HUMAN HEALTH AND DISEASE

Good Humor Hypothesis

- Health, for a long time, was considered as a state of body and mind where there was a balance of certain 'humors'. This is what early Greeks like **Hippocrates (Father of medicine)** as well as **Indian Ayurveda system** of medicine asserted.
- It was thought that persons with **'blackbile'** belonged to **hot personality and would have fevers.**
- The discovery of **blood circulation by William Harvey** using experimental method and the demonstration of normal body temperature in persons with blackbile using **thermometer disproved the 'good humor'** hypothesis of health
- In later years, biology stated that mind influences, through neural system and endocrine system, our immune system and that our immune system maintains our health. Hence, mind and mental state can affect our health.
- Health is affected by

(i) Genetic disorders – deficiencies with which a child is born and deficiencies/defects which the child inherits from parents from birth;
(ii) infections
(iii) life style including food and water we take, rest and exercise we give to our bodies, habits that we have or lack etc.

HEALTH

Health is a state of complete physical, mental and social well-being.

Advantage of good health

1. Good Health increases longevity of people
2. It reduces infant and maternal mortality.
3. A Person with good health possesses a good and pleasing personality
4. Healthy people are more efficient to work as compared to others. This increases the productivity and economic prosperity

How to achieve Good health

1. Balanced diet,
2. personal hygiene
3. Regular exercise
4. Practice Yoga to achieve physical and mental health.
5. Awareness about diseases and their effect on different bodily functions,
6. Vaccination (immunisation) against infectious diseases.
7. Proper disposal of wastes.
8. Control of vectors .
9. Consumption of hygienic food and water resources .

DISEASE

When the functioning of **one or more** organs or systems of the body is adversely affected, characterised by various signs and symptoms, we called it as disease.

Diseases can be broadly grouped into **infectious and non-infectious.**

1-Infectious disease

Diseases which are easily transmitted from one person to another are called infectious diseases.
Eg : **AIDS**

2-Non infectious disease

Diseases which are not easily transmitted from one person to another
Eg : **cancer ,Goitr,ulcer**

Pathogens

The disease causing organisms are called pathogens.
Eg: Bacteria, Virus,Protozoan, Helminthes, Fungus

- Pathogens as they cause harm to the host by living in (or on) them. The pathogens can enter our body by various means, multiply and interfere with normal vital activities, resulting in morphological and functional damage

Adaptations of pathogens

- Pathogens have to adapt to life within the environment of the host.
- For example, the pathogens that enter the gut must know a way of surviving **in the stomach at low pH and resisting the various digestive enzymes**.

COMMON DISEASES IN HUMANS

A) Bacterial disease

It include

- Typhoid fever,
- Pneumonia,
- Dysentery,
- Plague,
- Diphtheria,

a) Typhoid fever

- **Pathogen :**
  Salmonella typhi
- **Part of the body it infect** :
  These pathogens generally enter the **small intestine through food and water** contaminated with them and migrate to other organs through blood.
- **Symptoms :**
  - **Sustained high fever (39° to 40°C),**
  - weakness,
  - Stomach pain,
  - Constipation,
  - Headache
  - Loss of appetite.
  - **Intestinal perforation and death may occur in severe cases.**
- **Spread :**
  Contaminated food and water
- **Test :**
  Typhoid fever could be confirmed by **Widal test.**

Mary Mallon :

A classic case in medicine, that of **Mary Mallon** nicknamed **Typhoid Mary**, is worth mentioning here. She was **a cook by profession** and was a typhoid carrier who continued to spread typhoid for several years through the food she prepared

b) Pneumonia

- **Pathogen :**
  Streptococcus pneumonia
  Haemophilus influenza
- **Part of the body it infect:**
  Alveoli (air filled sacs) of the lungs. As a result of the infection, the alveoli get filled with **fluid** leading to severe problems in respiration.
- **Symptoms:**
  - Fever,
  - **Chills,**
  - Cough
  - Headache.
  - **In severe cases, the lips and finger nails may turn gray to bluish in colour.**
- **Spread:**
  It can be spread by
  - **Inhaling the droplets/aerosols released by an infected person**
  - By sharing glasses and utensils with an infected person.

B) Viral disease

It include

- Common cold,
- AIDS

a) Common cold

- **Pathogen :**
  Rhino viruses (It represent group of viruses which cause common cold).
- **Part of the body it infect :**
  Nose and respiratory passage **but not the lungs.**
- **Symptoms:**
  - Nasal congestion and discharge,
  - Sore throat,
  - Hoarseness,
  - Cough,
  - Headache,
  - Tiredness, etc.,

  These symptoms usually last for **3-7 days.**

- **Spread :**
  - Droplets resulting from cough or sneezes of an infected person are either inhaled directly
  - Transmitted through contaminated objects such as pens, books, cups, doorknobs, computer keyboard or mouse, etc., and cause infection in a healthy person.

b) Acquired Immuno Deficiency Syndrome (AIDS)

Introduction

- AIDS means, Deficiency of immune system, acquired during the lifetime of an individual indicating that it is **not a congenital disease**. 'Syndrome' means a group of symptoms.
- AIDS was first reported in **1981 in USA** and in the last twenty-five years or so, it has spread all over the world killing more than **25 million persons**.

- **Pathogen :**
  HIV (Human immuno deficiency virus). A member of a group of viruses called retrovirus, which have an envelope enclosing the RNA genome
- **Part of the body it infect :**
  Helper T lymphocyte/Immune system
- **Symptoms :**
  - Progressive **decrease in the number of helper T lymphocytes.**
  - During this period, the person suffers from bouts of **fever, diarrhoea and weight loss**..
  - Due to decrease in the number of helper T lymphocytes, the person starts suffering from infections that could have been otherwise overcome such as those due to bacteria especially **Mycobacterium, viruses, fungi and even parasites like Toxoplasma.**
  - The patient becomes so immuno-deficient that he/she is unable to protect himself/herself against these infections.
- There is always a time-lag between the infection and appearance of AIDS symptoms. This period may vary from a few months to many years **(usually 5-10 years).**

- **Spread :**
  Transmission of HIV-infection Generally occurs by
  (a) Sexual contact with infected person,
  (b) By transfusion of contaminated blood and blood products,
  (c) By sharing infected needles as in the case of intravenous drug abusers
  (d) From infected mother to her child through placenta.

Following individual are at high risk of getting HIV infections

1. **Individuals who have multiple sexual partners,**
2. **Drug addicts who take drugs intravenously,**
3. **Individuals who require repeated blood transfusions and**
4. **Children born to an HIV infected mother.**

Test :
Enzyme linked immune sorbent assay (ELISA)

Confirmatory test :
Western Blot

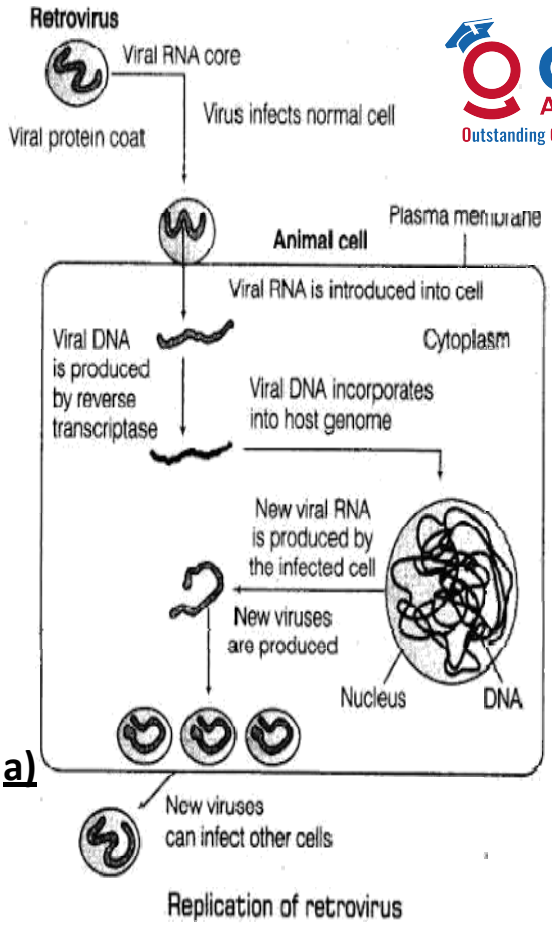
HIV/AIDS is not spread by mere touch or physical contact; **it spreads only through body fluids**. It is, hence, imperative, for the physical and psychological well-being, that the HIV/AIDS infected persons are not isolated from family and society.

