

- Immunity is the ability of an individual host to resist development of disease and allergy even after having received infective dose of pathogen with complete virulence and the various allergens.
- Immune system is the system of animal body which protects it from various pathogens / infectious agents / allergens and cancer
- Immunology is the science of development of immunity against particular pathogen or allergen
- The foundation of science of immunology were laid by three workers:
  - (i) Edward Jenner ( 1796)

A risky inoculation of small pox pustule through a scratch on vein was performed in Turkey and other eastern countries. Jenner noticed that milk – maids did not suffer from small pox though they did develop similar scabs of cowpox. He transferred the material from the scab of milkmaid sarah Nelmes to a young boy of eight years James Phipps. Later he inoculated the boy with live small pox material. The disease did not appear. The procedure was tried on other with equal success. Jenner also coined the term vaccine. He is regarded as father of immunology
  - (ii) Louis Pasteur ( 1879)

Developed the technique of weakening or attenuation of pathogen as heat, cold or starvation for preparation of vaccine
  - (iii) Von Behring ( 1891)

He discovered the technique of passive immunization by injecting of diphtheria pathogen into sheep and preparing serum from its blood after some time
- The agents which invite action of immune system are micro organism, their products certain food items, chemicals, drugs, pollen and pollutants. Body defense system or immunity is of two basic types, non-specific or innate and specific / acquired

#### NONSPECIFIC BODY DEFENSE

- It is natural defense system of the body with an individual is born and which is always available to protect the body against various types of discomfort causing environmental agents. This is done by having barriers to prevent entry of foreign agents and dispose of them as soon as they enter the body. Non specific body defense does not involve antigenic recognition. It is also called innate inborn, familial or natural immunity.
- There are number of components of innate immunity anatomic, physiological, phagocytic, inflammatory, natural killer cells and complement system. The

anatomic and physiological barriers constitute the first line of body defense. Phagocytic barriers, inflammatory barriers, natural killer cells and complement system constitute second line of body defense

- Innate immunity or non-specific body defense is only defense for most animals and plants.
- (1) Anatomic / physical barrier : These do not allow foreign agents and pathogens to enter the body
- (i) Skin : Keratinised dead outer cells of horny layer, do not allow entry of pathogen in body. Oil from sebaceous glands and sweat from sudoriferous glands make the skin acidic with pH 3-5, and possess bactericidal as well as fungicidal properties
  - (ii) Nostril hair: They filter out dust and micro –organism from inhaled air
  - (iii) External friendly microorganisms/ friendly bacteria : Many friendly bacteria live on skin, produce acids and secrete chemicals harmful to pathogens
  - (iv) Mucous membrane: They line digestive, respiratory and urinogenital tracts so as to prevent of entry of germs into body tissues.
  - (v) Mucus and cilia : Mucous membrane of the nasal tract possesses cilia for pushing back dust and germs. It also secretes mucus for trapping and killing them
  - (vi) Internal Friendly microorganism: They occur in intestine and vagina. Intestinal microorganisms secrete chemicals harmful to other microbes. Bacteria present in vagina secrete lactic acid for keeping it free from other microbes
- (2) Physiological Barriers : They are barriers related to body temperature, pH and chemical of body secretions which inhibits growth of pathogens.
- (i) Fever : There is rising of body temperature due to toxins released by pathogens and pyrogens produced by leucocytes. Fever stimulates phagocytosis and inhibits growth of many pathogens
  - (ii) External secretions: Sweat, oil and secretions of external friendly bacteria are acidic to prevent growth of many pathogens.
  - (iii) Lysozyme: It is a bacteriolytic enzyme present in sweat, tears, saliva and mucus lysozymes bring about hydrolysis / break down of bacterial cell walls
  - (iv) Activity of stomach : HCl of gastric juice kills most of microorganism ingested with food and drinks.
  - (v) Bile : It does not allow growth of micro-organisms

- (vi) Cerumen ( ear wax) : It is secretion of ceruminous glands present in external auditory canal cerumen traps dust particles, kills bacteria and repels insects.
- (vii) Interferons : They are glycoproteins which are produced in small amount of certain kinds of cells ( wbc, NKC, fibroblasts, epithelial ) when infected with virus. Interferons make the surrounding cells resistant to viral infection. Interferons were discovered by Isaac and Lindemann ( 1957). They are used in treatment of certain cancers, hepatitis, multiple sclerosis, osteoporosis, influenza etc

### (3) Phagocytic Barriers

Phagocytosis is carried out by leucocytes and macrophages. They act as soldiers of defense and scavengers of the body. Phagocytic leucocytes are neutrophils and monocytes. They come out of blood capillaries through diapedesis, engulf and digest most of the microorganisms.

