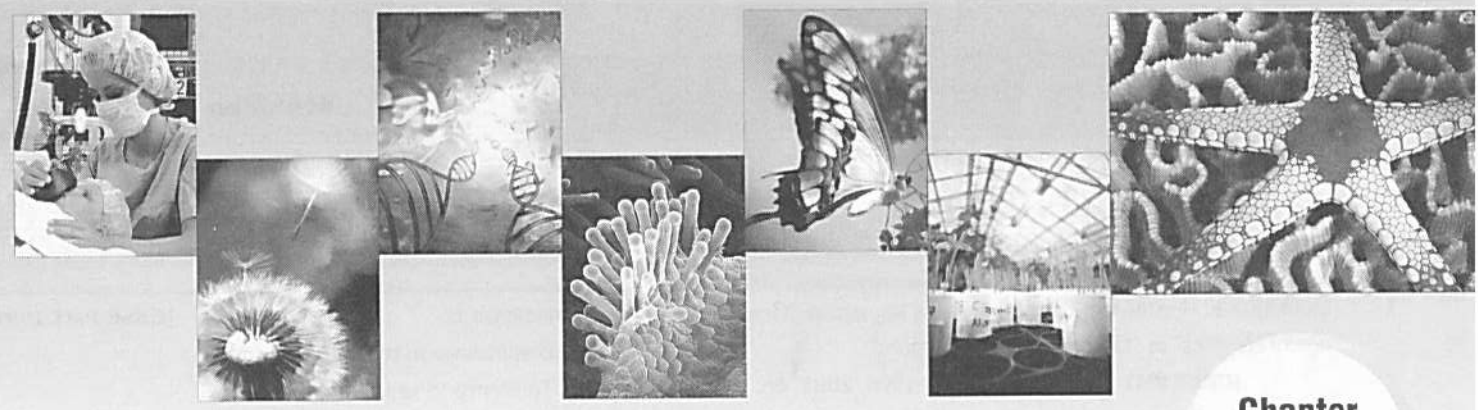

Chapter

8.1

Health and Diseases

"Disease" is a very wide term. Any change from the normal state that causes discomfort or disability or impairs the health may be called a disease. The oxford English Dictionary defines disease as "a condition of the body or some part or organ of the body in which its functions are disturbed or deranged". The World Health Organization (WHO) gave the following definition of health in 1948 –

"Health" is a state of complete physical, mental and social well-being, and not merely an absence of disease or infirmity". The WHO definition of health recognizes three dimensions of health : physical, mental and social. The physical health can be determined by various tests, but it is difficult to assess the mental health and social well-being.

Disease Agents

The disease agent is a factor (substance or force) which causes a disease by its excess or deficiency or absence. These agents are of five main types :

(1) **Biological Agents :** These include viruses, rickettesias, bacteria, fungi, protozoans, helminthes and arthropods. The biological agents are called **pathogens** (Gr. *Pathos* = disease; *genes* = producing).

(2) **Nutrient Agents :** These comprise food components such as carbohydrates, fats, proteins, minerals, vitamins and water.

(3) **Chemical Agents :** These are further of two types

(i) **Endogenous Chemical Agents :** These are formed in the body itself and include hormones, enzymes, urea and uric acid.

(ii) **Exogenous Chemical Agents :** These enter the body from outside by inhalation, ingestion or inoculation. Pollutants (fumes, gases, dusts, metals) and allergens (spores, pollen) are examples.

(4) **Physical Agents :** These include heat, cold, humidity, pressure radiation, electricity and sound.

(5) **Mechanical Agents :** These comprise chronic friction or other mechanical forces which results in injury, sprain, dislocation fracture.

(6) **Deficiency and Excess of substances :** *e.g.* Hormones, enzymes.

Some diseases are caused by genetic disorders and lack or underdevelopment of organs. The agents for certain diseases such as peptic ulcers, coronary heart diseases and hypertension, are not fully known.

Types of Diseases

The diseases may be broadly classified into two types : Congenital and acquired.