Life cycle of HIV

- HIV is a **retro virus (RNA virus)**
- After getting into the body of the person the virus enters into **macrophages**
- Where RNA genome of the virus replicates to form viral DNA with the help of the **enzyme reverse transcriptase (RNA dependent dna polymerase)**
- This viral DNA gets incorporated into host cell's DNA and directs the infected cells to produce virus particles
- The **macrophages** continue to produce virus and in this way acts like a **HIV factory.**
- Simultaneously, HIV enters into **helper T-lymphocytes (T_H),** replicates and produce progeny viruses.

- The progeny viruses released in the blood attack other helper T-lymphocytes. This is repeated leading to **a progressive decrease in the number of helper T lymphocytes in the body of the infected person.**
- During this period, the person suffers from **bouts of fever, diarrhoea and weight loss**.

a)



Replication of retrovirus

Treatment of AIDS :

Treatment of AIDS with **anti-retroviral drugs** is only partially effective. They can only prolong the life of the patient but cannot prevent death, which is inevitable.

Prevention of AIDS :

As AIDS has no cure, prevention is the best option. Moreover, HIV infection, more often, spreads due to conscious behavior patterns and is not something that happens inadvertently, like pneumonia or typhoid. Of course, infection in blood transfusion patients, new-borns (from mother) etc., may take place due to poor monitoring. The only excuse may be ignorance and it has been rightly said – **"don't die of ignorance".**

- In our country the **National AIDS Control Organisation (NACO**) and other non-governmental organisation (NGOs) are doing a lot to educate people about AIDS. WHO has started a number of programmes to prevent the spreading of HIV infection.

1. **Making blood (from blood banks) safe from HIV,**
2. **Ensuring the use of only disposable needles and syringes in public and private hospitals and clinics,**
3. **Free distribution of condoms, controlling drug abuse,**
4. **Advocating safe sex and promoting regular check-ups for HIV in susceptible populations, are some such steps taken up. but cannot prevent death, which is inevitable.**

C) Protozoan disease

It include **Malaria and Amoebiasis**

Malaria

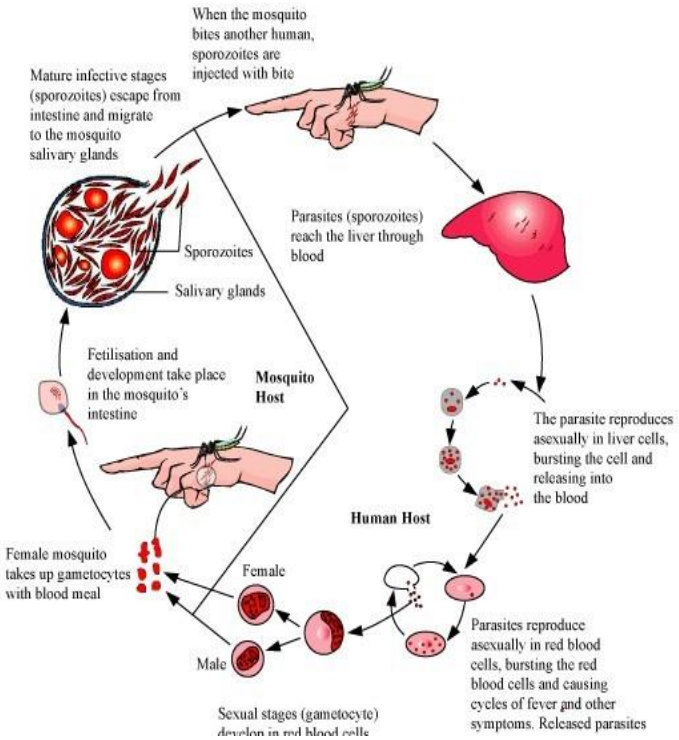
- **Pathogen** :
  - Plasmodium (a tiny protozoan)
  - Different species of Plasmodium (***P. vivax, P. malaria*** **and** ***P. falciparum***) are responsible for different types of malaria.
  - Of these, malignant malaria caused by ***Plasmodium falciparum*** is the most serious one and can even be **fatal.**
- **Part of the body it infect :**
  Liver, RBC
- **Symptoms :**
  - The rupture of RBCs is associated with release of a toxic substance, **haemozoin,** which is responsible for the chill and high fever **recurring** every three to four days
- **Spread :**
  Female Anopheles mosquitoes transmitting agent

Life cycle of Plasmodium

1. Plasmodium enters the human body as **sporozoites (infectious form)** through the bite of infected **female Anopheles mosquito.**
2. The parasites initially multiply within the liver cells and then attack the red blood cells (RBCs) resulting in their rupture.
3. The rupture of RBCs is associated with release of a toxic substance, **haemozoin**, which is responsible **for the chill and high fever recurring every three to four days**.
4. When a female Anopheles mosquito bites an infected person, these parasites enter the mosquito's body and undergo further development. The parasites multiply within them to form **sporozoites that are stored in their salivary glands.**
5. When these mosquitoes bite a human, the sporozoites are introduced into his/ her body, thereby initiating the events mentioned above.

- **It is interesting to note that the malarial parasite requires two hosts –**
  - **Human**
  - **Mosquitoes –**

  to complete its life cycle the female Anopheles mosquito is the vector (transmitting agent) too.
- **Malaria day=20th august**



b) Amoebiasis (Amoebic dysentery).

- **Pathogen :**
  Entamoeba histolytica
- **Part of the body it:**
  Large intestine of human
- **Symptoms :**
  - Constipation,
  - Abdominal pain
  - Cramps
  - **Stools with excess mucous and blood clots.**
- **Spread :**
  Houseflies act as mechanical carriers and serve to transmit the parasite f**rom faeces of infected person to food and food products**, thereby contaminating them. Drinking water and food contaminated by the faecal matter are the main source of infection

