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12th CBSE Biology

5 Molecular Genetics

Book Back Solved Questions - 1 Mark

I. Choose the Correct Answers

1. Hershey and Chase experiment with bacteriophage showed that

- a) Protein gets into the bacterial cells
- b) DNA is the genetic material
- c) DNA contains radioactive sulphur
- d) Viruses undergo transformation

2. DNA and RNA are similar with respect to

- a) Thymine as a nitrogen base
- b) A single-stranded helix shape
- c) Nucleotide containing sugars, nitrogen bases and phosphates
- d) The same sequence of nucleotides for the amino acid phenyl alanine

3. A mRNA molecule is produced by

- a) Replication b) Transcription
- c) Duplication d) Translation

4. The total number of nitrogenous bases in human genome is estimated to be about

- a) 3.5 million b) 35000
- c) 35 million d) 3.1 billion

5. *E. coli* cell grown on ^{15}N medium are transferred to ^{14}N medium and

allowed to grow for two generations. DNA extracted from these cells is ultracentrifuged in a cesium chloride density gradient. What density distribution of DNA would you expect in this experiment?

- (a) One high and one low density band.
- (b) One intermediate density band.
- (c) One high and one intermediate density band.
- (d) One low and one intermediate density band.

6. What is the basis for the difference in the synthesis of the leading and lagging strands of DNA molecules?

- (a) Origin of replication occurs only at the 5' end of the molecules.
- (b) DNA ligase works only in the 3' → 5' direction.
- (c) DNA polymerase can join new nucleotides only to the 3' end of the growing strand.
- (d) Helicases and single-strand binding proteins that work at the 5' end.

- 1. (b) DNA is the genetic material
- 2. (c) Nucleotide containing sugars, nitrogen bases and phosphates
- 3. (b) Transcription
- 4. (d) 3.1 billion

- 5. (d) One low and one intermediate density band.
- 6. (c) DNA polymerase can join new nucleotides only to the 3' end of the growing strand.

7. Which of the following is the correct sequence of event with reference to the central dogma?

(a) Transcription, Translation, Replication

(b) Transcription, Replication, Translation

(c) Duplication, Translation, Transcription

(d) Replication, Transcription, Translation

8. Which of the following statements about DNA replication is not correct?

(a) Unwinding of DNA molecule occurs as hydrogen bonds break.

(b) Replication occurs as each base is paired with another exactly like it.

(c) Process is known as semi-conservative replication because one old strand is conserved in the new molecule.

(d) Complementary base pairs are held together with hydrogen bonds.

9. Which of the following statements is not true about DNA replication in eukaryotes?

(a) Replication begins at a single origin of replication.

(b) Replication is bidirectional from

the origins.

(c) Replication occurs at about 1 million base pairs per minute.

(d) There are numerous different bacterial chromosomes, with replication occurring in each at the same time.

10. The first codon to be deciphered was _____ which codes for _____.

(a) AAA, proline

(b) GGG, alanine

(c) UUU, phenylalanine

(d) TTT, arginine

11. Meselson and Stahl's experiment proved

(a) Transduction

(b) Transformation

(c) DNA is the genetic material

(d) Semi-conservative nature of DNA replication

12. Ribosomes are composed of two subunits; the smaller subunit of a ribosome has a binding site for _____ and the larger subunit has two binding sites for two ____.

13. An operon is a:

(a) Protein that suppresses gene expression

(b) Protein that accelerates gene expression

7. (d) Replication, Transcription, Translation

8. (b) Replication occurs as each base is paired with another exactly like it.

9. (d) There are numerous different bacterial chromosomes, with replication occurring in each at

the same time.

10. (c) UUU, phenylalanine

11. (d) Semi-conservative nature of DNA replication

12. mRNA, tRNA

13. (c) Cluster of structural genes with related function

(c) Cluster of structural genes with related function

(d) Gene that switches other genes on or off

14. When lactose is present in the culture medium:

(a) Transcription of *lac y*, *lac z*, *lac a* genes occurs.

(b) Repressor is unable to bind to the operator.

(c) Repressor is able to bind to the operator.

(d) Both (a) and (b) are correct.

Book Back Solved Questions - 2 Marks

1. Give reasons. Genetic code is universal.

1. All living systems use **nucleic acids**.

2. The **triplet codon** directs the synthesis of the **same amino acid** in all organisms.

3. Eg. The **codon UUU** encodes for the amino acid, **phenylalanine** in all organisms.

2. Name the parts marked 'A' and 'B' in the given transcription unit.



A - Promoter

B - Coding strand

3. Mention any two ways in which single nucleotide polymorphism (SNPs) identified in human genome can bring revolutionary change in biological and medical science.

1. It helps in finding **chromosomal locations** of **disease associated** sequences.

2. It helps in tracing **human history**.

4. State any three goals of the human genome project.

1. To identify **all the genes** in human DNA, which is approximately **30,000**.

2. To determine the sequence of **three billion** chemical **base pairs** that makeup the human DNA.

3. To store these information in **databases**.

4. To improve **tools** for **data analysis**.

5. To transfer **related technologies** to other sectors.

6. To address the **ethical, legal** and **social issues** that may arise from the project.

5. Why the human genome project is called a mega project?

1. The project was aimed to **identify all the genes** (about **30000**) in human DNA.

2. Human genome has approximately **3×10^9 bp**.

3. Human genome is about **25 times larger** than the genome of other organisms.

14. (d) Both (a) and (b) are correct.

6. It has taken **13 years** to complete this project.

6. Why tRNA is called an adapter molecule?

1. tRNA molecule acts as a **vehicle**. It picks up the **amino acids** scattered throughout the **cytoplasm**.

2. The **anticodon** of tRNA base pairs with the codon of mRNA.

3. It reads **specific codes** of **mRNA** molecules.

7. Name the anticodons required to recognize the following codons: AAU, CGA, UAU and GCA.

Codons	Anticodons
1. AAU -	UUA
2. CGA -	GCU
3. UAU -	AUA
4. GCA -	CGU

8. If the coding sequence in a transcription unit is written as follows:

5'TGCATGCATGCATGCATGCATGC3'

Write down the sequence of mRNA.

3'ACGUACGUACGUACGUACGUACG5'

9. What are the three structural differences between RNA and DNA?

RNA	DNA
1. Ribonucleic acid .	1. Deoxyribonucleic acid .
2. It contains ribose sugar,	2. It contains deoxyribose sugar,
3. Uracil is present .	3. Uracil is not present .
4. Thymine is not present .	4. Thymine is present .
5. Every nucleotide residue has an additional -OH group at 2' position in the ribose.	5. Additional -OH group is not present .
6. RNA is a single stranded molecule.	6. DNA is a double stranded molecule.

Book Back Solved Questions- 3 Marks

1. Differentiate - Leading strand and lagging strand.

Leading Strand	Lagging Strand
1. It is the newly synthesized strand formed from template strand .	1. It is the newly synthesized strand formed from coding strand .
2. Replication is continuous .	2. Replication is discontinuous .
3. It produces a single DNA strand.	3. It produces many DNA fragments called Okazaki fragments .
4. Gaps are not formed in this strand.	4. Gaps are formed in this strand.
5. DNA ligase is not required .	5. DNA ligase is required .

2. Differentiate - Template strand and coding strand.

Template Strand	Coding Strand
1. This strand of DNA is used for transcription .	1. This strand of DNA is not used for transcription.
2. The polarity of this strand is 3'→5' .	2. The polarity of this strand is 5'→3' .
3. This strand is transcribed into mRNA .	3. This strand is not transcribed into mRNA.
4. The nucleotides are complementary to mRNA.	4. Nucleotides are similar to that in mRNA.

3. In *E.coli*, three enzymes, β -galactosidase, permease and transacetylase are produced in the presence of lactose. Explain why the enzymes are not synthesized in the absence of lactose.

1. In the absence of lactose, the ***i* gene** (regulator gene) transcribes a **repressor mRNA**.

2. The repressor mRNA produces a **repressor protein**.

3. This protein binds to the **operator region** of the operon.

4. This prevents **structural genes** from **translation**.

5. So, **enzymes** are **not produced**.

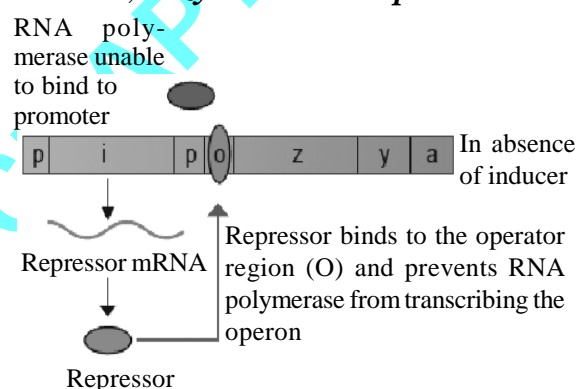


Fig. Lac Operon model.

4. Distinguish between structural gene, regulatory gene and operator gene.

Structural Gene	Regulatory Gene	Operator Gene
1. It codes for mRNA, proteins, rRNA and tRNA.	1. It codes for a repressor protein .	1. Repressor protein binds to operator gene and inhibits structural gene .
2. One or more structural genes may be present.	2. Only one regulatory gene is present.	2. Only one operator gene is present.
3. Active when lactose is present .	3. Active when lactose is absent .	3. Active when lactose is present .
4. Inactivated by the absence of glucose	4. Inactivated by lactose .	4. Inactivated by repressor protein .

5. A low level of expression of lac operon occurs at all the windows for treatment of various genetic disorders . Justify the statement.