(1) **Congenital Diseases :** These are anatomical or physiological abnormalities present from birth. They may be caused by (a) a single gene mutation (alkaptonuria, phenylketonuria, albinism, sickle-cell anaemia, haemophilia, colour blindness); (b) chromosomal aberrations (Down's syndrome, Klinefelter's syndrome, Turner's syndrome); or (c) environmental factors (cleft palate, harelip). Unlike the gene-and chromosome-induced congenital defects, environmentally caused abnormalities are not transmitted to the children.

(2) **Acquired Diseases :** These diseases develop after birth. They are further of two types : communicable and non-communicable.

(i) **Communicable (Infectious) Diseases :** These diseases are caused by viruses, rickettsias, bacteria, fungi, protozoans and worms.

(ii) **Noncommunicable (Noninfectious) Diseases :** These diseases remain confined to the person who develops them and do not spread to others. The non-communicable diseases are of four kinds :

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(a) **Organic or Degenerative Diseases :** These diseases are due to malfunctioning of some of the important organs, *e.g*, heart diseases, epilepsy. Heart diseases result from the abnormal working of some part of this vital organ. Epilepsy may result from abnormal pressure on regions of the brain.

(b) **Deficiency Diseases :** These diseases are produced by deficiency of nutrients, minerals, vitamins, and hormones, *e.g.*, kwashiorkar, beri-beri, goitre, diabetes are just a few from a long list.

(c) **Allergies :** These diseases are caused when the body, which has become hypersensitive to certain foreign substance, comes in contact with that substance. Hay fever is an allergic disease.

(d) **Cancer :** This is caused by an uncontrolled growth of certain tissues in the body.

Communicable Diseases

Reservoir of Infection for Pathogens : Every pathogen has some reservoir where it normally lives when it is outside the host susceptible to the disease. The reservoir varies for different pathogens. It may be soil, water, animals or other persons called **carriers**. The animals which act as reservoirs do not contract the diseases and are known as reservoir hosts.

Transmission of Diseases (Pathogens) : The diseases (pathogens) are transmitted from the reservoirs of infection to the healthy persons in the following ways :

(1) **Direct Transmission :** The pathogens of some diseases reach the human body directly without intermediate agents. This can occur as under :

(i) **Contact with Infected Persons :** Certain diseases produce sores or lesions on the skin. Contact with materials discharged from these sores or lesions brings about infection. Ringworm, athlete's foot, barber's itch, chickenpox, smallpox, syphilis and gonorrhoea are spread by direct contact. Kissing also spreads infection. The diseases that are transmitted by direct contact are called **contagious diseases**.

(ii) **Droplet Infection :** Some diseases are caught by merely being in a confined place (room, theatre, bus) with an infected person. The latter throws out tiny droplets of mucus by coughing, sneezing, spitting or even talking. These droplets may contain pathogens (viruses, bacteria) dislodged from nasal membrane, throat, and lungs. Many of these droplets are inhaled. Diphtheria, scarlet fever, influenza, common cold, measles, mumps, tuberculosis, pneumonia, and whooping cough are spread by droplets.

(iii) **Contact with Soil :** The bacteria responsible for tetanus and blood poisoning enter the human body from the soil through injuries. Hence, skin injuries should not be neglected.

(iv) **Animal Bites :** Virus of rabies, or hydrophobia, is introduced through the wound caused by the bites of rabid animals, most commonly dogs.

(v) **Through Placenta :** In the later part of pregnancy, due to age or injury, the placenta becomes permeable to certain pathogens such as virus of german measles and bacteria of syphilis. The pathogens then pass from the maternal blood into the foetal blood.

(2) **Indirect Transmission :** The pathogens of certain diseases reach the human body through some intermediate agents as explained below :

(i) **Arthropod Vectors :** Insects transmit diseases in two different ways.

Housefly carries the causative organisms of cholera, typhoid, dysentery and tuberculosis on the legs and mouth parts from faeces and sputum to food and drinks. The latter, if taken, cause infection. It also carries the microbes responsible for ophthalmia and conjunctivitis from eye to eye. Ants, cockroaches and house crickets also carry disease germs to articles of food.