D) Helminth disease

It include

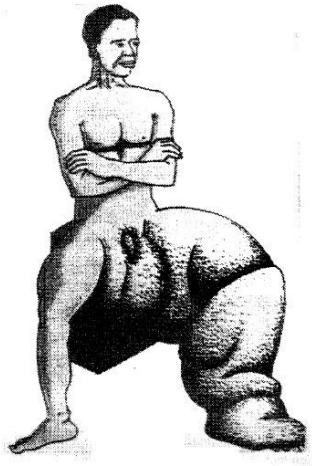
- Ascariasis
- Filariasis

a) Ascariasis

- **Pathogen :**
  Ascaris, (round worm)
- **Part of the body it infect :**
  Intestine
- **Symptoms :**
  - Internal bleeding,
  - Muscular pain,
  - Fever,
  - Anemia
  - Blockage of the intestinal passage.
- **Spread :**
  The eggs of the parasite are excreted along with the **faeces of infected persons** which contaminate soil, water, plants, etc. A healthy person acquires this infection **through contaminated water, vegetables, fruits, etc**

b) Fliariasis/Elephantiasis

- **Pathogen :**
  Wuchereria (W. bancrofti and W. malayi),
- **Part of the body it infect ;**
  The lymphatic vessels of the lower limbs .
  The genital organs are also often affected
- **Symptoms** :
  The filarial worms cause a slowly developing **chronic inflammation of the organs** in which they live for many years, usually the **lymphatic vessels of the lower limbs** and the disease is called elephantiasis or filariasis The genital organs are also often affected, **resulting in gross deformities.**
- **Spread:**
  The pathogens are transmitted to a healthy person through the bite by the **female mosquito vectors (Culex)**



E) Fungal disease

Ring worms

- **Pathogen :**
  Many fungi belonging to the genera **Microsporum, Trichophyton and Epidermophyton**

  Part of the body it infect :
  Skin, nails and scalp
- **Symptoms :**
  - Appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp are the main symptoms of the disease.
  - These lesions are accompanied by **intense itching.**
  - Heat and moisture help these fungi to grow, which make them thrive in skin folds such as those in the groin or between the toes.
- **Spread :**
  Ringworms are generally acquired from
  - **Soil**
  - **By using towels**,
  - **Clothes**
  - **Comb of infected individuals.**

PREVENTION AND CONTROL OF INFECTIOUS DISEASES

Maintenance of personal and public hygiene is very important for prevention and control of many infectious diseases

Personal hygiene

Measures for personal hygiene include

- Keeping the body clean;
- Consumption of clean drinking water, food, vegetables, fruits, etc.

Public hygiene

Public hygiene includes

- Proper disposal of waste and excreta;
- Periodic cleaning and disinfection of water reservoirs, pools, cesspools and tanks and observing standard practices of hygiene in public catering.

These measures are particularly essential where the infectious agents are transmitted **through food and water such as typhoid, amoebiasis and ascariasis**

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For air Borne disease

In cases of **air-borne diseases such as pneumonia and common cold**, in addition to the above measures, **close contact with the infected persons or their belongings should be avoided**

For vector borne disease

For diseases such as **malaria and filariasis** that are transmitted through insect vectors, the most important measure is **to control or eliminate the vectors and their breeding places**. This can be achieved By

- Avoiding stagnation of water in and around residential areas,
- regular cleaning of household coolers, use of mosquito nets,
- introducing fishes like **Gambusia** in ponds that feed on mosquito larvae,
- spraying of insecticides in ditches, drainage areas and swamps, etc.
- Doors and windows should be provided with wire mesh to prevent the entry of mosquitoes. Such precautions have become all the more important especially in the light of recent widespread incidences of the vector-borne **(Aedes mosquitoes-dengue fever and chikungunya) diseases like dengue and chikungunya** in many parts of India.

Immunization

- ✓ The use of vaccines and immunisation programmes has enabled us to completely eradicate a deadly disease like smallpox.
- ✓ A large number of other infectious diseases like polio, diphtheria, pneumonia and tetanus have been controlled to a large extent by the use of vaccines.
- ✓ Biotechnology is at the verge of making available newer and safer vaccines.
- ✓ Discovery of antibiotics and various other drugs has also enabled us to effectively treat infectious diseases

CANCER

- Cancer is one of the most dreaded diseases of human beings and is a major cause of death all over the globe.
- More than **a million Indians** suffer from cancer and a large number of them die from it annually
- In our body, cell growth and differentiation is highly controlled and regulated. In cancer cells, there is breakdown of these regulatory mechanisms.
- Normal cells show a property called **contact inhibition** by virtue of which contact with other cells inhibits their uncontrolled growth. Cancer cells appears to have lost this property. As a result of this, cancerous cells
- just continue to divide giving rise to masses of cells called tumors.
- Tumors are of two types:
  a)Benign tumors
  b)Malignant tumors,

a) Benign tumors

It normally remain confined to their original location and do not spread to other parts of the body and cause little damage.

b) Malignant tumors,

This is a mass of proliferating cells called neoplastic or tumor cells. These cells grow very rapidly, invading and damaging the surrounding normal tissues. As these cells actively divide and grow they also starve the normal cells by competing for vital nutrients. **Cells sloughed from such tumors reach distant sites through blood, and wherever they get lodged in the body, they start a new tumor there. This property called metastasis is the most feared property of malignant tumors.**

Causes of cancer :

Transformation of normal cells into cancerous neoplastic cells may be induced by **physical, chemical or biological agents**. These agents are called **carcinogens.**

I. **Physical Factor**

Ionising radiations (X-rays and gamma rays), **non-ionizing radiations (UV) cause DNA damage leading to neoplastic transformation.**

II. **Chemical Factor**

The **chemical carcinogens** present in tobacco smoke have been identified as a major cause of **lung cancer**.

III. **Biological agents**

- Cancer causing viruses called **oncogenic viruses** have genes called viral oncogenes.
- Furthermore, several genes called **cellular oncogenes (c-onc) or proto oncogenes** have been identified in **normal cells** which when activated under certain conditions, could lead to **oncogenic transformation** of the cells.

Cancer detection and diagnosis :

- Early detection of cancers is essential as it allows the disease to be treated successfully in many cases.

a) Biopsy and Histopathology

Cancer detection is based on **biopsy and histopathological studies** of the tissue and blood and bone marrow tests for increased cell counts in the case of **leukemias (blood cancer)**

In biopsy, a piece of the suspected tissue cut into thin sections is stained and examined under microscope (histopathological studies) by a pathologist.

b) Computed tomography (CT)

Computed tomography uses **X-rays** to generate a three-dimensional image of the internals of an object.

c) Magnetic resonance imaging (MRI)

MRI uses **strong magnetic fields and nonionising radiations** to accurately detect pathological and physiological changes in the living tissue.

d) Antibodies

Antibodies against cancer-specific antigens are also used for detection of certain cancers.

e) Molecular Biology Techniques

Techniques of molecular biology can be applied to detect genes in individuals with inherited susceptibility to certain cancers. Identification of such genes, which predispose an individual to certain cancers, may be very helpful in prevention of cancers. Such individuals may be advised to avoid exposure to particular carcinogens to which they are susceptible (e.g., tobacco smoke in case of lung cancer).

Treatment of cancer :

- The common approaches for treatment of cancer are **surgery, radiation therapy and immunotherapy.**
- **In radiotherapy,** tumor cells are irradiated lethally, taking proper care of the normal tissues surrounding the tumor mass.
- **Several chemotherapeutic drugs** are used to kill cancerous cells. Some of these are specific for particular tumors. Majority of drugs have side effects like hair loss, anemia, etc.
- Most cancers are treated by combination of **surgery, radiotherapy and chemotherapy**.
- Tumor cells have been shown to avoid detection and destruction by immune system. Therefore, the patients are given substances called **biological response modifiers such as α-interferon** which **activates their immune system and helps in destroying the tumor**.

IMMUNOLOGY

- The overall ability of the host to fight the disease-causing organisms, conferred by the immune system **is called immunity**. Immunity is of two types:

(i) Innate immunity and
(ii) Acquired immunity.

i) Innate immunity/Inborn immunity /Non specific immunity

- This type of immunity is present **at the time of birth**.
- This is accomplished by providing **different types of barriers** to the entry of the foreign agents into our body. Innate immunity consist of **four types of barriers**. These are

(a) Physical barriers :
- **Skin** on our body is the main barrier which prevents entry of the micro-organisms.
- **Mucus coating** of the epithelium lining the respiratory, gastrointestinal and urogenital tracts also help in trapping microbes entering our body.