Macrophages are modified monocytes. They are large phagocytic cells of two types – fixed ( inside lymph nodes, spleen, liver, bone marrow) and wandering ( connective tissue). They constitute reticulo-endothelial system macrophages of liver are present along sinusoids and called Kupffer's cells. Macrophages attack germ and inorganic substances that happen to enter tissues and engulf them. Pus may collect. Pus is a thick liquid formed in the region of wound and is composed of tissue fluid, damaged body cells, dead phagocytes, some leucocytes and microorganisms

### (4) Inflammatory Barrier

Inflammation is reaction of living tissues to injury, irritation or infection which is characterized by pain, swelling, redness or heat. Inflammatory response can be localized ( area of injury or infection) or systemic ( whole body). The injured region attracts mast cells ( histamocytes) of connective tissue and basophils of blood. They release prostaglandins and histamine. Histamine dilates blood capillaries and other small blood vessels. Therefore, more blood flows into the area of injury making it red and warm. Histamine also makes fine blood vessel permeable, lowers blood pressure and allows greater leakage of phagocytes allows destruction of microorganism. Plasma contains serum proteins with antimicrobial activity. Accumulation of tissue fluid causes swelling and dilution of toxins produced by pathogens.

### (5) Natural killer cells (NKC)

They are small lymphocytes / cells of immune system which are specialized to kill virus infected and tumor cells. Killer cells produce perforins. The latter produce pores in the plasma membrane of the target cells. Water enters the

perforated cells. They swell up and burst. Cellular remains are then cleared by phagocytes.

#### (6) Complement system

It is a system of thirty proteins which participate in both innate and acquired immunities in cascade fission for protecting the individual from pathogens. Many of the proteins of complement system function as enzyme precursors. In acquired immunity the system becomes active in response to antigen – antibody complex. It is also called classical pathway. In innate immunity, the complement system is activated directly in response to bacterial endotoxins, microbial polysaccharides, cell wall and other components of invading the microorganisms. It is called alternate pathway as well as properdin system. The pathway helps in dealing with invading microorganisms even before a person becomes sensitized against them, certain proteins of this system cleave and form two components, membrane attack complex and biologically active fragments. Membrane attack complex functions as lytic complex which produces trans membrane pores in the microbes. The latter burst and die. Biologically active fragments produce opsonins, anaphylotoxins and chemotactic factors. They form a coat over the invading microbes and attract phagocytes ( neutrophils and macrophages) for engulfing them. Complement system also causes agglutination of microbes, neutralization of viruses, activation of mast cells and basophils and has some direct inflammatory effect.

#### SPECIFIC BODY DEFENSE / ACQUIRED IMMUNITY

- It is immunity obtained during the life of an individual against a particular microorganisms due to previous infection vaccination or inoculation of antiserum. Specific body defense is also called acquired adaptive or specific immunity. This type of immunity occurs only in vertebrates. It supplements protection provided by innate or inborn immunity. However it takes a few to several days to become effective. Acquired immunity is also called third line of body defense.
- It has four unique characteristics:
  - (i) Specificity – It is a specific for each type of pathogen.
  - (ii) Diversity – Acquired or adaptive immunity can develop against all the diverse type of pathogens their toxins and other molecules
  - (iii) Discrimination between self and nonself – It can differentiate foreign ( non self) and body ( self) cells and molecules. Only the foreign or nonself materials are attacked

(iv) Memory – The first encounter between the specific foreign agent or microbe and the body's immune response but also memory of this encounter. Because of it a second encounter with the same microbe brings about quicker and heightened response.