?

6. How is the two stage process of protein synthesis advantageous?

This helps to turn **on** or **off** protein synthesis at any one stage.

1. Protein synthesis takes place in **two** stages, namely:

1. *Transcription*

2. *Translation*

2. **Gene expression** can be **turned on** or **off**. This is known as **gene regulation**.

3. By controlling the level of expression, the **amount** of **protein** product made by a gene can be controlled.

4. This may occur at **different levels**:

- *Transcription level*
- *Post-transcription level*
- *Translation level*

Most often, it occurs at **transcription level**.

5. Turning 'on' or 'off' the correct genes, is essential for the **normal functioning** of a cell.

6. Dysregulation of these genes can cause diseases such as **cancer**, **autoimmunity**, etc.

7. Gene regulation at **transcription**

level has led to the development of **novel pharmaceuticals**.

7. Why did Hershey and Chase use radioactively labelled phosphorus and sulphur only? Would they have got the same result if they use radiolabelled carbon and nitrogen?

Reason

This is because phosphorus is present only in **DNA** and sulphur is present only in **protein**.

1. They wanted to observe whether **DNA** or **protein** entered the bacteria, when infected by **bacteriophages**.

2. All **nucleic acids** contain **phosphorus** and not sulphur.

3. Proteins contain **sulphur** and no phosphorus. The amino acids, **cysteine** and **methionine** contain **sulphur**. These amino acids are present in the **protein coats** of **bacteriophages**.

4. Labelling the phages with these isotopes helps to track **viral proteins** and **nucleic acids** during the infection process. He wanted to find whether **DNA** or **protein** entered the bacteria.

Radiolabelled Carbon and Nitrogen

No, they would not get the same result.

Reason

Carbon and **nitrogen** are present both in **DNA** and **protein**.

Book Back Solved Questions - 5 Marks

1. From their examination of the structure of DNA, what did Watson and Crick infer about the probable mechanism of DNA replication, coding capability and mutation?

Mechanism of DNA Replication

They inferred *semi-conservative method* of replication.

In semi-conservative replication, *both strands* serve as *template* to form two new DNA molecules, each having *one parent* strand and *one newly synthesized* strand.

Coding Capability

During replication, the strand with polarity $3' \rightarrow 5'$ acts as *template strand*.

The strand with $5' \rightarrow 3'$ acts as the *coding strand*.

Both strands take part in replication.

But the *template strand* alone takes part in transcription.

Mutation

When replication occurs at a *faster rate*, *errors* may occur.

Errors occurring leads to *mutation*.

2. Explain the formation of a nucleosome.

Nucleosomes are *structures* formed when *negatively charged DNA* is wrapped around the *positively charged histone octamer*.

Nucleosomes are a series of *repeating units* that form the *chromatin*.

Kornberg proposed the following *model* for the nucleosome.

1. A nucleosome is a unit of *histone octamer* wrapped by DNA.

2. It is made up of *8 histone* molecules of the following *four* types:

- H2A • H2B
- H3 • H4

3. The histone octamer is *positively* charged and the DNA is *negatively* charged.

4. Typical nucleosome contains *200 bp* of *DNA helix*.

5. Histone octamers are in *close contact*.

6. *DNA* is coiled on the *outside* of *nucleosome*.

7. *Neighbouring* nucleosomes are connected by *linker DNA*. Linker DNA is exposed to *enzymes*.

8. DNA makes *two complete turns* around the histone octamers.

9. The two turns are *sealed* off by a histone *H1 molecule*.

10. Chromatin *lacking H1* has a beads-on-a-string appearance. *DNA* enters and leaves the nucleosome at random places.

11. *H1* of one nucleosome can interact with H1 of *neighbouring nucleosome*.

12. This results in further *folding* of the *fibre*.

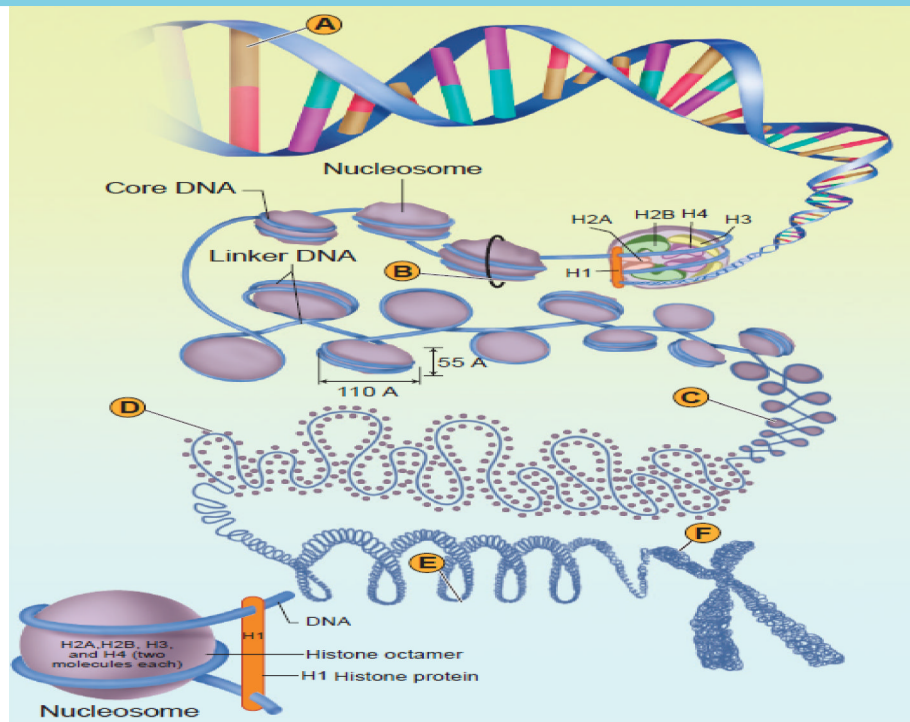


Fig. Condensation of DNA.

3. It is established that RNA is the first genetic material. Justify giving reasons.

1. RNA is the **genetic material** in TMV.

2. It was demonstrated and separated by **Conrat** and **Singer** in 1957.

3. A typical cell contains **ten times** as much **RNA** as DNA.

4. The **first genetic** material as **RNA** was hypothesised by '**RNA world**'.

5. RNA world is the **first stage** in the **evolution of life**.

6. 'RNA world' was independently proposed by the following biologists:

- **Leslie Orgel**
- **Francis Crick**
- **Carl Woese**

7. The term 'RNA world' was first used by **Walter Gilbert** in **1986**.

8. **Walter Gilbert** in 1986, proposed that RNA is the **first genetic** material on the **Earth**.

9. RNA acts as both, **genetic material** and **catalyst**.

10. It catalyses **several** biochemical reactions:

- **Metabolism**
- **Translation**
- **Splicing**

11. Catalytic ribosome is known as **ribozyme**.

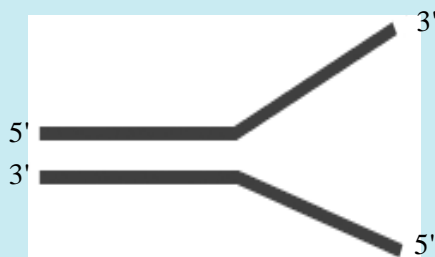
12. **RNA** is **more reactive** and **unstable** than DNA.

13. This led to the evolution of **more stable DNA**.

14. Some RNA molecules function as **gene regulators** by binding to **DNA**. This affects **gene expression**.

4. a) Identify the figure given below.

b) Redraw the structure as a replicating fork and label the parts.



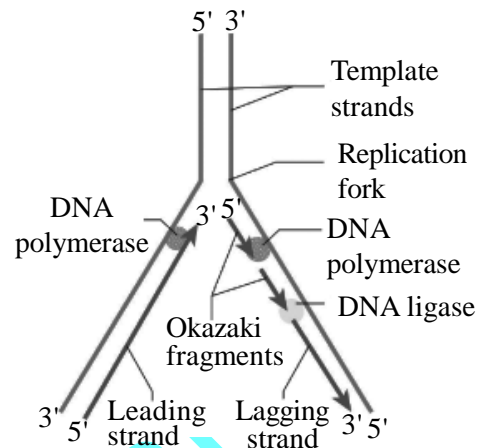
c) Write the source of energy for this replication and name the enzyme involved in this process.

d) Mention the differences in the synthesis of DNA, based on the polarity of

the two template strands.

a) Replication fork

b)



c) **Source of Energy**

Deoxy nucleotide triphosphate

Enzymes Involved

DNA polymerase

d)

3' → 5' Polarity	5' → 3' Polarity
1. The strand with polarity 3' → 5' acts as the template strand .	1. Strand with polarity 5' → 3' is the coding strand .
2. Replication in this strand is continuous .	2. Replication in this strand is discontinuous .
3. Replication produces the leading strand .	3. Replication produces the lagging strand .
4. Gaps are not present in the leading strand .	4. Gaps are present in the lagging strand.
5. It produces a single DNA strand .	5. It produces many DNA fragments called Okazaki fragment .
6. Ligase is not required .	6. Ligase is needed to seal off the gaps.

7 Human Health and Diseases

Book Back Solved Questions - 1 Mark

Choose the Correct Answer

1. A 30 year old woman has bloody diarrhoea for the past 14 hours. Which one of the following organisms is likely to cause this illness?