(b) Physiological barriers :
- **Acid** in the stomach,
- **Saliva** in the mouth,
- **Tears** from eyes–all prevent microbial growth.
- Saliva and tear contain antibacterial agent called **Lysozyme**

(c) Cellular barriers :
- Certain types of **leukocytes** (WBC) of our body like
  - **Polymorpho-nuclear leukocytes** (PMNL-neutrophils)
  - Monocytes
  - **Natural killer** (type of lymphocytes)

in the blood as well as **macrophages in tissues** can **phagocytose** and destroy microbes.

(d) Cytokine barriers :
- Virus-infected cells secrete proteins called **interferons** which protect non-infected cells from further viral infection.

ii) Acquired immunity/adaptive immunity/specific immunity

- It is pathogen specific.
- It is characterised by **memory**. This means that our body when it encounters a pathogen for the **first time** produces a response called **primary response** which is of low intensity. Subsequent encounter with the same pathogen elicits a highly intensified **secondary or Anamnestic response.** This is ascribed to the fact that our body appears to have memory of the first encounter.

B-lymphocytes and T lymphocytes

The primary and secondary immune responses are carried out with the help of two special types of lymphocytes present in our blood,
i.e., B-lymphocytes and T lymphocytes

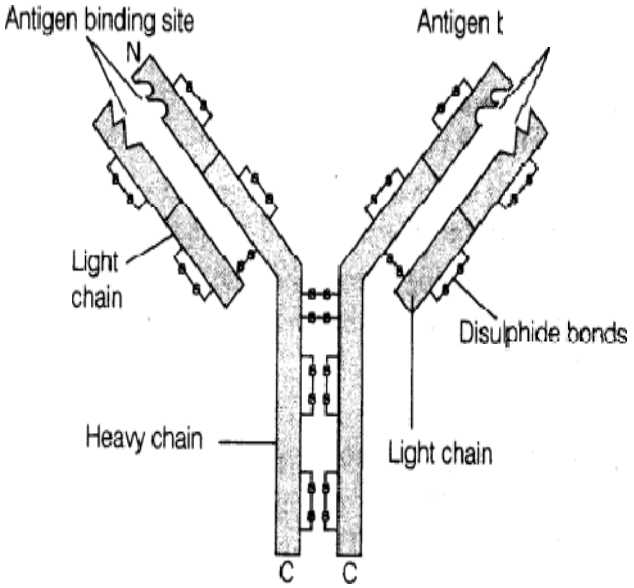
B-Lymphocytes
- Certain cells of bone marrow produce lymphocytes (Haematopoiesis). These cells mature in the bone marrow called B lymphocytes.
- The B-lymphocytes produce **an army of proteins** called in response to pathogens into our blood to fight with them. These proteins are called **antibodie**s.
- Immune response by the **B-cells** by production of antibody is called **Antibody mediated immune response (AMI) or humoral immune response**

T-Lymphocytes
- Some stem cells in the Bone marrow give rise to immature lymphocytes.
- These Immature lymphocytes migrate via the blood **to the thymus**, where they mature as **T cells**. In the thymus, these cells mature as T lymphocytes. **The T-cells themselves do not secrete antibodies but help B cells produce them.**
- Immune response **by T-cells** which detects and **destroys the foreign cells** and also cancerous cells **called cell mediated immune response.(CMI)**
- Rejection of organs in transplantation is due to **T-lymphocytes.**

- Tissue matching, blood group matching are essential for organ transplantation.
- **Immune-suppressants** is required before and after transplantation
- The body is able to differentiate 'self ' and 'nonself' and the cell-mediated immune response is responsible for the graft rejection

Structure of Antibody

- Each antibody molecule has **four peptide chains**, two small called **light chains** and two longer called **heavy chains**.
- Hence, an antibody is represented as H_2L_2.
- Different types of antibodies are produced in our body. IgA, IgM, IgE, IgG are some of them



Structure of an antibody molecule

Active and Passive Immunity

Active immunity:

- When a host is exposed to **antigens**, which may be in the form **of living or dead microbes** or other proteins, **antibodies** are produced in the host body. This type of immunity is called active immunity.
- Active immunity is **slow** and takes time to give its full effective response.
- **Injecting the microbes** deliberately during immunisation or infectious organisms gaining access into body during natural infection induce active immunity.
  Eg: **Vaccines**

Vaccines

- 1st vaccination was carried out by British Physician **Edward Jenner to protect people from small pox**
- The principle of immunisation or vaccination is based on the property of '**memory'** of the immune system.
- In vaccination, **a preparation of antigenic proteins of pathogen or inactivated/weakened pathogen (vaccine) are introduced into the body.** The antibodies produced in the body against these antigens would neutralise the pathogenic agents during actual infection.
- The vaccines also generate **memory – B and T-cells that recognize the pathogen quickly on subsequent exposure** and overwhelm the invaders with a massive production of antibodies.
- So the principle of immunisation or vaccination is based on the property of 'memory' of the immune system
- Examples for vaccines

Live BCG vaccine	Tuberculosis
Killed TAB vaccine	Enteric fever
MMR	Rubella,mumps,measles
Salk vaccine	Poliomyelitis
DPT	Diphtheria, Pertusis and tetany

- **Recombinant DNA technology** has allowed the production of antigenic polypeptides of pathogen in bacteria or yeast. Vaccines produced using this approach **allow large scale production** and hence greater availability for immunisation,
  e.g., **Hepatitis B vaccine** produced from **yeast**

Passive immunity

- When **ready-made antibodies are directly given to protect the** body against foreign agents, it is called passive immunity.
- Eg:The yellowish fluid **colostrum** secreted by mother during the initial days of lactation has abundant antibodies (IgA) to protect the infant
- Eg: **The foetu**s also receives some antibodies **(IgG)** from their mother, t**hrough the placenta** during pregnancy.

- If a person is infected with some deadly microbes to which quick immune response is required as in tetanus, we need to directly inject the preformed antibodies, or antitoxin (a preparation containing antibodies to the toxin).
- Eg:in cases of **snakebites**, the injection which is given to the patients, contain preformed antibodies (**Anti venom**) against the snake venom

	Active Immunity	Passive Immunity
Mechanism	Body produces its own antibodies in response to an antigen (foreign substance)	Antibodies are introduced into the body from an external source
Antigen Exposure	Requires exposure to a weakened or inactive form of the pathogen (vaccine) or the actual pathogen itself	Does not require exposure to the antigen
Development of Immunity	Takes time for the body to develop an immune response (days to weeks)	Provides immediate protection (hours to days)
Duration of Immunity	Can be long-lasting (years or even lifetime) depending on the vaccine or exposure	Short-lived (weeks to months)
Examples	Vaccination, natural infection (usually)	Injection of antibodies (immunoglobulin), breast milk from mother to infant
Memory	Develops immunological memory, allowing for a faster and stronger response upon future exposure	No immunological memory is developed

Difference between active immunity and passive immunity

Active Immunity	Passive immunity
When a host is exposed to **antigens**, which may be in the form of living or dead microbes or other proteins, **antibodies** are produced in the host body. This type of immunity is called active immunity	When **ready-made antibodies are directly given to protect the** body against foreign agents, it is called passive immunity
It takes time to develop immunity	It is used when immune response has to be faster
Memory cells are formed	No memory cells formed

Allergies/Hypersensitivity

- The **exaggerated response** of the immune system to certain antigens present in the environment is called allergy.
- The substances to which such an immune response is produced are called **allergens.**
- Examples of allergens are
  - Mites in dust,
  - Pollens,
  - Animal dander
  - Certain drugs
  - Certain food, etc.
- The antibodies produced to these are of **IgE type.**

Symptoms

It include
- Sneezing
- Watery eyes,
- Running nose
- difficulty in breathing.