- Acquired immunity or specific body defense is of two type

i) Active (acquired) immunity

This involves the active functioning of the person's own immune system leading to the synthesis of antibodies and / or production of immunologically active cells

Active immunity is produced by clonal selection and expansion. This occurs because interaction of an antigen with its receptors on the lymphocytes surface stimulates cell division, so that more lymphocytes are available to combat subsequent exposures to the same antigen

Clonal selection lead to the eventual production of :

(i) A pool of antibody – secreting plasma cells plasma cells are B-cells that have booled up ( forming a large endoplasmic reticulum) for massive synthesis and secretion of an antibody. The antibody is the secreted version of the BCB ( B-cell receptors for antigen)

(ii) A pool of ' memory ' cell – These are B lymphocytes with receptors of the same specificity as those on the original activated B cell

ii) Passive ( acquired ) immunity

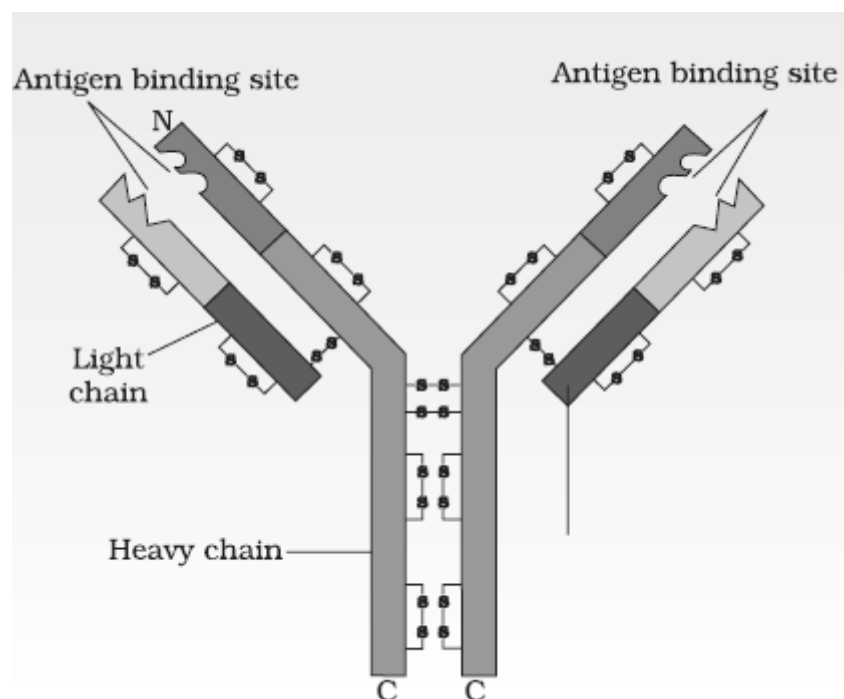
- Immunity is said to be passive when antibodies produced in other organisms are injected into a person who already has potential antigen in his body.

Passive immunity is developed to counteract snake venom, rabies, tetanus toxin and salmonella infection

- An antigen or immunogen is any foreign substances like protein or polysaccharide present in the external coating of pathogen, toxin of pathogen, white egg, feathers, constituent of vegetable, fruit, meat, drug chemical, tissue or organ transplant which induces the immune system to produce antibodies. Sites over the antigens that are recognized by antibodies and receptors found on B and T cells are called antigen determinants ( epitope). An antigen may have one to several types of antigen determinants

- Antibodies are glycoproteins which are of innumerable types, each specific to specific antigen. They occur in blood plasma as gamma-globulins or immunoglobulines (Ig). About 20% of plasma proteins are antibodies, each antibody consists of four polypeptides, two long heavy or H chains and two short, light or L-chains. They are held together in a Y-shaped configurations. Long H-chains are present throughout while short L-chains are restricted to

the two arms. The tips of the two arms possess a specific architecture that fits over the antigen determinant in a lock and key fashion to form antigen-antibody complex. The antigen binding fragment (Fab) of arms is called variable or V-region while the stem and basal parts of arms of antibody form constant or crystalline fragment (Fc). The latter determines diffusivity and adherence of the antibody