- a) *Streptococcus pyogenes*
- b) *Clostridium difficile*
- c) *Shigella dysenteriae*
- d) *Salmonella enteritidis*

2. Exo-erythrocytic schizogony of *Plasmodium* takes place in

- a) RBC
- b) Leucocytes
- c) Stomach
- d) Liver

3. The sporozoites of *Plasmodium vivax* are formed from

- a) Gametocytes
- b) Sporoblasts
- c) Oocysts
- d) Spores

4. Amphetamines are stimulants of the CNS, whereas barbiturates are

- a) CNS stimulant
- b) Both a and b
- c) Hallucinogenic
- d) CNS depressants

5. Choose the correctly matched pair.

- a) Amphetamines - Stimulant
- b) LSD - Narcotic
- c) Heroin - Psychotropic
- d) Benzodiazepine - Pain killer

6. The Athlete's foot disease in human is caused by ———

- a) Bacteria
- b) Fungi
- c) Virus
- d) Protozoan

7. Cirrhosis of liver is caused by chronic intake of ———

- a) Opium
- b) Alcohol
- c) Tobacco
- d) Cocaine

8. The sporozoite of the malarial parasite is present in ———

- a) Saliva of infected female *Anopheles* mosquito.
- b) RBC of human suffering from malaria.
- c) Spleen of infected humans.
- d) Gut of female *Anopheles* mosquito.

1. (c) *Shigella dysenteriae*

2. (d) Liver

3. (c) Oocysts

4. (d) CNS depressants

5. (a) Amphetamines - Stimulant

6. (b) Fungi

7. (b) Alcohol

8. (a) Saliva of infected female *Anopheles* mosquito.

20. The antigen binding site can '**fit**' to a specific **antigenic determinant** of an antigen.

21. The stem region of the antibody monomer determines the **antibody class**.

- It serves common **function** in all **antibodies**.

3. Auto immunity is a misdirected immune response. Justify.

Justification

1. **Auto immunity** is an abnormal **immune response** against **own body**.

2. The immune system fails to distinguish between **self** and **non-self**.

3. It **attacks** its own body.

4. It produces antibodies called **auto antibodies** and **cytotoxic-T cells**.

5. They destroy our **own** tissues.

6. They cause **auto-immune** disease.

7. Thus, **auto immunity** is a misdirected immune response.

Additional Solved Questions - 1 Mark

1. Disease caused by bacteria.

- a) Typhoid b) Measles
c) Cold d) Dengue

2. Non infectious disease

- a) Typhoid b) Cholera
c) Chicken pox d) Arthritis

3. Test to confirm typhoid is

- a) Widal b) ELISA
c) Western blot d) Southern blot

4. Name the protozoan disease

- a) Mumps b) Measles
c) Dengue d) Kala-azar

5. Match the following with correct sequence

Diseases **Pathogens**

1. Athlete's foot - (i) Virus

2. Kala-azar - (ii) Fungi

3. Measles - (iii) Bacteria

4. Diptheria - (iv) Protozoan

a) 1 - (ii), 2 - (iv), 3 - (i), 4 - (iii)

b) 1 - (iii), 2 - (iv), 3 - (i), 4 - (ii)

c) 1 - (iv), 2 - (iii), 3 - (ii), 4 - (i)

d) 1 - (iv), 2 - (iii), 3 - (i), 4 - (ii)

6. Common cold is caused by the virus

- a) HIV b) Rhino virus
c) RNA virus d) DNA virus

7. Swine flu was first identified in

- a) 1990 b) 1991
c) 1919 d) 1921

8. Zoonotic virus

- a) HIV b) Nipah
c) Polio virus d) Pox virus

1. (a) Typhoid

2. (d) Arthritis

3. (a) Widal

4. (d) Kala-azar

5. (a) 1 - (ii), 2 - (iv), 3 - (i), 4 - (iii)

6. (b) Rhino virus

7. (c) 1919

8. (b) Nipah

9. In which disease, blood and visceral organs are affected by yellow fever and dengue fever.

- a) *Neurotropic diseases*
- b) *Pneumotropic diseases*
- c) *Dermotropic disease*
- d) *Viscerotropic diseases*

10. Mumps disease is caused by virus.

- a) *Paramyxovirus*
- b) *Rubella virus*
- c) *Flavivirus*
- d) *Alpha virus*

11. African sleeping sickness is caused by

- a) *Trypanosoma*
- b) *Musca domestica*
- c) *Entamoeba*
- d) *Nipah virus*

12. Match the following with correct pair

- i) T.gambiense - a) *Glossina morsitans*
- ii) T.rhodesiense - b) *Glossina palpalis*
- iii) T.cruzi - c) *Leishmania donovani*
- iv) Kala azar - d) *Triatoma megista*

- a) i - a, ii - b, iii - d, iv - c
- b) i - b, ii - a, iii - c, iv - d
- c) i - b, ii - a, iii - d, iv - c
- d) i - c, ii - d, iii - a, iv - b

13. Kala-azar is transmitted by

- a) *Tsetse fly* b) *Sand fly*
- c) *House fly* d) *Mosquitoes*

14. The pathogenic bacteria causing bubonic plague is

- a) *Yersinia pestis*
- b) *Clostridium tetani*
- c) *Shigella sp*
- d) *Streptococcus*

15. Life cycle of *Plasmodium*

- a) *Schizogony* b) *Gamogony*
- c) *Sporogony* d) *All the above*

16. It is a pandemic disease

- a) *Polio* b) *Swine flu*
- c) *Cancer*
- d) *Heart attack*

17. Incubation period of malaria is

- a) *15 days* b) *12 days*
- c) *16 days* d) *14 days*

18. Find the wrong pair

	Viral disease		Affecting organ
(a)	<i>Dermotropic</i>	-	<i>Skin and subcutaneous tissues</i>
(b)	<i>Neurotropic</i>	-	<i>Central nervous system</i>
(c)	<i>Pneumotropic</i>	-	<i>Brain and spinal cord</i>
(d)	<i>Viscerotropic</i>	-	<i>Blood and visceral organs</i>

9. (d) *Viscerotropic diseases*

10. (a) *Paramyxovirus*

11. (a) *Trypanosoma*

12. (c) i - b, ii - a, iii - d, iv - c

13. (b) *Sand fly*

14. (a) *Yersinia pestis*

15. (d) *All the above*

16. (b) *Swine flu*

17. (b) *12 days*

18. (c) *Pneumotropic- Brain*

and spinal cord 205

19. Oocyst undergoes meiosis by a process called

- a) *Schizogony* b) *Gamogony*
 c) *Sporogony* d) *Trophozoite*

20. Disease caused by Flavi virus

- a) *Dengue fever* b) *Typhoid*
 c) *Malaria* d) *Measles*

21. Vector for filariasis

- a) *Anopheles mosquito*
 b) *Aedes aegypti*
 c) *Culex mosquito*
 d) *Tse-tse fly*

22. Periodicity of fever occurred by *Plasmodium malariae* is

- a) *Every 24 hrs* b) *Every 48 hrs*
 c) *Every 38 hrs* d) *Every 72 hrs*

23. Hereditary material in retrovirus

- a) *DNA* b) *RNA*
 c) *Lipoprotein* d) *Vitamin*

24. Select the correct pair

- a) *P. vivax* - 72 hrs
 b) *P. malariae* - 36 - 48 hrs
 c) *P. ovale* - 48 hrs
 d) *P. falciparum* - 42 hrs

25. *Ascaris lumbricoides* is called

- a) *Ring worm* b) *Round worm*
 c) *Tape worm* d) *Filarial worm*

26. WHO does not recommend use of RTS, S vaccine in babies between

..... weeks of age.

- a) *2 and 3 wks* b) *6 and 12 wks*
 c) *12 and 16 wks* d) *12 and 20 wks*

27. Female filarial worm gives rise to juveniles called

- a) *Microfilariae larvae*
 b) *Wuchereria bancrofti*
 c) *Helminthiasis*
 d) *Ascariasis*

28. Amoebiasis is called

- a) *Amoebic dysentery*
 b) *Amoebic colitis*
 c) *Both (a) and (b)*
 d) *None of the above*

29. Identify the viral disease

- a) *Typhoid* b) *Amoebiasis*
 c) *Ascariasis* d) *Common cold*

30. Ability of body to fight against the disease causing pathogen

- a) *Susceptibility*
 b) *Auto immune disease*
 c) *Immunity* d) *Antibody*

31. Substance capable of eliciting immune response.

- a) *Antibody* b) *Antigen*
 c) *Immunity* d) *Susceptibility*

32. Antibacterial agent that cleaves bacterial cell wall.

- a) *Interferon* b) *Neutrophils*

19. (c) *Sporogony*

20. (a) *Dengue fever*

21. (c) *Culex mosquito*

22. (d) *Every 72 hrs*

23. (b) *RNA*

24. (c) *P. ovale* - 48 hrs

25. (b) *Round worm*

26. (b) *6 and 12 wks*

27. (a) *Microfilariae larvae*

28. (c) *Both (a) and (b)*

29. (d) *Common cold*

30. (c) *Immunity*

31. (b) *Antigen*

32. (c) *Lysozyme*

14. Define Hygiene according to WHO?

★ “**Conditions** and **practices** that help to maintain **health**” and **prevent** the **spread** of **diseases**.

15. Define Immunology?

+ Study of immune system.
 + Immune system **protects** from various **infective agents**.

+ Immunology refers to study of **immune** mechanisms used by the body for **protection** from **environmental agents**.

16. Define antigen.

- + ‘Antibody generator’
- + Any substance capable of eliciting **immune response**.
- + ‘Immunogen’
- + It reacts with antibodies.
- + It is represented by **Ag**.