- Allergy is due to the release of chemicals like **histamine and serotonin from the mast cells.**
- For determining the cause of allergy, the patient is exposed to or injected with very small doses of possible allergens, and the reactions studied.
- The use of drugs like **anti-histamine, adrenalin and steroids quickly reduce the symptoms of allergy.**
- **Modern-day life style has resulted in lowering of immunity and more sensitivity to**

allergens – more and more children in metro cities of India suffer from allergies and **asthma due to sensitivity to the environment.** This could be because of the protected environment provided early in life.

Auto Immunity

- Memory-based acquired immunity evolved in higher vertebrates based on the ability to differentiate foreign organisms (e.g., pathogens) from self cells.
- **Due to genetic and other unknown reasons, the body attacks self-cells**. This results in damage to the body and is called auto-immune disease.

  Eg: **Rheumatoid arthritis**
  Mysthenia gravis

Immune System in the Body

The human immune system consists of

- **Lymphoid organs,**
- **Tissues,**
- **Cells**
- **Soluble molecules like antibodies**.

Immune system is unique in the sense that it recognises foreign antigens, responds to these and remembers them, The immune system also plays an important role in allergic reactions, auto-immune diseases and organ transplantation.

Lymphoid organs:

These are the organs where **origin and/or maturation and proliferation of lymphocytes occur.**

The primary lymphoid organs /central lymphoid organ

- It include **Bone marrow and Thymus**
- Here immature lymphocytes differentiate into antigen-sensitive lymphocytes.

The bone marrow:

it is the main lymphoid organ where all blood cells including lymphocytes are produced.

The thymus:

- It is a lobed organ located near the heart and beneath the breastbone.
- The thymus is quite large at the time of birth but keeps reducing in size with age and by the time puberty is attained it reduces to a very small size. Hence thymus gland is called **juvenile gland.**

Both bone-marrow and thymus provide micro-environments for the development and **maturation of T-lymphocytes**

Secondary lymphoid organ

- After maturation the lymphocytes migrate to secondary lymphoid organs like **spleen, lymph nodes, tonsils, Peyer's patches of small intestine and appendix**.
- The secondary lymphoid organs provide the sites for interaction of lymphocytes with the antigen, which then proliferate **to become effector cells.**

The spleen:

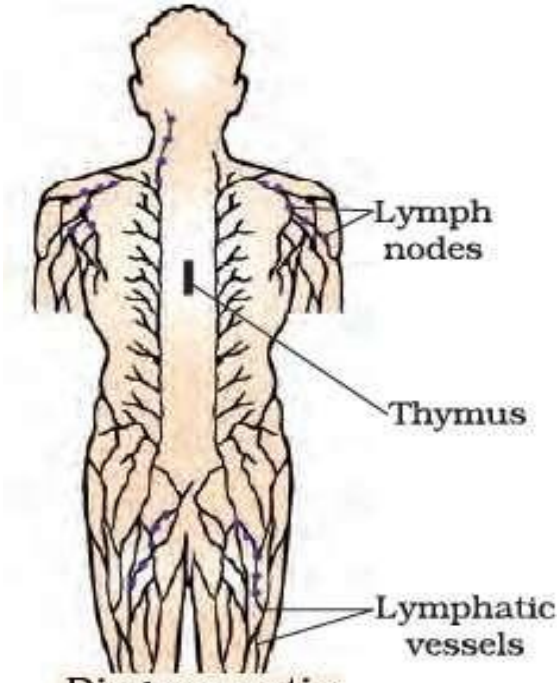
- it is a large bean shaped organ.
- It mainly contains lymphocytes and phagocytes.
- It acts as a **filter of the blood** by trapping blood-borne microorganisms.
- Spleen also has a large **reservoir of erythrocytes.**

The lymph nodes:

- They are small solid structures located at different points along the lymphatic system.
- Lymph nodes serve to trap the micro-organisms or other antigens, which happen to get into the lymph and tissue fluid.
- Antigens trapped in the lymph nodes are responsible for the activation of lymphocytes present there and cause the immune response.

Mucosal associated Lymphoid Tissue (MALT)

Lymphoid tissue located within the lining of the major tracts (respiratory, digestive and urogenital tracts) called mucosa associated lymphoid tissue (MALT). It constitutes about 50 per cent of the lymphoid tissue in human body.



Diagrammatic representation of Lymph nodes

DRUGS

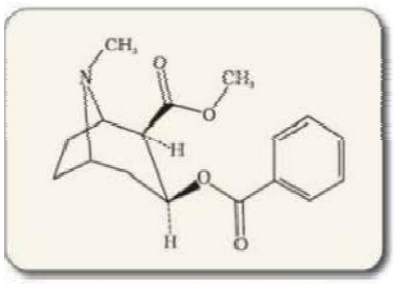
- **Any substance, other than food, used in the prevention , diagnosis, or treatment of a disease is called drug**
- The drugs, which are commonly abused are **opioids, cannabinoids and coca alkaloids.** Majority of these are obtained from **flowering plants**. Some are obtained from **fungi**.

1.Opioids,

- Opioids are the drugs, which bind to specific **opioid receptors present in our central nervous system and gastrointestinal tract.**

Examples

- **a)Heroin** commonly called **smack** is chemically **diacetylmorphine** which is a white, odourless, bitter crystalline compound.
- This is obtained by **acetylation of morphine** which is extracted from the latex of poppy plant *Papaver somniferum* .
- Generally taken by snorting and injection, heroin is a depressant and slows down body functions.
- **b)Morphine** is a very effective sedative and painkiller, and is very useful in patients who have **undergone surgery**



Chemical structure of Morphine


Opium poppy

2.Cannabinoids

- They are a group of chemicals which interact with **cannabinoid receptors present principally in the brain.**
- Natural cannabinoids are obtained from the inflorescences of the plant ***Cannabis sativa***
- The flower tops, leaves and the resin of cannabis plant are used in various combinations to produce **marijuana, hashish, charas and ganja**.
- Generally taken by inhalation and oral ingestion, **these are known for their effects on cardiovascular system of the body**

3. Coca alkaloid or cocaine

- It is obtained from coca plant ***Erythroxylum coca***, native to South America.
- It **interferes with the transport of the neuro-transmitter dopamine**.
- **Cocaine**, commonly called coke or crack is usually snorted.
- It has a potent stimulating action on central nervous system, producing a sense of euphoria and **increased energy.**
- **Excessive dosage of cocaine causes hallucinations.**
- Other well-known plants with hallucinogenic properties are *Atropa belladona* and Datura These days cannabinoids are also being abused by some **sports persons**


Flowering branch of *Datura*

4. Drugs used as medicines

Drugs like

- **Barbiturates(Sleeping pills),**
- **Amphetamines (Anti sleep drugs),**
- **Benzodiazepines(Anti-anxiety drugs)**, and other similar drugs, that are normally used as medicines to help patients cope with **mental illnesses like depression and insomnia**, are often abused.
- Several plants, fruits and seeds having hallucinogenic properties have been used for hundreds of years in folk-medicine, religious ceremonies and rituals all over the globe.
- **When these are taken for a purpose other than medicinal use or in amounts/frequency that impairs one's physical, physiological or psychological functions, it constitutes drug abuse**.
- LSD is obtained from fungus

SMOKING

- Tobacco has been used by human beings for more than 400 years. It is smoked, chewed or used as a snuff.
- Tobacco contains a large number of chemical substances including nicotine, an alkaloid.