#### IMMUNOGLOBULIN CLASSES AND THEIR FUNCTIONS

- IgA: Called secretory immunoglobulin because it is present in all body secretions including colostrum and mother's milk. Functions as first line of defense against inhaled and ingested pathogens by activating alternate pathway of complement system.
- IgD: Along with IgM occurs over B-lymphocytes as antigen receptors activation of B-cells, also present in serum tissue and effective against toxins and allergens.
- IgE : Present in mucous membranes, skin and lungs. Attaches to mast cells and basophils for releasing histamine and other substances that mediate hypersensitive response to allergens.
- IgG : Constitue 75% of total Ig, present in all body parts including milk and can pass through placenta providing passive immunity to neonates, stimulates complement system and phagocytes against toxins, fungi, viruses and bacteria

- IgM : Largest Ig with 10 binding sites, activates B-cells over which it is present along with IgD, also first to reach the site of infection and activate classical pathway of complement system.

#### COMPONENTS OF IMMUNITY SYSTEM

- Immunity system contains antibodies, specific cells, tissues and lymphoid organs. It takes part in recognition of foreign antigens, eliminates them and keeps a memory of the same. It has also a role in allergies, autoimmunity and organ transplantation.
- Immune system has two components humoral and cell mediated.

#### Humoral Immune System or antibody mediated immune response ( AMIR)

- Antibody – mediated immunity is associated with the appearance of antibodies, secreted by cells of the B-lymphocyte series, in extra cellular fluids such as plasma, lymph and external secretions.
- The AMIR defends the body against
  - a) Some viruses.
  - b) Bacteria with polysaccharide capsule.
  - c) Toxins that enter the body fluids ( blood and lymph).
- When antibodies on a B cell's surface bind antigens, the B cell is activated and divides producing a clone of daughter B Cells. The daughter cell specialize into plasma B cells and memory B cells
- The plasma B cells are antibody factories. The antibodies pass into and circulate in three lymph to dispose of the antigens. For this, the antibodies selectively bind to the antigens forming antigen – antibody complexes to destroy the antigen. Each person can make  $10^7$  to  $10^8$  different kinds of antibody molecules so that there is an antibody molecules, so that there is an antibody on a B cells to fit any antigen
- The plasma cells do not migrate to the site of infection and act through a fluid ( lymph). Hence they are said to form humoral immune system ( L. humor = liquid). The B – lymphocytes are short lived and are replaced every few days from the bone marrow
- The memory B cells live for a long time and serve to quickly dispose off the antigens in case re-infection of the same virus or bacterium occurs.
- The antibodies bind to their specific antigens and inactivate the invading microorganism or foreign molecules so that these are conveniently disposed of by the pathogen.
- The antibodies fight the antigene in five different ways

- (i) Neutralization – some antibodies neutralize the antigens termed toxins and make them ineffective. They are called antitoxins. The phagocytes dispose off the neutralized antigen – antibody complexes
- (ii) Agglutination – Certain antibodies causes the particulate antigen to stick together in clumps, thus immobilizing them for easy disposal by the phagocytes through ingestion. They are termed agglutinins.
- (iii) Opsonization – Other antibodies coat the surface of the microbes and make them more susceptible to phagocytosis. Such antibodies are known as opsonin
- (iv) Precipitation – other antibodies combine with the antigens to form precipitates that are easily ingested by phagocytes
- (v) Complement activation – Antibody antigen complexes activate complement protein which may –
  - a) Lyse cell walls of bacteria, causing their disintegration.
  - b) Incite inflammatory response.
  - c) Opsonize antigen.
  - d) Attract phagocytes to area of infection.

