus
Entry inhibitors attach themselves to proteins on the surface of T-cells or HIV to prevent the two from joining.
Answer: B

48. Which of the following bacteria convert nitrate in soil into atmospheric nitrogen during nitrogen cycle?
A. Denitrifying bacteria
B. Nitrogen-fixing bacteria
C. Nitrifying bacteria
D. Ammonifying bacteria
Denitrifying bacteria reduce nitrate to nitrogen gas that escapes from the soil.
Answer: A