17. Define immunity?

Overall ability of body to **fight** against the **disease** causing **pathogen**.

18. Name the cutaneous infection caused by fungi? To which genera do these fungi belong to?

Dermatomycosis

Genera

- ♦ *Trichophyton*
- ♦ *Microsporum*
- ♦ *Epidermophyton*

19. Classify antibodies.

- ✱ IgG (gamma)
- ✱ IgM (mu)
- ✱ IgA (alpha)
- ✱ IgD (delta)
- ✱ IgE (epsilon)

20. Classify antigens.

1. Endogenous antigens

2. Exogenous antigens**21. Name the two types of immunity.**

- ✱ Innate immunity
- ✱ Acquired immunity

22. Define haptens.

✱ **Substances** that are **non-immunogenic** but can react with the **products** of a **specific immune response**.

23. Define adjuvants.

Substances that can enhance the **immune response** to an **antigen**.

24. Define antigenicity.

Property of an antigen, that allows it to **react** with the **products** of the **specific immune response**.

25. Define antibodies.

- **Immunoglobulin**
- Protein molecules **synthesized** on exposure to **antigen**.
- **Combine** specifically with the **antigen**.
- Represented by **Ig** or **ab**.

26. Define epitope.

- **Antigenic determinant**
- **Active** part of an **antigen**

27. Define paratope.

- ✱ Antigen binding site of an **antibody**.
- ✱ It recognizes and **binds** to an **antigen**.

28. What are the four types of dendritic cells.

1. Langerhans cells
2. Interstitial cells
3. Myeloid cells
4. Lymphoid cells

29. What is zoonotic virus? Give example.

Virus transmitted from **animals** to **human beings**.

Eg. *Nipah virus*

30. What is Korsakoff syndrome?

- **Chronic memory** disorder
- Caused by **alcohol misuse**

31. Define trophozoite?

An **active, infective** and **feeding** form of some **protozoan parasites** inside the body of the host.

Eg. *Entamoeba*, *Plasmodium*

32. What happens if one's immune system do not function efficiently?

- Lack of immunity occurs.
- One becomes susceptible to **infection**
- Causes many **diseases**

33. Define Acquired immunity.

• Immunity that an **individual** acquires **after birth**.

• It is the **body's resistance** to a specific **pathogen**.

34. Write down the unique features of acquired immunity?

- Antigenic specificity
- Diversity
- Recognition of self and non-self
- Immunological memory

35. Define haematopoiesis?

Production of **blood cells** in the **bone marrow**.

36. What are lymphoid organs?

They are organs of the **immune system**, involved in the **origin, maturation** and **proliferation** of lymphocytes.

37. How are lymphoid organs classified according to their functions?

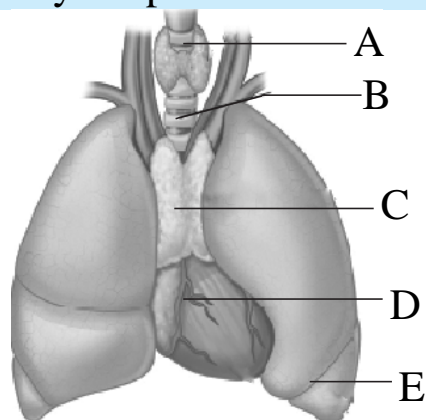
1. **Primary** lymphoid organs (or)
Central lymphoid organs
2. **Secondary** lymphoid organs (or)
Peripheral lymphoid organs

38. The barriers in the innate immunity are given in the following table. Identify A,B,C,D

Type of Barrier	Barrier
1. Physical	a) Skin, A_____
2. Physiological	b) B_____
3. C_____	c) Interferon
4. Phagocytic	d) WBC, D_____
A - Mucus membrane	
B - Temperature, chemical mediators like interferon	
C - Chemical mediators	
D - Macrophages	

39. How does malaria differ from chikungunya with reference to their vectors?

Malarial Vector	Chikungunya Vector
1. Malaria is transmitted by the bite of female Anopheles mosquito .	1. Chikungunya is transmitted by the bite of female Aedes aegypti mosquito.
2. Vector prefers biting during night .	2. Vector prefers biting during day time .
3. Breeds in contaminated water .	3. Breeds in clean water .

40. Identify the parts A to E.


Ans:

- A - Thyroid gland
- B - Trachea
- C - Thymus
- D - Heart
- E - Lung

41. Write notes on Adenoids.

- * Adenoids are **antibody** producing **glands**.
- * They are **located** in the roof of the **mouth**, behind the soft palate where the **nose** connects to the **throat**.
- * They produce **antibodies** to fight against **infections**.
- * They **shrink** during **adolescence**.
- * They **disappear** by **adulthood**.

42. Write a note on lymph node.

1. Lymph node is a **secondary lymphoid organ**.
2. It is a part of the **body's immune system**.
3. It is a **small bean-shaped** structure.
4. It is packed **tightly** with **white blood cells**, namely **lymphocytes** and **macrophages**.
5. **Lymph** passes through lymph node.
6. It is the **first one** to encounter the **antigen** that enters the tissue spaces.

* It **filters** and **traps** pathogens that **travel** through the **lymph**.

7. The lymph, leaving the lymph **node** carries **antibodies** secreted by plasma cells against pathogens.

43. Define antibody affinity.

Strength of antigen-antibody reaction between a single **antigenic determinant** and a single **combining site** of the **antibody**.

44. Define vaccination.

- * Process of **administering** a **vaccine** into the body.
- * Act of **introducing** a **vaccine** into the body to produce **immunity** to a specific **disease**.

45. Define allergy.

- * Allergy-*allo*-altered, *erg*-reaction.
- * Exaggerated **response** of the **immune system** to certain **antigens** present in the environment.
- * It is a **hypersensitivity reaction**.
- * It is caused by **allergen**.
- * It is a form of **over active immune response** mediated by
 - IgE
 - Mast cells
- * It is also due to the release of the following substances by mast cells:
 - **Histamine**
 - **Serotonin**

46. Define allergen.

- * An **antigen** that causes an **allergic reaction**.
- * Substances to which an **over active immune response** is produced.
- * Eg. ☞ **Mites**
- ☞ **Pollen**

47. What is digenic organism? Give example.

An **organism** which completes its life cycle in **two hosts** is said to be digenic.

Plasmodium vivax completes its life cycle in *Anopheles* mosquito and man.

Female *Anopheles* mosquito - Primary host; Man - Secondary host

Eg. *Plasmodium vivax*

48. Write the symptoms of allergic reactions.

- ☞ Sneezing
- ☞ Watery eyes
- ☞ Running nose
- ☞ Difficulty in breathing

49. What are the organisations involved in AIDS awareness programme?

WHO - World Health Organisation

NACO - National AIDS Control Organisation

NGO - Non-Governmental Organisation

50. Some allergens trigger sneezing and wheezing in human beings. What causes this type of response by the body.

☛ Hypersensitivity - overactive immune response.

- ☛ **Production** of **IgE** type antibody.
- ☛ Production of **mast** cells.
- ☛ Release of chemicals like **histamine** and **serotonin**.

51. Name two plants with hallucinogenic properties.

1. *Atropa belladonna*
2. *Datura*

52. Name some drugs used to treat depression.

1. Methamphetamine

2. Amphetamines

3. Barbiturates

4. Tranquilizers

5. Lysergic acid diethylamide (LSD)

53. How does smoking tobacco causes oxygen deficiency in the body?

☛ It increases **carbon monoxide** content in blood.

☛ This **reduces** the **concentration of haem-bound oxygen**.

☛ This causes **oxygen deficiency** in the body.

54. Name the drugs which slow the activity of the brain.

Depressants like

1. Alcohol
2. Barbiturates
3. Tranquilizers

55. Write notes on Heroin.

1. Heroin is also called **smack**.
2. It is chemically **diacetyl morphine**.
3. It is a **white, odourless** and **bitter crystalline** compound.
4. It is obtained by **acetylation of morphine**.

56. Name an opioid drug and its source plant. How does the drug affect the human body?

Opioid Drug

Heroin

Source Plant

Poppy plant

Effect on Users

1. Heroin is a **depressant**.
2. It **slows** down the **body functions**



Fig. Dendritic cell.

2. These extensions resemble **dendrites** of **nerve cells**.
3. They are **antigen presenting cells**.
4. They present antigen to T-helper cells.
5. They are four types:
 1. *Langerhans cells*

2. *Interstitial cells*

3. *Myeloid cells*

4. *Lymphoid cells*

112. Write notes on Metastasis?

- Metastasis means **spreading of cancer cell** to **other parts** of the body.
- It gives rise to **secondary tumour**.