#### Cell mediated immunity / Action of T cells

- T cells are long – lived cells which have upto 100,000 receptors sites on their surface for binding antigens. The cells develop antigen specificity through previous contact. They are often called competent lymphocytes. The latter respond to specific antigen by forming a clone of cells. The cells then differentiate into following types
1. Cytotoxic or killer T-cells : The cells reach the site of infection or agglutination and get attached to antigen containing microorganisms. They secrete perforins that produce holes in the attached cells. The killer T cells then pass toxic chemicals into attached cell for killing the same. Afterwards they move away for attacking new antigen containing cells. Killer T cells attack virus, invaded cells, cancer cells and cells of transplanted organs. They also destroy helper T cells when the latter are invaded by HIV. AIDS is due to deficiency of helper T cells. The killed cells are removed by phagocytes
  2. Helper T cells : They constitute more than 75% of total T- cells. They regulate immune functions by secreting lymphokines. Interleukin-2 has positive feedback system for helper T cells, stimulates growth and proliferation of other T cells. Interleukin-4,5 and 6 stimulate B lymphocytes macrophages are attracted to the site of infection and stimulated to phagocytosis by lymphokines.



3. Suppressor T cells : The cells act as negative feedback and keep the activity of other T-cells under check. This protects the body tissues and chemicals from attack of phagocytes and their antibodies
4. Memory T cells : They are sensitized T Cells which retain memory of antigen specificity for future. Sometimes lifelong. Other T Cells are amplifier T cells, killer, helper and suppressive T-cells are also called effectors cells.

#### CELLS OF IMMUNE SYSTEM

- They are lymphocytes and antigen presenting cells like macrophages. A healthy human has about a trillion lymphocytes. Lymphocytes are of two types, T-lymphocytes ( T-cells) and B-lymphocytes ( B-cells). Both of them develop in bone marrow from lymphatic system cells by the process called haematopoiesis, some of the young lymphocytes migrate into thymus for preprocessing. They are called T-lymphocytes. Afterwards they pass on to all the lymphoid tissues of the body and get lodged there. The other types of lymphocytes remain in the bone marrow and get preprocessed there. They are called B lymphocytes because in birds they are preprocessed in lymphoid diverticulum of cloaca called bursa of Fabricius. After being preprocessed B lymphocytes also migrate to all the lymphoid tissue of the body where they reside near but separate from T-lymphocytes
- MHC / HLA molecules ( HLA antigen )  
Polymorphic molecules call MHC class I are present on most body cells, Another group of molecules, , MHC class II, occur over professional antigen presenting cells. They bind to peptide antigen producing MHC antigen complex. The same is present to CD4 and CD8 T-cells respectively
- Activation of adaptive / acquired immunity  
An antigen is processed by antigen presenting cells like macrophages and B-lymphocytes. A type of T-cells ( T-helper cells) interacts with presented antigen and becomes activated. The activated T-cells not only form a clone of T-cells but also B-lymphocytes.

#### CLONAL SELECTION

- Formation of a clone of cells by each activated T-lymphocyte and antibody producing plasma cells by activated B-lymphocyte, each exhibiting the specificity for the same antigen is called clonal selection. The cells are of course of more than one type and perform different functions. One type of cloned lymphocyte do not function as effector cells but instead develop into long lived memory cells.

## PRIMARY AND SECONDARY IMMUNE RESPONSES

- Primary immune response is the first immune response developed during the first encounter with the antigen. It is feeble but relatively longer
- Secondary immune response is quick heightened immune response against a subsequent encounter with some antigen. It is due to the presence of memory cells against that antigen. A person having caught chicken pox or measles only becomes immune to subsequent attack of the pathogen due to it.

## LYMPHOID ORGANS

- They are those organs having lymphatic tissues where maturation and proliferation of lymphocytes occur. The sites where T-lymphocytes and B-lymphocytes mature and develop antigen specific receptors are called primary lymphoid organs viz. thymus for T-lymphocytes. And bone marrow for B-lymphocytes
- Secondary lymphoid organs are those organs having lymphatic tissues where B and T-cells are settled after maturation and where they undergo proliferation / differentiation on being activated by specific antigens e.g. lymph nodes, spleen and tonsils, MALT is mucosal lymphoid associated tissue. It constitutes more than 50% of the total lymphoid tissue.