Certain blood-sucking insects carry disease-causing organisms in their body and transmit them with bites. Human body-louse spreads typhus, rat flea transmits bubonic plague, tsetse fly spreads African sleeping sickness, sandfly transmits kala-azar and oriental sore, *Aedes* mosquito spreads yellow fever, *Culex* mosquito transmits filariasis, and *Anopheles* mosquito spreads malaria, ticks spread rocky mountain spotted fever.

(ii) **Vehicle-borne Method :** The causative organisms of dysentery, cholera and typhoid enter the human digestive tract with food, water and ice. Most of the helminthes which produce diseases in man also get into the body in a similar way. Some diseases are transmitted through blood, *e.g.*, AIDS.

(iii) **Air-borne Method :** The pathogens may reach the humans with air and dust. The epidemic typhus spreads by inhalation of dried faeces of infected lice.

(iv) **Fomite-borne Method :** Many diseases are transmitted through the use of contaminated articles such as handkerchiefs, towels, clothes, utensils, toys, door handles, taps, soaps, syringes and surgical instruments.

(v) **Unclean Hands :** The unclean hands may carry disease germs to food or mouth. Therefore, hands should be washed before taking meals.

(vi) **Human Carriers :** Certain diseases, notably diphtheria and typhoid, spreads by human carriers. The latter are themselves healthy and immune, but have pathogenic organisms in their body. These pathogens are transmitted in the ways already mentioned.

How Pathogens Cause Diseases : Pathogens produce diseases in two ways : tissue damage and toxin secretion.

(1) **Tissue Damage :** The bacteria responsible for tuberculosis damage cells and cause lesions in the lungs. Blood oozes from the lesions into the air sacs, leading to haemorrhages. The bacteria that cause meningitis attack the protective membranes covering the brain. The virus of rabies destroys brain tissue. The polio virus damages motor nerve cells in the spinal cord.

(2) **Toxin Secretion :** Many microbes produce powerful poisons, called **toxins**, which cause diseases. Toxins are of 2 types :

(i) **Exotoxins :** These are released as soon as produced. The diseases brought about by exotoxins include tetanus, scarlet fever, diphtheria, and botulism (food poisoning)

(ii) **Endotoxins :** These are retained in the bacterial cells and released when bacteria die and disintegrate. The diseases caused by endotoxins include typhoid fever, cholera, bubonic plague and dysentery.

Defence mechanism

Immune response : Nature has provided certain ways in the body to defend ourselves from the invasion of pathogens and therefore, from the disease. The ability of a host's body to prevent or overcome the effects caused due to the invasion by pathogenic organisms and its toxins is known as **resistance** and **immunity**. Resistance is considered as an inherent factor and those acquired during life to overcome the disease, while the **immunity** is accepted to be due to the acquired factors that help in resistance. The host body has two lines of defence that must be overcome by a pathogen before establishing an infection.

External defence mechanism : This defence mechanism involves mechanical and chemical factors *e.g.* skin, mucus membrane, mucus secretion, peristalsis, coughing, sneezing, shedding tears, etc. Chemicals are lysozymes present in the body.

Internal defence mechanism : This mechanism of defence has two lines of defence against pathogen :

(1) **Non-specific Defence Mechanism :** It is further of two types : external defence or first line of defence and internal defence or second line of defence.

(i) **External Defence :** It includes physical and chemical barriers.

(a) **Physical Barriers**

❑ **Skin :** The skin is physical barrier of body. Its outer tough layer, the stratum corneum prevents the entry of bacteria and viruses.

❑ **Mucus Membrane :** Mucus secreted by mucus membrane traps the microorganisms and immobilises them. Microorganisms and dust particles can enter the respiratory tract with air during breathing which are trapped in the mucus. The cilia sweep the mucus loaded with microorganisms and dust particles into the pharynx (throat). From the pharynx it is thrown out or swallowed for elimination with the faeces.