113. Define Anaphylaxis.

- **Immediate** hypersensitivity reaction.
- Occurs as a result of rapid generalized **mast cell degranulation**.
- It is a
 - Sudden
 - Systemic
 - Severe and
 - Immediate allergy

Additional Solved Questions - 3 Marks

1. List the viral diseases in human and give their causative organisms.

1. Common cold - Rhino virus
2. Measles - Rubella virus
3. Mumps - Mumps virus
(Paramyxovirus)
4. Viral hepatitis - Hepatitis-B virus
5. Dengue fever - Flavi virus
6. Chikungunya - Toga virus/
Alpha virus
7. Chicken pox - Varicella-zoster
virus
8. Poliomyelitis - Polio virus

2. Which viral disease causes paralysis? Write about it.

Poliomyelitis

Causative Agent

Polio virus-RNA virus

Site of Infection

- Intestine
- Brain
- Spinal cord

Mode of Transmission

- ☞ Droplet infection
- ☞ Faecal -Oral route

Symptoms

- ☞ Fever
- ☞ Muscular stiffness
- ☞ Muscular weakness
- ☞ Paralysis
- ☞ Respiratory failure

3. Write notes on personal hygiene.

- Maintaining one's body clean
- It includes activities like
 - ★ *Bathing*
 - ★ *Washing hands*

- ★ *Trimming finger nails*
- ★ *Wearing clean clothes*
- ★ *Keeping the surfaces in home and work place clean and pathogen free*
- ✦ Toilets and bathrooms should be clean and pathogen free

4. What is the protozoan disease causing stools with excess mucous? Write about it?

Amoebiasis

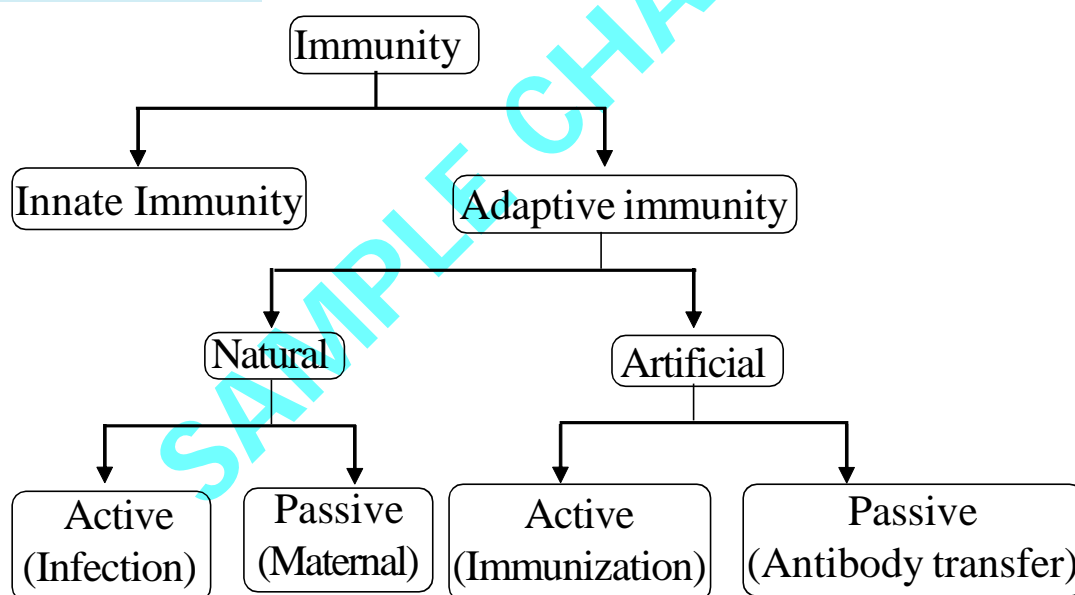
- ✦ It is a **protozoan disease**.
- ✦ **Amoebic dysentery** or **Amoebic colitis**.

- ✦ Caused by a protozoa, ***Entamoeba histolytica***
- ✦ ***Entamoeba histolytica*** lives in the **large intestine** of humans.
- ✦ It feeds on **food particles** and **bacteria**.
- ✦ Infective stage is **trophozoite**.
- ✦ **Trophozoite penetrates** the walls of the **host intestine** (colon).
- ✦ Secretes **histolytic enzymes**.

Symptoms

- ✦ Diarrhoea
- ✦ Ulceration
- ✦ Dysentery
- ✦ Bleeding
- ✦ Abdominal pain
- ✦ Stool with excess mucus

5. Classify immunity.



6. Name the three species of *Trypanosoma* causing sleeping sickness in man.

Species	Transmission	Disease
1. <i>T.gambiense</i>	<i>Glossina palpalis</i> (Tsetse fly)	Gambian (or) Central African sleeping sickness
2. <i>T.rhodesiense</i>	<i>Glossina morsitans</i>	Rhodesian (or) East African sleeping sickness
3. <i>T.cruzi</i>	<i>Triatoma megista</i>	Chagas disease (or) American trypanosomiasis

7. Write a note on innate immunity.

* **Natural** phenomenon of **resistance** to **infection**.

* An individual possesses it from **birth**.

* Innate **defense mechanisms** are **non-specific**.

* They are effective against a **wide range** of **infectious agents**.

* Innate immunity is of the **following types**:

1. Anatomical - Skin, barriers *Mucus membrane*
2. Physiological - Temperature barriers Low pH Chemical mediators
3. Phagocytic - Monocytes, barriers Neutrophils, Macrophages
4. Inflammatory- Serotonin barriers Histamine Prostaglandins

8. What is the bone marrow equivalent lymphoid organ of birds? Mention its location and role.

Bone Marrow Equivalent

Lymphoid Organ

Bursa of Fabricius

Location

Attached to the **dorsal side** of the **cloaca**.

Role

* **B-lymphocytes** **mature** in the bursa.

* They bring **humoral immunity**.

9. What are Peyer's patches.

* **Oval** shaped areas of **thickened tissue** embedded in the **mucus-secreting** lining of the **small intestine** of **human** and **vertebrates**.

* **Secondary lymphoid** organ.

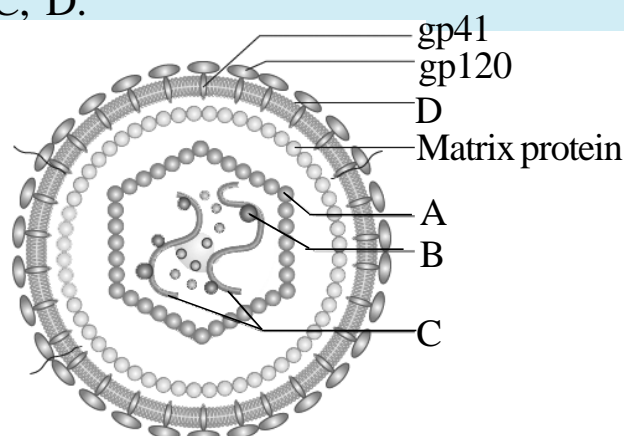
* Peyer's patches contain

- *Variety of immune cells*
- *Macrophages*
- *Dendritic cells*
- *T-cells*
- *B-cells*

10. What are the chief applications of antigen-antibody reactions?

1. To **determine blood groups**.
2. To study **serological ascertainment** of exposure to infectious agents.
3. To develop **immunoassays** for the quantification of various substances.
4. To detect the **presence** or **absence** of **protein** in **serum**.
5. To determine **immunodeficiency diseases**.

11. Identify the figure and label A, B, C, D.



Identification: HIV

A - Capsid protein

B - Reverse transcriptase

C - Single stranded RNA

D - Lipid bilayer

12. How is cancer treated by immuno-therapy.

- Immunotherapy is also called **biological therapy**.

- It is a type of **cancer treatment**.

- Monoclonal antibodies** are used to improve or restore **immune system** function.

- Immunotherapy is important in getting rid of the **malignant cells**.

- It is used after the **tumour** has been **removed**.

13. Write down the scopes of Immunology.

- Immunotherapy
- Microbial immunology
- Clinical immunology
- Cellular immunology
- Allergy and immunology
- Translational immunology
- Transplantation immunology
- Neuro-inflammatory disorders
- Tumour immunology
- Vaccine immunology
- Inflammatory disorders
- Ocular immunology and inflammation

14. Write notes on Bone marrow.

- Primary lymphoid organ**
- Bone marrow is a **lymphoid tissue**.
- It is found within the **spongy portion** of the **bone**.
- It contains **stem cells** known as **haematopoietic cells**.
- These cells **multiply** through **cell division**.
- They either **remain** as stem cells

or **differentiate** and mature into different blood cells.

7. **B** and **T lymphocytes** are produced in the bone marrow.

8. **B cells** stay in the bone marrow until they **mature**.

9. **T cells** leave the bone marrow and mature in the **thymus**.

15. How skin and mucus membrane act as barriers for infections?

Skin

Skin is an anatomical barrier of **innate immunity**.

- Prevents** the **entry** of **microbes**.

- It provides **acidic** environment with pH 3 - 5. It retards the growth of microbes

Mucus Membrane

Mucus is an **anatomical barrier** of **innate immunity**.

- It **entraps** foreign **microorganisms**.

- It **competes** with **microbes** for attachment.

16. What is diapedesis?

- The **leakage** of vascular fluid with **leucocytes** through the capillaries in the inflammatory areas is called **diapedesis**.

- The vascular fluid contains the following **chemotactic signals**:

- Serotonin
- Histamine
- Prostaglandins

- The chemotactic signals influx the **phagocytic cells** into the affected area.

- It occurs during **tissue damage** and **infections**.

- It is an *innate immunity*.
- It is an *inflammatory barrier*.

17. How does immunodeficiency occur? What are its types?

Immunodeficiency

Immunodeficiency results from the failure of one or more components of the *immune system*.

Types

1. *Primary immune deficiencies* are caused by

- *Genetic developmental defects*

2. *Secondary immune deficiencies* are caused by

- *Use of Cytolytic drugs*
- *Use of Immunosuppressive drugs*
- *Infections*
- *Radiation*

18. How to prevent AIDS.

- Safe sex
- Promoting regular check-up
- Safe *blood transfusion*
- Use of *disposable needles*
- *Use of condoms* during sexual contact
- AIDS awareness programme

19. Classify and explain autoimmune diseases

Classification of Autoimmune Diseases

1. *Organ specific autoimmune diseases*
2. *Non-organ specific autoimmune diseases*

1. Organ Specific Autoimmune Diseases

+ *Auto immune process* is directed against one *organ*.