## VACCINATION AND IMMUNISATION

- Immunization is phenomenon of increasing specific antibody production and development of memory B and T cells against the potential attack of a pathogen. It is carried out through vaccination and injection of antiserum. When an immunized person is attacked by the pathogen, the existing antibodies immediately attack the antigen while the memory T and B cells give rise to a massive crop of lymphocytes and antibodies.
- Vaccination is a process of inoculation of harmless antigenic material into healthy person for providing active acquired immunity against the disease. A single vaccination against the disease. A single vaccination may not give adequate immunity. Therefore 2-3 booster doses of vaccine are administered later on at specific intervals. Vaccine is suspension / extract of weakened attenuated dead germs or antigen containing compound of pathogens which when injected into healthy person provides active acquired immunity to the disease
- Now vaccines are also available for diphtheria, cholera, typhoid, whooping cough, tetanus, tuberculosis, plague, measles, mumps and polio. The cells

infected with cancer causing viruses usually show on their surface to the virus. This has led to the first successful immunization against cancer in cats and chickens. Unfortunately, efforts to produce antibodies to cancers not caused by virus have had very little success

- Many serious infectious diseases also have no effective vaccines. These include malaria, trypanosomiasis and AIDS
- In India, vaccines are generally produced at Hoffkins Institute at Mumbai and Virus Institute at Pune
- National Institute of Immunology ( NII), New Delhi is involved in the production of antifertility vaccine kits to detect pregnancy and infectious disease etc.

## DISORDERS OF IMMUNE SYSTEM

### AUTOIMMUNITY ( Auto immune diseases)

- Auto immunity is an abnormal immune response against self antigens. When the cell acts as antigens in the same body then they are called autoantigens
- The nature of auto immune diseases depends on the autoantigens involved. For example, if the autoantigens are RBC then the body destroys its own RBCs, resulting in chronic anemic, if the autoantigens are muscle cells then it results in the destruction of its own muscles resulting in severe weakness ( myasthenia gravis); if the autoantigens are liver cells, then it results in chronic hepatitis, etc. Other autoimmune diseases are insulin dependent diabetes, Addison's disease, ulcerative colitis and rheumatoid arthritis

### ALLERGY ( Hypersensitivity)

- Allergy is the inappropriate immune response of person to harmless substances coming in contact with the body or entering the body from the environment or in food or in medicine
- The substances which causes allergic reaction are called allergens. They are generally weak antigens. The common allergens are dust, dust mites, cat, pollen, feathers, fur, venom etc.
- Allergic reaction depends on the nature of the allergen. The common allergic reactions are inflammation of mucous membrane, sneezing, gasping, running of eyes, irritation of upper respiratory tract, itching, skin rash
- Allergy involves mainly IgE antibodies and histamine. It causes marked dilation of all the peripheral blood vessels and the capillaries becomes highly

permeable so that large amounts of fluid leak out from the blood into tissues. The blood pressure decreases drastically often resulting in the death of the individual within a short time

- Hay fever : In this allergic form, there is swollen, reddened, running eyes and nose. The drugs called antihistamines are of major importance in treatment.
- Asthma: The tissue surrounding the respiratory tubes in the lungs swell up and compress the tubes. Hence there is difficulty in breathing. Antihistamine drugs are also given in this disease

### IMMUNODEFICIENCY

#### Severe combined immune deficiency ( SCID)

- Severe combined immunodeficiency ( SCID) represents a group of rare, sometimes fatal congenital disorders characterized by little or no immune response
- It is a defect in the specialized white blood cells ( B and T-lymphocytes)
- Without a functional immune system, SCID patients are susceptible to recurrent infections such as pneumonia, meningitis and chicken pox. Though invasive, new treatment such as bone marrow and stem cells transplantation save as many as 80% of SCID patients.
- Sometimes new born children are without T-cells and B-cells. These children are susceptible to various infections
- SCID is caused by a defect in the gene that codes for the enzyme adenosine deaminase on chromosome number 20. Lack of the enzyme adenosine deaminase (ADA). Means that the substrate for this enzyme accumulate in the cells. Immature lymphoid cells of the immune system are particularly sensitive to the toxic effects of these unused substrates, so fail to reach maturity.
- As a result, the immune system of the afflicted individual is severely compromised or completely lacking. Lack of this enzyme makes the body defenseless against infections.
- SCID is the first genetic disorder to be combated with gene therapy.