(b) **Chemical barriers :** Oil secreted by the oil glands and sweat secreted by sweat glands make the surface of the skin acidic (*pH* 3-5). This does not allow the microorganisms to establish on the skin. Some friendly bacteria also occur on the skin which releases acids and other metabolic wastes that check the growth of pathogens. The sweat also contains an enzyme named **lysozyme** that destroys the cell walls of many bacteria.

The mesh of fine hair in our nostrils filters out particles which may carry pathogens. Nasal secretions also destroy the harmful foreign germs with their lysozyme.

Certain bacteria normally live in vagina. These bacteria produce lactic acid. Lactic acid kills the foreign bacteria.

Thus physical and chemical barriers form the first line of defence.

(ii) **Internal Defence :** The internal defence is carried on by white blood corpuscles, macrophages, inflammatory reaction, fever and interferons.

(a) **White blood corpuscles (Leucocytes) :** The leucocytes in general and lymphocytes in particular are capable of squeezing out through the wall of the blood capillaries into the extra-vascular regions. This phenomenon is called **diapedesis**. The leucocytes protect in different ways.

❑ **Lymphocytes :** Lymphocytes can produce plasma cells which secrete antibodies to provide immunity.

❑ **Monocytes :** They are phagocytic in action.

❑ **Eosinophils :** Eosinophils can attach themselves to parasitic forms and cause their destruction by liberating lysosomal enzymes on their surface.

❑ **Neutrophils :** They eat harmful germs and are, therefore phagocytic in nature.

(b) **Macrophages :** The macrophages are formed by enlargement of monocytes. They are large cells which are phagocytic in nature.

(c) **Inflammatory Response :** When the microorganisms like bacteria, viruses, etc. enter the body tissue through some injury, these produce some toxic substances which kill more cells. These broken cells also release some material which attract the mast cells. The mast cells release histamine. Histamine causes dilation of capillaries and small blood vessels surrounding the injury and increases the permeability of the capillary walls. The more blood flows to area making it red and warm. The fluid (plasma) leaks out into the tissue spaces, causing its swelling. This reaction of the body is known as inflammatory response. The plasma that accumulates at the injured site dilutes the toxins secreted by bacteria and decreases their effect.

(d) **Fever :** The inflammatory response may be in the region of the wound (localized), or it may spread all over the body (systemic). In systemic inflammatory response, the number of WBC increases generally, the fever is caused by the toxins released by the pathogens or by compounds called pyrogens (fever producing substances; Gr. *Pre* = fire). These compounds are released by W.B.C. in order to regulate temperature of the body. Moderate fever stimulates the phagocytes and inhibits growth of microorganisms. However, a very high fever is dangerous.

(e) **Interferons :** These are the proteins released by the cells in response to a viral infection which they help to combat. These interferons do not inactivate the virus, but they make the unattacked cells less susceptible so they are prevented from the attack of virus. They also prevent the viruses from taking over the cellular machinery. *Interferon proteins* have proved to be effective in, treating influenza and hepatitis, but their role in cancer treatment is doubtful. Thus the leucocytes, macrophages, inflammatory response, fever and interferons forms second line of defence.

Table : 8.1-1 Differences between Antibodies and Interferons

Antibodies	Interferons
These act inside the cells.	These act outside the cells.
They are slow acting.	They are quick acting.
They act against bacteria and viruses.	They act only against viruses.
Their action is long lasting	Their action is temporary.

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(2) **Specific Defence Mechanism (The Immune System):** Immune system forms third line of defence. There are two components of immune system in the body : Humoral immune system and cell-mediated immune system. One of the most important characteristics of the immune system is that it can recognize body's own cells and macromolecules **(self)** from those which are foreign invaders **(nonself)**.

(i) **Humoral Immune System or Antibody-mediated Immune system (AMIS) (Humoral** : Pertaining to body fluids): Humoral immune system results in production of antibodies. These antibodies circulate as soluble proteins in the plasma of blood and lymph which were earlier called **humors**. The humoral system protects the body against bacteria and viruses that enter the blood and lymph of the body. Antibodies are of many kinds.