+ *Auto antibodies* may *block* the functions performed by that *organ*.

- + Eg. 1. *Hashimoto's thyroiditis*
- 2. *Graves' disease*
- 3. *Addison's disease*

2. Non-organ Specific Autoimmune Diseases

• It is also known as *systemic* diseases.

• *Autoimmune* activity spreads throughout the body.

- Eg. 1. *Rheumatoid arthritis*
- 2. *Multiple sclerosis*

20. Name the plant source of Cannabinoids. What are natural cannabinoids and give its effects?

Plant Source

Cannabis sativa-Indian hemp plant

Natural Cannabinoids

1. Marijuana
2. Ganja
3. Hashish
4. Charas

Effects

1. Cannabinoids interfere in the *transport* of *neurotransmitter* and *dopamine*.

2. They stimulate the action of *central nervous system*.

3. They produce *increase energy* and sense of *euphoria*.

21. How does alcohol act in human body?

- Alcohol is a *psychoactive drug*.
- It acts on *brain*.
- It affects a person's *mind* and *behaviour*.
- It acts as a *depressant*.
- It *slows* down the activity of *nervous system*.

22. Differentiate Malignant and Benign tumour.

Malignant Tumour	Benign Tumour
1. Cancerous 2. Harmful tumours 3. Spread to other body parts. 4. They invade cells. 5. They grow rapidly . 6. They are larger in size. 7. Cell growth and differentiation is not controlled .	1. Non-cancerous 2. Harmless tumours 3. Do not spread to other body parts. 4. They do not invade cells. 5. They grow at slow rate . 6. They are small in size. 7. Cell growth and differentiation is controlled .

23. What is the immune response which produce antibodies immediately? Explain.

Immune Response

Secondary immune response (or) Booster response.

Secondary Immune Response

1. Secondary immune response occurs when a person is **exposed** to the **same antigen** again.

2. It is the result of **immunological memory**.

3. The immune system starts producing **antibodies immediately**.

4. After recognition of **antigen**, new army of **plasma cells** are **generated**.

5. Within 2-3 days, the **antibody concentration** in the blood **rises steeply**.

6. It reaches much **higher level** than **primary response**.

7. **Antibody** level remains for **longer period**.

8. Secondary immune response occurs in the **bone marrow**.

9. This is also called as "**booster res-**

ponse".

24. Expand the following: 1. MALT
2. CMI 3. AIDS 4. NACO 5. HIV

1. MALT - Mucosal Associated Lymphoid Tissue
2. CMI - Cell Mediated Immunity
3. AIDS - Acquired Immuno Deficiency Syndrome
4. NACO - National AIDS Control Organisation
5. HIV - Human Immuno-deficiency Virus

25. List the effects of alcohol during adolescence.

1. Alcohol **produces excess acid** in stomach.
2. Alcohol affects the ability of the **liver** to **breakdown fat**.
3. It leads to the following:
 - Irritation of the stomach lining
 - Ulcers.
 - **High blood pressure**
 - **Stroke**
 - **Coronary artery disease**
 - **Heart attack**

• **Korsakoff syndrome-Chronic memory disorder**

4. **Destruction of liver cells.**

5. "**Liver cirrhosis**" scar tissue grows in the place of dead liver cells.

26. What role does Helper T-cells and Killer T-cells play?

Helper T-Cells

1. Helper T-cells **release** a chemical called **cytokine**.

2. Cytokine activates **B cells**.

Killer T-Cells

1. Killer T-cells **move** around the body.

2. They **destroy** the **damaged** or **infected** cells.

27. How bacteria develop resistance to antibodies? How bacterial resistance can be reduced?

Bacterial resistance

1. If an antibiotic is used too often to

fight a specific bacterial infection, the bacteria may become resistant to the specific antibiotic.

2. Hence the specific antibiotic can no longer be used to treat the bacterial infection.

3. Some bacteria have developed resistance to many antibiotics. Therefore, infections caused by these bacteria are difficult to be cured.

Reducing Bacterial Resistance

1. Avoid using **antibiotics** to treat **minor infections**.

2. Do not use **antibiotics** to treat viral infections.

3. Complete the prescribed doses.

4. **Skipping doses** or **failing to complete** the prescription doses may allow **antibiotic resistance** to **develop**.

Eg. Common cold or flu.

28. Differentiate Amoebic dysentery and Bacillary dysentery.

Amoebic dysentery	Bacillary dysentery
1. Protozoan disease	1. Bacterial disease
2. Amoebiasis	2. Shigellosis
3. Caused by <i>Entamoeba histolytica</i> .	3. Caused by <i>Shigella</i> sp.

29. Give the difference between B-lymphocytes and T-lymphocytes.

B-Lymphocytes	T-Lymphocytes
1. B-cells	1. T-cells
2. B-lymphocytes mature in the bone marrow .	2. T-lymphocytes mature in the thymus .
3. They produce antibodies .	3. They do not produce antibodies .
4. They are activated by T-cells .	4. They are activated by antigen-presenting cells .
5. Produce plasma cells.	5. Do not produce plasma cells.

30. Name the disease caused by round worm. List their symptoms.

Disease

Ascariasis

Symptoms

- Abdominal pain
- Vomiting
- Headache
- Diarrhoea
- Anaemia
- Irritability
- Nutritional deficiency
- Enteritis
- Hepatitis
- Bronchitis
- Heavy infection leads to stunted growth.

31. What is MALT? State its importance.

MALT

- Mucosa Associated Lymphoid Tissue
- It is a diffuse system of **lymphoid tissue**. It is present in
 - **Respiratory tract**
 - **Digestive tract**
 - **Urogenital tract**

Importance of MALT

1. It is rich in the following **lymphocytes**:

- ☞ *T cells*
- ☞ *B cells*
- ☞ *Plasma cells*
- ☞ *Macrophages*

2. MALT **regulates immune response** to specific antigens encountered along **mucosal epithelium**.

32. Write the possible preventive measures for malaria.

1. **Killing** the insect vector.
2. **Spray oil** over the water.
3. *Bacillus thuringiensis* culture can be sprayed to **kill** mosquito larvae.
4. Stocking water bodies with fishes such as **Gambusia**, that feeds on mosquito larvae.
5. Avoid **mosquito bites**.
6. Use **mosquito nets, wire gauging of windows and doors**.

33. Differentiate between humoral immunity and cell-mediated immunity.

Humoral Immunity	Cell-mediated Immunity
1. Humoral immunity produces antibodies. 2. B-cells mediate this immunity. 3. Pathogens are destroyed by antibodies .	1. Cell mediated immunity does not produce antibodies . 2. T-cells mediate this immunity. 3. Pathogens are destroyed by macrophages and natural killer cells .

34. Differentiate infectious and non-infectious diseases.

Infectious Diseases	Non-infectious Diseases
1. Infectious diseases are transmitted from one person to another. 2. They are transmitted through air, water, food, physical contact or vector 3. Communicable diseases. 4. They are caused by pathogens . 5. Eg. ☞ <i>Malaria</i> ☞ <i>Cholera</i> ☞ <i>Typhoid, etc.</i>	1. Non-infectious diseases are not transmitted from one person to another. 2. They are caused due to genetic, nutritional or degenerative problems. 3. Non-communicable diseases. 4. They are not caused by pathogens . 5. Eg. ☞ <i>Diabetes</i> ☞ <i>Cancer, etc.</i>

35. Which cell does a HIV virus initially invade? Give the other cell where HIV replication takes place? How many days can it survive? List the routes of transmission.

Initial invasion of HIV

Macrophages

Other cell where replication occurs

Helper T- lymphocytes

Survival of HIV

- ❖ **1.5 days** inside a cell.
- ❖ **6 hours** outside a cell.

Routes of Transmission

1. Unsafe sexual contact
2. Blood contaminated needles
3. Organ transplants
4. Blood transfusion
5. Vertical transmission from HIV infected mother to child.

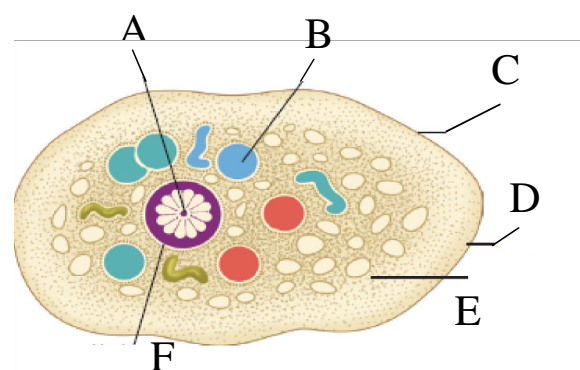
36. Point out the factors that determine binding force of antigen-antibody reaction.

1. Closeness between antigen and

antibody.

2. Non covalent bonds or inter-molecular forces
3. Affinity of antibody

37. (i) Identify the given diagram and label the parts A to F.



(ii) Name the disease which it causes

(i) Identification : *Entamoeba histolytica*

- A - Endosome
- B- Food vacuole
- C - Plasmalemma
- D - Ectoplasm
- E - Endoplasm

F - Nucleus

(ii) Amoebiasis

38. Alcohol abuse during adolescence damages the liver. Name the disease and explain.

Disease

Liver cirrhosis

Explanation

1. Use of **alcohol** during **adolescence** may lead to liver **cirrhosis**.

2. Alcohol interferes with the ability of liver to **break down fat**.

3. Fat **accumulates** in the liver.

4. Accumulated fat and alcohol **destroy** the **liver cells**. The liver cells **die**.

5. The dead cells are replaced by the growth of **scar tissues**.

6. Scarring of liver is called liver cirrhosis.

39.(i) What is antigen antibody reaction?