Harmful effects of smokong

- ❖ **Nicotin**e stimulates adrenal gland to release adrenaline and nor-adrenaline into blood circulation, both of which raise blood pressure and increase heart rate.
- ❖ Smoking is associated with increased incidence of **cancers** of lung, urinary bladder and throat, bronchitis, emphysema, coronary heart disease, gastric ulcer, etc.
- ❖ Tobacco **chewing** is associated with increased risk of cancer of the oral cavity.
- ❖ Smoking increases carbon monoxide (CO) content in blood and reduces the concentration of haem bound oxygen. This causes **oxygen deficiency in the body.**

Adolescence

- Adolescence means both 'a period' and 'a process' during which a child becomes mature in terms of his/her attitudes and beliefs for effective participation in society.
- The period between **12-18** years of age may be thought of as adolescence period.
- In other words, adolescence is a bridge **linking childhood and adulthood.**

Characterstics of adolescence

Adolescence is accompanied by several biological and behavioural changes. Adolescence, thus is a very vulnerable phase of mental and psychological development of an individual.

Alcoholism

- Continous heavy consumption of Alcoholic products is called alcoholism.

Causes of Alcohol or Drug Abuse

- **Curiosity,**
- **Need for adventure**
- **Excitement**
- **Experimentation,**
- **To Escape for stress**
- **Peer pressure**
- **Unsupportive family structure**

Addiction and Dependence

- **Addiction is a psychological attachment to certain effects such as euphoria and a temporary feeling of well-being –associated with drugs and alcohol**.
- These drive people to take them even when these are not needed, or even when their use becomes self-destructive.
- With repeated use of drugs, the **tolerance level of the receptors present in our body increases.** Consequently the receptors respond only to higher doses of drugs or alcohol leading to greater intake and addiction. However, it should be clearly borne in mind that use of these drugs even once, can be a fore-runner to addiction.
- Thus, the addictive potential of drugs and alcohol, pull the user into a vicious circle leading to their regular use (abuse) from which he/she may not be able to get out. In the absence of any guidance or counselling, the person gets addicted and becomes dependent on their use.
- **Dependence is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drugs/alcohol is abruptly discontinued. This is characterised by anxiety, shakiness, nausea and sweating, which may be relieved when use is resumed again.**
- In some cases, withdrawal symptoms can be severe and even life threatening and the person may need medical supervision.
- Dependence leads the patient to ignore all social norms in order to get sufficient funds to satiate his/her needs. These result in many social adjustment problems.

Effects of Drug/Alcohol

- Reckless behaviour,
- Vandalism
- Violence.
- Excessive doses of drugs may lead to coma and death due to respiratory

failure, heart failure or cerebral hemorrhage.

- A combination of drugs or their intake along with alcohol generally results in overdosing and even deaths.

Warning signs of drug/alcohol abuse

- Drop in academic performance,
- Unexplained absence from school/college,
- Lack of interest in personal hygiene,
- withdrawal,,isolation from family and friends
- Depression,
- Fatigue,
- Aggressive and rebellious behaviour,
- Loss of interest in hobbies,
- Change in sleeping and eating habits
- Fluctuations in weight, appetite, etc.

- If an abuser is unable to get money to buy drugs/alcohol he/she may turn to stealing. The adverse effects are just not restricted to the person who is using drugs or alcohol.
- a drug/alcohol addict becomes the cause of mental and financial distress to his/her entire family and friends.
- Those who take drugs **intravenously (direct injection into the vein using a needle and syringe), are much more likely to acquire serious infections like AIDS and Hepatitis B.**
- The viruses, which are responsible for these diseases, are transferred from one person to another by sharing of infected needles and syringes. Both AIDS and Hepatitis B infections are chronic infections and ultimately fatal. Both can be transmitted through sexual contact or infected blood.
- The use of alcohol during adolescence may also have long-term effects. It could lead to heavy drinking in adulthood. The chronic use of drugs and alcohol damages nervous system and liver (cirrhosis).
- The use of drugs and alcohol during pregnancy is also known to **adversely affect the foetus.**
- Another misuse of drugs is what certain sportspersons do to enhance their performance. They (mis)use narcotic analgesics, anabolic steroids, diuretics and certain hormones in sports to increase muscle strength and bulk and to promote aggressiveness and as a result increase athletic performance.

The side-effects of the use of anabolic steroids in females

- Masculinisation (features like males)
- Increased aggressiveness, mood swings
- Depression, abnormal menstrual cycles
- Excessive hair growth on the face and body
- Enlargement of clitoris
- Deepening of voice

The side-effects of the use of anabolic steroids in Males

- Acne
- Increased aggressiveness
- Mood swings
- Depression
- Deduction of size of the testicles
- Decreased sperm production
- Potential for kidney
- Liver dysfunction
- Breast enlargement
- Premature baldnes
- Enlargement of the prostate gland.

Prevention and Control

'Prevention is better than cure' holds true here also.

- **(i) Avoid undue peer pressure -** Every child has his/her own choice and personality, which should be respected and nurtured. A child should not be pushed unduly to perform beyond his/her threshold limits; be it studies, sports or other activities.
- **(ii) Education and counselling -** Educating and counselling him/ her to face problems and stresses, and to accept disappointments and failures as a part of life. It would also be worthwhile to channelize the child's energy into healthy pursuits like sports, reading, music, yoga and other extracurricular activities.
- **(iii) Seeking help from parents and peers -** Help from parents and peers should be sought immediately so that they can guide appropriately. Help may even be sought from close and trusted friends. Besides getting

proper advise to sort out their problems, this would help young to vent their feelings of anxiety and guilt.

- **(iv) Looking for danger signs -** Alert parents and teachers need to look for and identify the danger signs discussed above. Even friends, if they find someone using drugs or alcohol, should not hesitate to bring this to the notice of parents or teacher in the best interests of the person concerned. Appropriate measures would then be required to diagnose the malady and the underlying causes. This would help in initiating proper remedial steps or treatment.
- **(v) Seeking professional and medical help** - A lot of help is available in the form of highly qualified psychologists, psychiatrists, and deaddiction and rehabilitation programmes to help individuals who have unfortunately got in the quagmire of drug/alcohol abuse. With such help, the affected individual with sufficient efforts and will power, can get rid of the problem completely and lead a perfectly normal and healthy life.

OGY Academy
Outstanding Guidance for Youth

HUMAN HEALTH AND DISEASE

1 Innate immunity is non-specific type of defence, that is present at the time of birth. Which are the four types of barriers involved in innate immunity and mention one examples for each.
(HSE-March-2024)(2)

2 In a debate conducted in school, your friend said that AIDS can be transmitted through touch or physical contact.
(a) Do you agree with that statement ? (½)
(b) Name the clinical test used to diagnose AIDS. (½)
(c) How do HIV infect human body ? (1)
(HSE-March-2024)(2)

3 Expand the following :
(HSE June-2023)(2)
a)MALT b)ELISA c)NACO d)CMI

4 Mention any four measures helpful for the prevention and control of Drugs and Alcohol abuse among adolescents in your locality. (HSE June-2023)(2)

5 Some commonly occurring diseases in man are given below :
(HSE June-2023)(3)

Malaria, Filariasis, Common Cold
Amoebic dysentry, Typhoid

(a) Select a bacterial disease from it.
(b) Write any 3 symptoms of it.
(c) Mention any two possible preventive and control measures for the same.