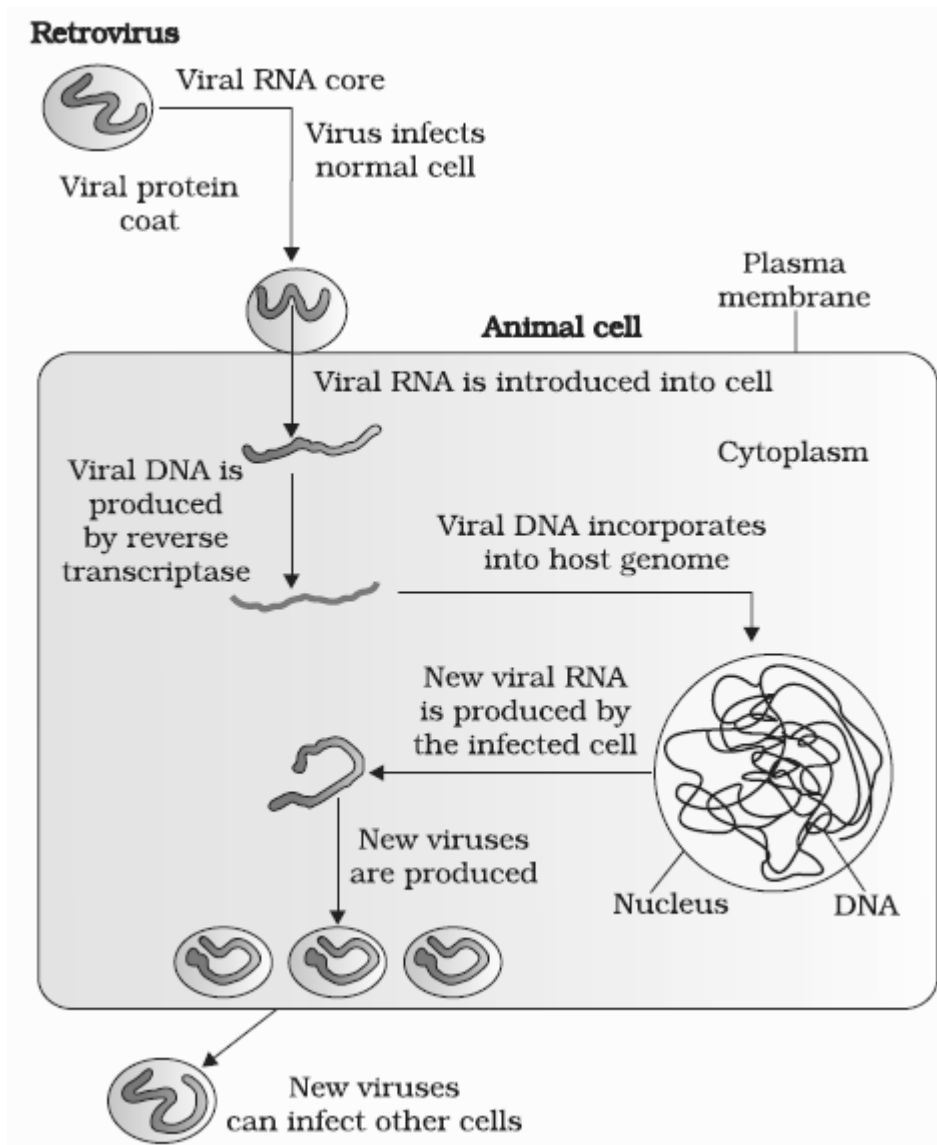
#### Acquired immune deficiency syndrome ( AIDS)

- AIDS is a disorder of cell mediated immune system of the body. There is a reduction in the number of helper T-cells which stimulate antibody production of B-cells. This results in loss of natural defense against viral infection
- AIDS infection were detected in India for the first time in prostitutes of Chennai in 1986.