(ii) Write the stages of antigen antibody reaction.

(i) The reaction between an antigen and antibody is called antigen antibody reaction.

(ii) The reaction between an antigen and antibody is the basis for humoral immunity or antibody mediated immunity.

The reaction between antigen and antibody occurs in **three** stages.

During the first stage, the reaction involves the formation of **antigen - antibody complex**.

The next stage, leads to **visible events**

like **precipitation, agglutination**, etc.

The final stage includes **destruction** of antigen or its **neutralization**.

40. (i) What is the bond that hold the antigen to the antibody combining site.

(ii) What are types of bonds?

(i) **Covalent bond** hold the antigen to the antibody.

(ii) The covalent bonds include

1. **Hydrogen bonds**

2. **Electrostatic bonds**

3. **Van der Waals forces**

4. **Hydrophobic bonds**

41. What are the applications of antigen antibody reaction.

1. To determine **blood groups** for transfusion.

2. To study serological ascertainment of exposure to infectious agents.

3. To develop **immunoassays** for the quantification of various substances.

4. To detect the presence or absence of protein in serum.

5. To determine the characteristics of certain immunodeficiency **diseases**.

42. What is the reaction between particulate antigen and antibody? Write about it with a diagram.

Agglutination reaction

Agglutination Reaction

The reaction between particulate antigen and antibody is called **agglutination reaction**.

It results in **clumping** or **agglutination** of antigens.

Eg. Reaction between bacteria and antibody.

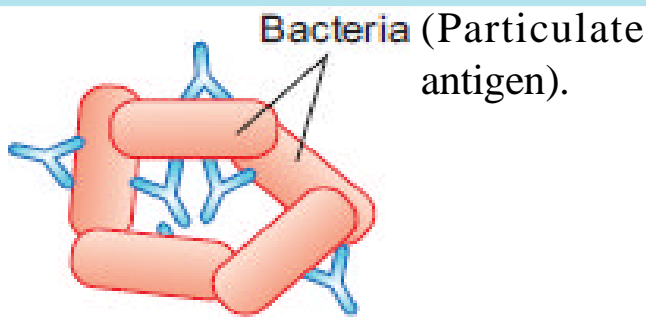


Fig. Agglutination.

43. What happens when a soluble antigen is mixed with an antibody? Illustrate this with a diagram.

When a soluble antigen is mixed with an antibody, a visible **precipitate** is formed.

This reaction is called **precipitation reaction**.

The antibody, producing precipitate, is called **precipitin**.

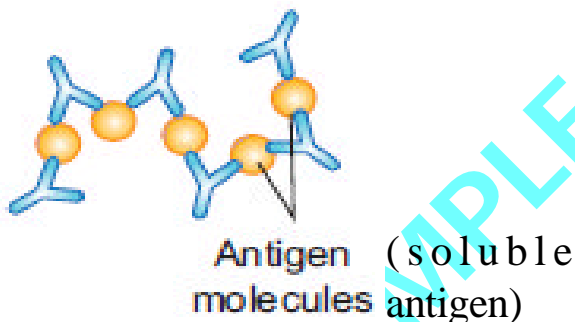


Fig. Precipitation.

44. (i) What is a vaccine?
(ii) What is its role?

(i) Vaccine

A vaccine is a **biological preparation that provides active acquired immunity** to a particular disease.

It resembles a disease-causing microorganism.

It is made from

- Weakened microbes
- Attenuated microbes
- Killed microbes

- Toxins of microbes
- Surface proteins of microbes

Role of Vaccines

Vaccines “**teach**” our body how to defend itself when viruses or bacteria, invade it.

45. Vaccines are preparations of pathogenic organism used to prevent infection?. Why they do not cause disease in human?

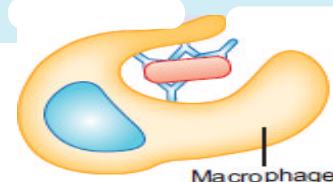
1. Disease causing organisms are **killed**.
2. They are **inactivated killed**.
3. They are **weakened**.
4. They are **attenuated**.
5. Microbe’s **toxins** are used.
6. **Surface proteins** of microbes are used.
7. They are used in **very little amount**.

This allows the immune system to recognize the organism **without actually experiencing the disease**.

46. (i) Identify the figure.

(ii) Explain the process.

(iii) What are the cells involved in this process.



(i) Phagocytosis

(ii) Specialised cells engulf and digest pathogens. It is called **phagocytosis**. The cells are called **phagocytes**.

- (iii)**
- ✦ Macrophages
 - ✦ Monocytes
 - ✦ Neutrophils

Additional Solved Questions - 5 Marks

1. Differentiate Active immunity and Passive immunity.

Active Immunity	Passive Immunity
1. Active immunity is produced actively by host's immune system. 2. It is produced due to contact with pathogen or by its antigen . 3. It is durable and effective in protection. 4. Immunity is effective only after a short period . 5. Immunological memory is present . 6. Booster effect on subsequent dose is possible.	1. Passive immunity is received passively . 2. It is produced due to antibodies obtained from outside. 3. It is transient and less effective . 4. Immunity develops immediately . 5. Immunological memory is not present. 6. Subsequent dose is less effective .

2. Give the difference between primary immune response and secondary immune response.

Primary Immune Response	Secondary Immune Response
1. It occurs as a result of primary contact with an antigen . 2. Antibody level reaches peak in 7-10 days. 3. It requires a long period to develop immunity. 4. Antibody level declines rapidly . 5. It appears in lymph nodes and spleen .	1. It occurs as a result of second and subsequent contacts with the same antigen. 2. Antibody level reaches peak in 3-5 days. 3. It establishes immunity in a short time . 4. Antibody level remains high for longer period. 5. It appears mainly in bone marrow followed by spleen and lymph nodes.

3. Which gland secretes thymosin? Explain its structure and function.

Thymosin Secreting Gland

- * Thymus

Structure

- * Thymus is a **primary lymphoid** organ.
- * Thymus is a **flat** and **bilobed** organ.

* Located **behind** the **sternum**, **above** the **heart**.

* Each lobe of the thymus contains numerous **lobules**.

* These lobules are separated from each other by **septa**.

* Septa are formed of **connective tissue**.

* Each lobule is differentiated into **two compartments** namely:

1. **Cortex** - Outer compartment

2. **Medulla** - Inner compartment

* **Cortex** is the outer compartment.

It is densely **packed** with **immature T-cells** called **thymocytes**.

* **Medulla** is the inner compartment. It is sparsely populated with **thymocytes**.

* In early teens, thymus begins to **atrophy** and is **replaced** by **adipose tissue**.

* It is most active during **neonatal** and **pre-adolescent** periods.

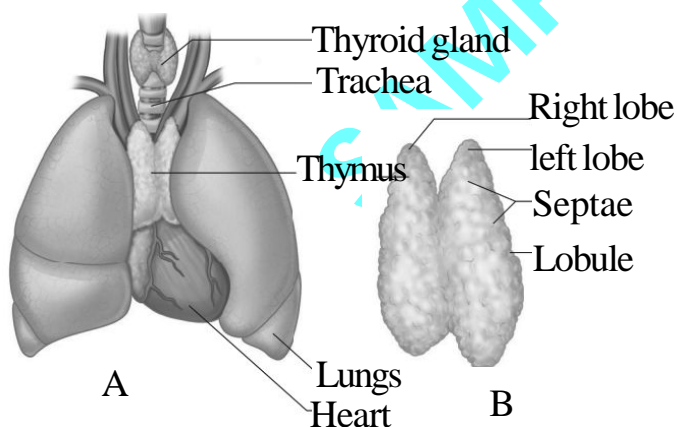


Fig: Thymus. A - Location B - Structure

Functions

* Thymus secretes **Thymosin**.

* Thymus stimulates the T-cell to become **mature** and **immuno-competent**.

4. Which disease is caused by HIV?
Explain the structure of HIV.

Disease Caused by HIV

AIDS-Acquired Immuno Deficiency Syndrome

Structure of HIV

1. HIV is a **RNA virus**.
2. It belongs to the genus **Lentivirus**.
3. HIV is **spherical** in shape.
4. It is about **100-120 nm** in diameter.
5. It has the following components
 - i) Envelope
 - ii) Matrix protein
 - iii) Capsid
 - iv) Core
6. HIV is surrounded by a **lipoprotein envelope**.
7. Envelope has **glycoprotein spikes**.
8. Glycoprotein spikes are **gp41** and **gp 120**.

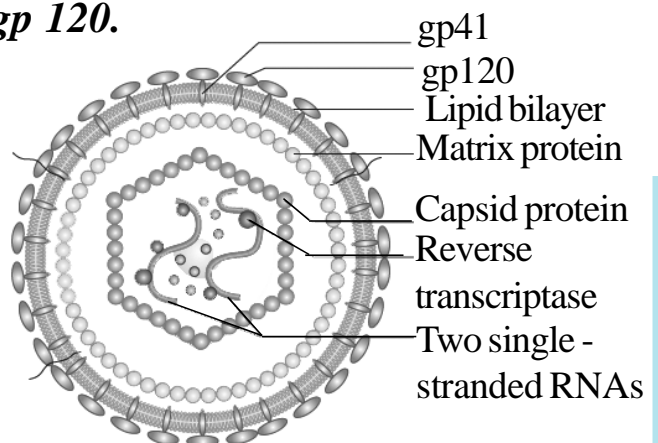


Fig: Structure of HIV

9. Below the envelope, a layer of **matrix protein** is present.

10. **Capsid** is present inner to the matrix protein.