(ii) **Cell-mediated Immune System (CMIS) :** In this system, highly specialized cells carry out defensive activities. These circulate in the blood and tissue. It protects the body against pathogens including the protists and fungi which have entered the host's cells. This system also reacts against tissue transplants and perhaps also against the body's own cells if they become cancerous. Two kinds of cells (*T* and *B* cells) are responsible for these responses.

The antigens are foreign 'molecules' that invade the body of an organism. The word 'antigen' is a shortened form of 'antibody generating' because they stimulate the production of antibodies in response to infection. Antigens are generally large molecules. The majority of them are made of proteins or polysaccharides found on the cell walls of bacteria and other cells or on the coats of viruses. All antigens are not the parts of microorganisms. Other structures like pollen grains, white of an egg, shell fish, certain fruits and vegetables, chicken, feathers of birds, blood cells from other persons or animals, drugs, chemicals, etc. can also induce the immune system to produce antibodies.

Table : 8.1-2 Types of Antibodies

S.No.	Classes	Description
1.	**IgG**	Main antibody type in circulation; attacks microorganisms and their toxins.
2.	**IgA**	Main antibody type in secretions, such as saliva and milk; attacks microorganisms and their toxins.
3.	**IgE**	Antibody responsible for allergic reactions.
4.	**IgM**	Antibody type found in circulation; largest antibody, with 5 subunits,
5.	**IgD**	Antibody type found primarily as a membrane bound immunoglobulin.

Cells of the Immune System : Lymphocytes (a type of WBCS) are the main cells of immune system of the body. Lymphocytes, meant for immune system, are of two types : T-cells and B-cells. Both types of cells develop from the stem cells found in the liver of the foetus and in the bone marrow cells of the adult. Those lymphocytes that migrate to the thymus and differentiate under its influence are called **'T-cells'**, while those cells that continue to be in the bone marrow for differentiation are known as **'B-cells'**. The final maturation of young lymphocytes occur in lymphoid tissues like lymph nodes, spleen and tonsils. T-cells are responsible for cellular immunity, however, B-cells produce the antibodies–about 20 trillions per day that take part in the humoral immunity. Both T-cells and B-cells require antigens to trigger them into action but they respond differently.

B-lymphocytes are independent of the thymus and in man probably complete their early maturation within the bone marrow. They are called B-cells because they mature within the **Bursa of Fabricius** in birds

Table : 8.1-3 Cells of Immune System

S.No.	Cell Type	Function
1.	Helper T Cell	Assists the immune process by helping other cells in the immune system to achieve an efficient immune response.
2.	Cytotoxic T Cell	Detects and kills infected body cells recruited by helper T cells.
3.	Suppressor T Cell	Guards against the overproduction of antibodies and overactivity of cytotoxic T cells.
4.	Memory cell	"Remembers" the original stimulation by the immune system and remains in the lymphoid tissue.
5.	Natural killer cell (NK)	The lymphocyte without receptor site and help to attack and neutralize virus-infected and tumor cells.
6.	B Cell	Precursor of plasma cell, specialized to recognize a specific foreign antigen.
7.	Plasma cell	Biochemical factory devoted to the production of antibodies directed against a specific antigen.
8.	Mast cell	Initiator of the inflammatory response which aids the arrival of leucocytes at a site of infection, secretes histamine and is important in allergic response.
9.	Monocyte	Precursor of macrophage.
10.	Macrophage	The body's first cellular line of defence; also serves as antigen presenting cell to B and T cells and engulfs antibody covered cells.

(1) **Mode of Action of B-Cells to Antigens :** When antigens enter a tissue fluid, B-cells are stimulated to produce antibodies. The body has thousands of antigen-specific B-cells. The membrane of each B-cell type would have been sensitized by the previous contact with the antigen. If this does not happen, the B-cells are destroyed. However, the new B-cells will keep on producing. Once an antigen-specific B-cell is activated by the antigen it multiplies very fast to form a clone of **plasma cells**. These plasma cells produce antibodies at a rate of about 2,000 molecules per second. This 'capacity' of the B-cells to produce specific antibodies is acquired during its process of development and maturation even before it was exposed to an antigen. However, an antigen is necessary to stimulate the production of antibodies.