- Virus responsible for AIDS was identified and named HIV

### AIDS virus – HIV

- HIV virus belong to the retrovirus family, a family of single stand RNA viruses distinguished by possession of viral reverse transcriptase that transcribes viral RNA into provirus DNA which is integrated into the host cell genome.
- HIV is 100 to 140 nm in diameter, has a cylindrical core, single-stranded linear RNA and reverse transcriptase enzyme surrounded by glycoprotein coat, double lipid membrane and two protein coats
- Virus of AIDS was isolated and identified in green monkey by Prof. Luc Montagnier in France in 1983 and almost the same time by Prof Robert Gallo in USA ( 1984 )
- HIV is subdivided into two distantly related types, HIV-1 and HIV-2. HIV-1 is the predominant world wide isolated from individuals with AIDS or at high risks for the development of AIDS. HIV-2 is endemic among people in west Africa.



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- HIV -1 and HIV-2 differ in their ability to cause disease and their geographical distribution
- Both, HIV-1 and HIV-2, cause the body to produce antibodies with three to six months, although the period between initial infection and illness may be longer in case of HIV-2
- The incubation period of HIV is 15 -57 months. Average incubation period is 28 months

#### Transmission

- AIDS is transmitted only by a constant of infected cells containing blood of a patient with the blood of a healthy person as in:
  - (i) Unprotected sexual intercourse with an infected person
  - (ii) Use of contaminated needles and syringes to inject drugs or vaccines.
  - (iii) Use of contaminated razors for shaving

- (iv) Use of infected blood or blood product for transfusion
- (v) Organ transplant
- (vi) Parturition from mother to baby due to rupturing of blood vessels
- The sexual route of transmission accounts for over 75% of infections
- AIDS can not be acquired by
  - i) Insect bites
  - ii) Crowded transport
  - iii) Shaking hands
  - iv) Sharing towels
  - v) Coughing and sneezing
  - vi) Kissing and embracing
  - vii) Sharing utilities

#### Signs and symptoms of AIDS

- People infected with AIDS virus remain apparently well even after infection. They may not show any physical symptoms of illness for a long time
- When the AIDS virus enters the blood stream it begins to attack certain white blood vessels and antibodies. These antibodies can be detected by a specific blood test usually two weeks to three months after infection.
- In some people, the protective immune system may be destroyed by the virus and then other germs that ordinarily do not attack cause opportunistic disease to infect and destroy the body.
- Opportunistic infections occur during the last phase of HIV, which can occur up to 10 to 11 years after the infection. These infections are described as AIDS related complex (ARC)
- AIDS virus may attack nervous system causing damage to the brain resulting in memory loss and other neurological disorders.
- Some early signs may be persistent cough and fever associated with difficulty in breathing.
- Certain cancers
- Tuberculosis
- A typical pneumonia by fungus pneumocystis carinii
- Brain damage
- Night sweats and tiredness
- Swollen lymph nodes and fever
- Weight loss, chronic diarrhea that last for more than one week, loss of appetite and lack of resistance to infection.

## Diagnostic test

- HIV is diagnosed by testing the blood for the presence of antibodies to the virus.
- ELISA ( Enzyme -linked immunosorbent assay) screening test is the initial one. The test works by detecting antibodies, substances, proteins which are produced in the blood, when the virus is present.
- Western blot test will confirm the result of repeated test through detection of HIV proteins.
- Viral load test measures the amount of virus in the blood which will help in determining the probable progression of the disease

## Treatment

- However, no specific treatment has been found so far, and the mortality from AIDS is virtually 100%
- A combination of three and more antiretroviral agents, called triple therapy or highly active anti-retroviral therapy ( HAART ), has been highly effective in reducing the number of HIV particles in blood stream though HAART is not cure for HIV.

## Prevention

- The following steps may help in controlling this dreaded disease:
  - i) People should be educated about AIDS transmission, advantage of condoms.
  - ii) Disposable needles and syringes should be used
  - iii) High risk group should be refrain from donating blood
  - iv) Sexual habits should be changed
  - v) Before receiving blood, ensure that it has been screened for HIV
  - vi) While getting dental treatment, insist on the use of thoroughly sterilized equipment.
- December 1 is celebrated every year as the world AIDS Day.