11. Capsid is made up of **protein subunits**.

12. A dense core is present inner to the capsid

13. The core contains *two single stranded RNA* and *reverse transcriptase* enzyme.

14. The RNA contains the enzyme *protease* and *ribonuclease*.

5. Name the stage of *Plasmodium* that is transmitted to human body by the vector. Describe the life cycle of the parasite in human.

Stage of *Plasmodium*

Sporozoite stage of *Plasmodium* is transmitted to human by the vector.

Life Cycle of

Plasmodium in Human

1. *Anopheles* mosquito contains *sporozoites* in its *salivary gland*.

2. When it bites, *sporozoites* are injected into the *blood of human*.

3. It is carried by *blood* to the *liver cells*.

4. In liver, they undergo multiple *asexual fission* known as *schizogony*.

5. They produce *merozoites*.

6. *Merozoites* are *released* from the *liver cells*.

7. They *penetrate* the *RBCs*.

8. Inside the RBC, the merozoite begins to develop as *unicellular trophozoites*.

9. *Trophozoite* grows in *size* and a *central vacuole* develops.

10. As the vacuole increases in size, the *nucleus* is pushed to one side of

cytoplasm and becomes the *signet ring stage*.

11. The *nucleus* divides *asexually* to produce the *schizont*.

12. Large schizont shows *yellowish brown pigmented granules*. They are called *Schuffners granules*.

13. Schizont *divides* and produces *mononucleated merozoites*.

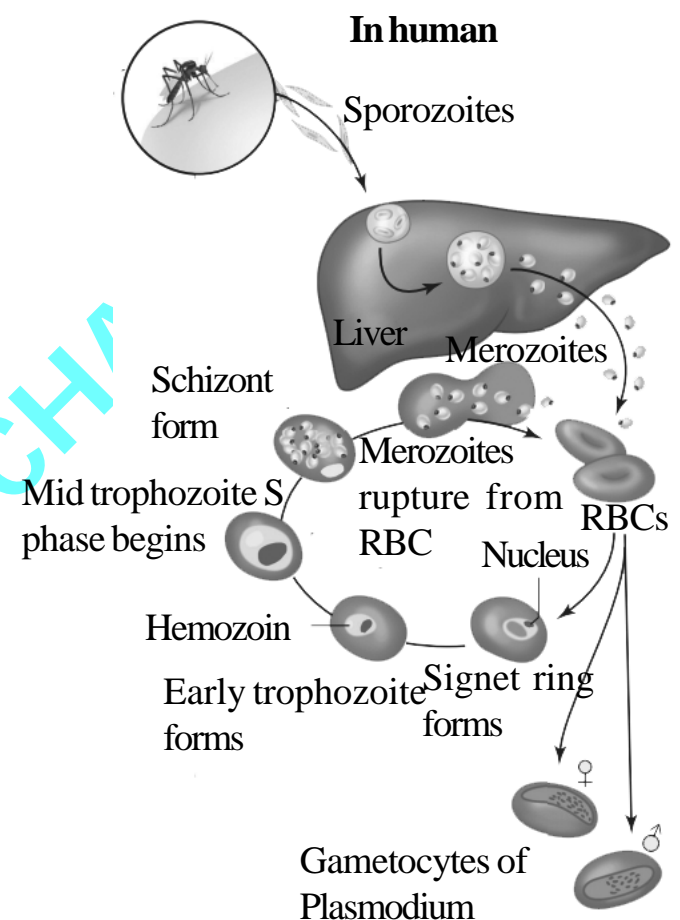


Fig. Life cycle of *Plasmodium* in man.

14. Finally the *erythrocyte lyses*, releasing *merozoites* and *haemozoin* toxin into the blood.

15. Sudden *release* of merozoites *triggers* an attack on *RBCs*.

16. Merozoites also *infect* other *erythrocytes*.

17. **Lysis** of **red blood cells** results in cycles of fever and other symptoms.

18. This is known as **erythrocytic cycle**.

19. Erythrocytic cycle repeats every 48 - 72 hrs.

20. Occasionally, **merozoites** differentiate into **microgametocytes** and **macrogametocytes**.

21. During mosquito bite, these **gametocytes** are ingested by the mosquito.

6. In which host, sexual phase of life cycle of *Plasmodium* occurs? Explain.

Host

Mosquito - Primary host

Sexual phase of life cycle of Plasmodium

1. When the female *Anopheles mosquito* bites a man, the **male** and **female gametocytes** of the parasite enter into the **gut** of the **mosquito**.

2. In the gut, infected **erythrocytes lyse**.

3. Macrogametocyte becomes **macrogamete** (female gamete).

4. Microgametocyte becomes **microgamete** (male gamete) by **exflagellation**.

5. Male and female gametes **fertilize** to form a **diploid zygote**.

6. The Zygote becomes elongated to form **ookinete**.

7. Ookinete **migrates** to the mosquito's gut wall.

8. It **develops** into **oocyst**.

9. Oocyst undergoes **meiosis** by a process called **sporogony**.

10. It produces **sporozoites**.

11. These sporozoites **migrate** to the **salivary glands** of the mosquito.

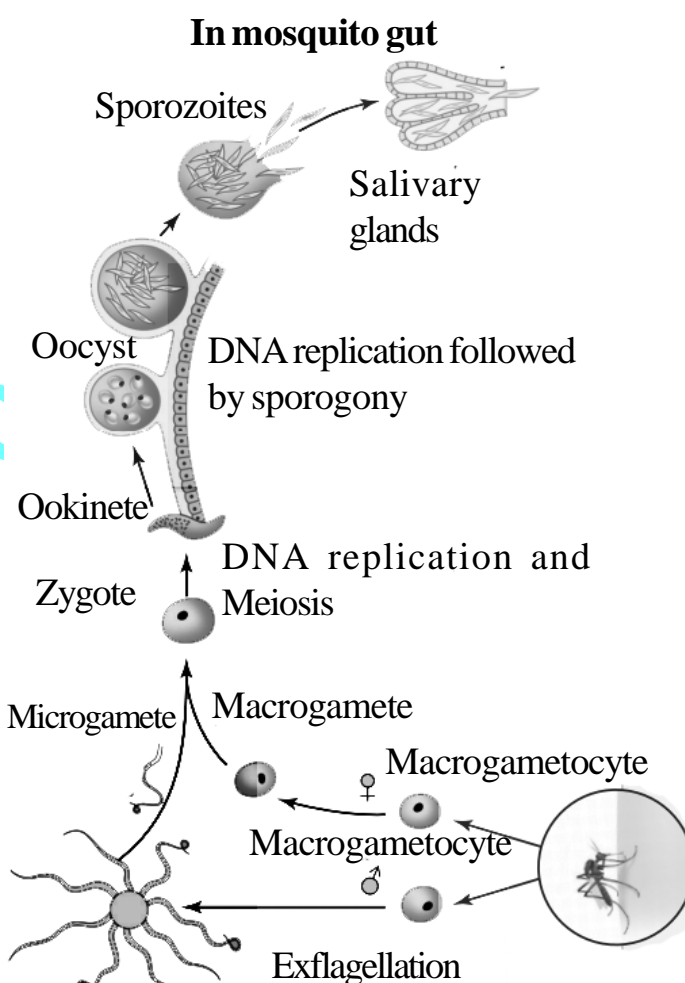


Fig. Life cycle of *Plasmodium* in mosquito.

7. Give the differences between normal cells and cancer cells.

Normal Cells	Cancer Cells
1. Small cells	1. Large cells.
2. Nuclei is uniform in shape.	2. Nuclei is variable in shpae.
3. Large cytoplasmic volume.	3. Small cytoplasmic volume.

Normal Cells	Cancer Cells
4. Conformity in cell size and shape. 5. Cells arranged into discrete tissues 6. May possess differentiated cell structures. 7. Normal presentation of cell surface markers. 8. Lower levels of dividing cells. 9. Cell tissues clearly demarcated.	4. Variation in cell size and shape. 5. Arrangement of cells are disorganised 6. Loss of normal specialized features. 7. Elevated expression of certain cell markers. 8. Large number of dividing cells. 9. Poorly defined tumor boundaries.

8. Write short notes on prevention and control for drug and alcohol abuse.

Some ways to prevent drugs and alcohol abuse are:

1. *Effectively dealing with peer pressure.*
2. *Seeking help from parents and peers.*
3. *Education and counselling*
4. *Looking for danger signs.*
5. *Seeking professional and medical assistance.*

1. Effectively Dealing with Peer Pressure.

1. Should have better group of friends to avoid friends / peer groups pressure.

2. Seeking Help from Parents and Peers

* *Seek help* from *parents* and *peer groups* for their *guidance*.

* Getting *proper advices* will *sort*

out the *problems*.

* Helps the young to *vent* their *feelings* of anxiety and guilt.

3. Education and Counselling

- To *create* positive attitude.
- To *deal* with many *problems*.
- To *accept disappointments* in life.

4. Looking for Danger Signs

Teachers and *parents* need to look for *danger signs* that indicate tendency to go in for *addiction*.

5. Seeking Professional and Medical Assistance

* *Medical assistance* from *psychologists* and psychiatrists *helps* individuals .

* *Deaddiction* and *rehabilitation programmes* help to overcome their problems.