6 Pick out the correct pair of disease and its pathogen : (HSE March-2023)(1)
(A) Filaria – Rhino virus
(B) Typhoid – Streptococcus
(C) Malaria – Plasmodium
(D) Ascariasis – Entamoeba

7 Differentiate between Active immunity and Passive immunity.
(HSE March-2023)(2)

8

SAY YES TO LIFE NO TO DRUGS

Write some important measures that would be useful for the prevention and control of alcohol and drug abuse among adolescents. (Write relevant four points) (HSE March-2023)(2)

9 Mention any four measures useful for prevention and control of alcohol and drug abuse (HSE July 2022)(2)

10 Match the column (A) with column (B)
(HSE July 2022)(2)

(A)	(B)
Type of Barrier	**Example**
Physical barrier	Neutrophil
Physiological barrier	Skin
Cellular barrier	Interferon
Cytokine barrier	Saliva in mouth

11 Match the Column (A) with Column (B) and (C) : (HSE July 2022)(2)

(A)	(B)	(C)
Disease	Causative Organism	Type of Pathogen
Typhoid	Microsporum	Protozoa
Malaria	Salmonella typhi	Fungus
Ringworm	Plasmodium	Bacteria

12 Write any four ill-effects of Drug/Alcohol abuse.

(HSE March 2022)(2)

13 (a) Expand the term AIDS. Mention the name of virus that causes AIDS.

(b) Name the widely used diagnostic test for AIDS. (HSE March 2022)(5)

(c) List out any four practices for the prevention of AIDS

14 Innate immunity is characterised by providing different types of barriers. Name the four types of barriers of innate immunity (HSE August 2021)(2)

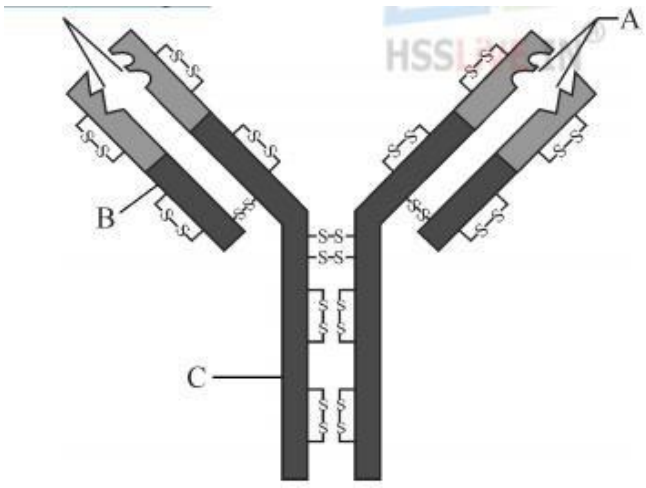
15 World Health Organisation has started a number of programmes to prevent the spreading of HIV Infection. Mention any four preventive measures against HIV infection (HSE August 2021)(2)

16 Which is the causative organism for malaria disease ? Name the two hosts required for the malarial parasites to complete its life cycle

(HSE August 2021)(2)

17 Observe the figure

(HSE March 2021)(2)



(a) Identify the molecular structure given in the figure.

(b) Name the regions labelled as A, B and C.

18 Drug/Alcohol abuse results in immediate and far reaching effects. Write some effects you have studied.

(HSE March 2021)(2)

19 Vaccines are given to children at various stages of their development. (a) What is meant by 'vaccine' ?

(b) Write the principle of vaccination.

(HSE March 2021)(2)

20 Observe the list of certain common diseases in human given below and answer thefollowing :(HSE-July-2020)(2)

Common cold, Malaria, Amoebiasis, Typhoid, Filariasis

(a) Identify the bacterial disease among the enlisted.

(b) Name its causative organism.

(c) Mention any two symptoms of it.

21 Prepare a pamphlet as part of an awareness programme in your school regarding the"Prevention and control of Alcohol and Drug abuse in adolescents".

[Hint :Prevention and control measures]

(HSE-July-2020)(3)

22 Name any two protozoan diseases, its causative organism and any two symptoms. (HSE-March-2020)(2)

23 Complete the illustration chart given below. (HSE-March-2020)(2)

24 Explain the measures useful for prevention and control of alcohol and drugs abuse among adolescents.

(HSE-March-2020)(3)

25 'Don't die of ignorance.'

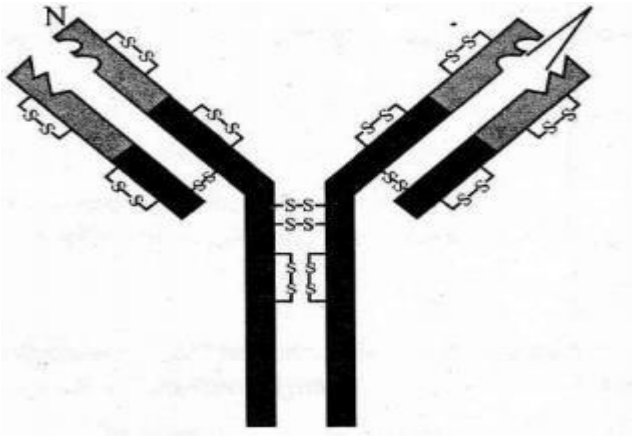
(a) About which it is mentioned ?

(b) List two measures taken by WHO to prevent it (HSE-June-2019)(2)

26 Observe the figure and answer the following questions (HSE-June-2019)(2)

a) Identify the given molecule.

b)Mention two types of immune responses in human body.

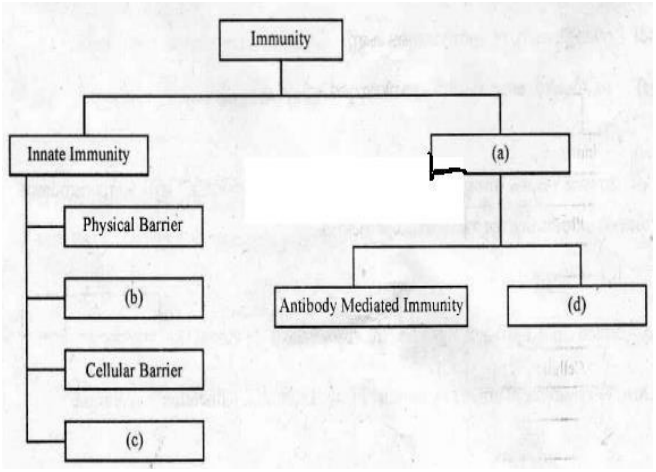


27 Write the effect of the following drugs in human body (HSE-June-2019)(3)

(a) Ophiods (b) Cannabinoids

(c) Coca alkaloids

28 Complete the flow chart given below



(HSE-March-2019)(2)

29 List of some diseases commonly occurring in man are given below. Arrange them based on causative organism in the table. **Malaria, Common cold, Typhoid, Ascariasis. Pneumonia, Ring worm, Amoebiasis** (HSE-March-2019)(2)

Bacteria	Fungus	Virus	Protozoan

30 Identify the bacterial disease from the following (HSE-June 2018)(1)

a)Typhoid b)Amoebiasis

c)Malaria d)Filariasis

31 Classify the following barriers of innate immunity under 3 suitable heading (HSE-June 2018)(3)

Skin, Saliva, WBC, Monocyte, Mucus, Acid of stomach

32 Innate immunity is a non-specific type of defense and consists of four types of barriers. Categorize the barriers and give one example for each. (HSE-March 2018)(2)

33 Complete the table given below (HSE-March 2018)(2)

Column – I	Column – II	Column – III
Typhoid	A	Stomach pain Intestinal perforation
B	Rhinovirus	Sore throat hoarseness
Malignant Malaria	C	Chill high fever
D	Wuchereria	Chronic inflammation of lymph gland

34 Consumption of drug and alcohol affect the person's mental and physical health very badly. List the warning sign of alcohol or drug abuse (HSE-March 2018)(2)

35 Study the relationship between the first twowords and fill the blank space with a suitable word

Pnemonia : Streptococcus pneumonae

Typhoid:.....

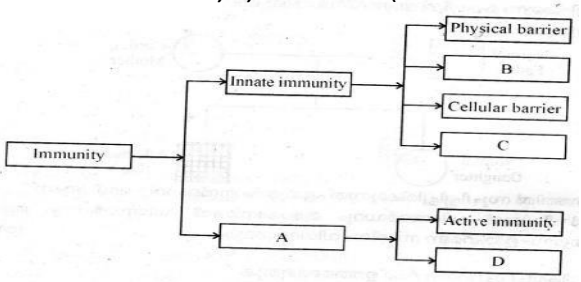
(HSE-Model 2018)(1)

36 Prepare a hand out to educate students aboutthe symptoms ofthe dreaded disease cancer, itsdetection and treatment (HSE-Model 2018)(3)

37 Prepare a brief note to be presented in an awareness programme for adolescents about AIDS, their causes and preventive measures

(HSE-June-2017)(3)

38 Fill the box A,B,C and D (HSE-JUNE-2017)(2)



39 Fill the blanks A,B,C and D using correct terms given in the box

(HSE-JUNE-2017)(2)

Passive immunity
Sensitivity to some particles
Metastasis
Active immunity
Autoimmune deficiency
Immune deficiency disease

a)....A ..... Cancer

b)Allergy -..B.....

C).....C. .....-AIDS

d)Rheumatoid arthritis-.....D.....

40 Morphine is said to be an abused drug. Discriminate the term 'use' and 'abuse' of the drugs based on this example ?

(HSE-March-2017)(2)

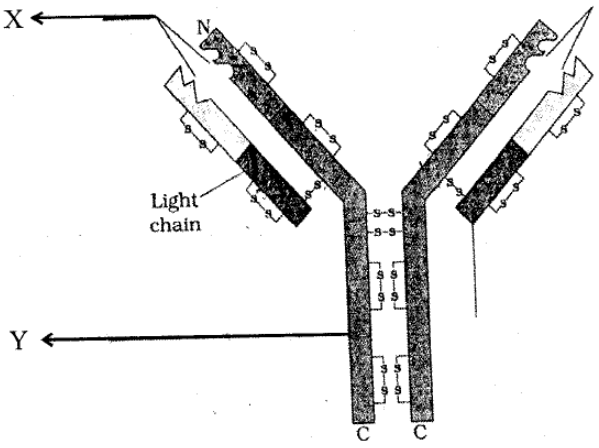
41 Differentiate active immunity from passive immunity. Give an example for passive immunity ?

(HSE-March-2017)(2)

42 Complete the table by filling a,b,c and d (HSE-June 2016)(2)

Disease	Pathogen	Symptom
---a---	*Streptococcus pneumonae*	Alveoli filled with fluid
Common cold	---b---	Nasal congestion and discharge
---c---	*Plasmodium vivax*	Chill and fever
Filariasis	*Wuchereria*	---d---

43 Answer the question about the given figure (HSE-June 2016)(2)



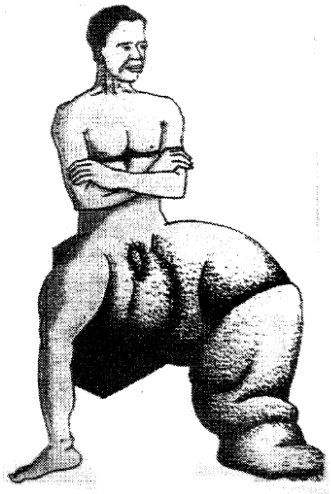
a) Identify the part X and Y ?

b) Name any two type of this molecules ?

44 Select odd one out and justify your selection (HSE-June 2016)(1)

Malaria, Gonorrhoea, Amoebiasis, filariasis.

45 Identify the disease shown in the following figure and write the causative organism of the disease (HSE-March 2016)(1)



46 "Blood of a man is tested positive for cannainoid"

a) what are these?

b) from where there are extracted naturally ?

c) which part of the body is affected by these ? (HSE-March 2016)(3)

47 Match the terms given in three coloumn of table correctly (HSE-June 2015)(2)

Pathogen	Group	Disease
Haemophilus Influenzae	Protozoa	Ringworm
Plasmodium Vivax	Fungus	Pneumonia
Wuchereria Bancrofli	Bacteria	Malaria
Trichophyton	Flatworm	Filariasis

48 "If proper care and attention is not given by adults, adolescent may become addicted to drug or alcohol". What is your opinion about this statement ?substantiate your answer ? (HSE-June 2015)(2)

49 Cancer is one of the most dreaded diseases of human beings, and is major cause of death all over the globe (HSE-March-2015)(3)

a) what are the causes of cancer?

b) what are the methods for detection of cancer?

c) What are the types of treatment of cancer?

50 Briefly describe the characteristic of cancer cells ? (HSE-June 2014)(2)

51 It is said that "Chikunguniea" once affected will not a person in next half of his life. Justify this statement (HSE-June 2014)(2)

52 Classify the diseases given in the box as two groups based on their causative organism. Specify the type of causative organism for each group (HSE-March-2014)(2)

Typhoid,
Malaria, Pneumonia
Diphtheria
Amoebiasis

53 Prepare a pamphlet for an awareness programme in your school about the measures to prevent and control alcohol and drug abuse in adolescents (HSE-March-2014)(2)

54 The meaning of 'antibiotics' is 'against life', where as with reference to human being is is 'pro life' (HSE-March-2014)(2)

Substantiate this statement with suitable example ?

55 Prepare a pamphlet for adolescent children to make them aware of alcohol and drug abuse?
(HSE-May 2013)(2)

56 "Prevention is better than cure" . This statement is true in the case of AIDS as well as immunisation .
Substantiate (HSE-May 2013)(2)

57 Most often HIV Infection occur due to conscious behaviour patterns. Do you agree with this statement ? Substantiate your answer?
(HSE-March 2013)(2)

58 Nature has as many verities of plants which give drugs for abuse, as there are medicinal plants which give medicines. Substantiate with two examples (HSE March 2013)(2)

59 Note the relationship between first two terms and suggest a suitable term for the fourth place (HSE-june-2012(1)

a) Erythroxylum coca : Cocaine
Papaversomniferum :.....
b) salmonellatyphi : Typhoid fever
plasmodium falciparum :.....

60 One of your Friend Argued that anti-retroviral drugs are effective medicine to treat AIDS
(HSE-June-2012)(3)

a) What is your opinion about it?
b) How HIV affect our immunity ?

61 Arrange the following diseases in the following coloumn in correct order (HSE-March-2012) (2)

Typhoid,Ring worm, Amoebiasis, AIDS, Malaria, Pneumonia, Common Cold

Bacteria	Virus	Protozoa (Protista)	Fungus

62 In a class room discussion a student argues that allergic reaction are more common in metro cities than in villages.(March-2012)(2)

a) Do you agree with this statement ?
b) Which type of immunoglobulin is responsible for allergic reactions?
c) suggest two drugs which reduce allergic symptoms ?