(2) **Mode of Action of T-cells to Antigens :** Like B-cells, T-cells also respond to antigens by producing a clone (a group) of T-cells. T-cells live for 4-5 years or even longer. There are separate T-cells for each type of antigen that invades the body. T-cells of a clone that are produced in response to an antigen are similar morphologically but they perform different functions. According to their functions, they are of three types.

(i) **Killer T-cells :** These cells attack directly and destroy antigens. In the process, these cells move to the site of invasion and produce chemicals that attract phagocytes and stimulate them so that they can feed more vigorously on antigens. They also produce substances that attract other T-cells.

(ii) **Helper T-cells :** These cells stimulate B-cells to produce more of antibodies.

(iii) **Suppressor T-cells :** These cells suppress the entire immune system keeping it away from attacking the own body cells. Some of these cells also become memory cells.

Table : 8.1-4 Distribution of B- and T-Cells in Man

S.No.	Tissue	B-Cells %	T-Cells %
1.	Blood	15-25%	75-85%
2.	Spleen	55-75%	5-45%
3.	Bone marrow	Abundant	Few
4.	Thoracic duct	10-20%	80-90%
5.	Lymph nodes	20-30%	60-70%
6.	Thymus gland	Few	Abundant

Table : 8.1-5 Differences between B-Lymphocytes (B-Cells) and T-Lymphocytes (T-Cells)

S.No.	Feature	B-Lymphocytes (B-cells)	T-Lymphocytes (T-cells)
1.	Origin and site of differentiation	Bone marrow, Bursa of Fabricius (in fowl), gut-associated lymphoid tissue (Peyer's patches)	Bone marrow Thymus
2.	Immune System	B-cells form humoral or antibody-mediated immune system (AMIS).	T-cells form cell-mediated immune system (CMIS).
3.	Action	They defend against viruses and bacteria that enter the blood and lymph.	They defend against pathogens including protists and fungi that enter the cells.
4.	Division	They are formed by the division of plasma cells.	They are formed by the division of lymphoblasts of three types : killer, helper and suppressor cells.
5.	Movement	Plasma cells do not move to the site of infection.	Lymphoblasts move to the site of infection.
6.	Reaction against Transplants and cancer cells	Plasma cells do not react against transplants and cancer cells.	Killer cells react against transplants and cancer cells.
7.	Effect on Immune System	Plasma cells have no inhibitory effect on immune system.	Suppressor cells inhibit immune system.

Immunity

Definition : The resistance of the body to occurrence of any disease is known as immunity. Study of the ability of an organism to resist a disease is called **immunology**.

Development of Immunity : A person may develop immunity in three ways.

(1) **Vaccination :** It is a technique to develop immunity without infection. Weakened or dead pathogens **(attenuated)** or parts of pathogens are injected into a person who is required to be made immune. The pathogens given in a vaccine are unable to cause the disease but are sufficient to stimulate the formation of antibodies by the host's immune system. Often 2 or 3 additional doses are needed to generate adequate immunity. These doses are called **booster doses**.

(2) **Antitoxins :** Antibodies that neutralize toxins produced in the body or introduced from outside are, called **antitoxins**. Bacterial toxins are produced in the body, however antitoxins produced from outside are prepared from snake venom and is used as a remedy for snake bites.

(3) **Immunity through Diseases :** Some diseases such as mumps, measles, small pox produce a life long immunity. Hence these diseases do not appear again.

Types of Immunity : There are two main types of immunity : Inborn or innate and acquired or adaptive.

(1) **Inborn or Innate Immunity :** This type of immunity is inherited by the organisms from their parents and protects it from birth throughout life. Examples : Human beings have inborn immunity against **distemper** (a fatal disease of dogs).

(2) **Acquired or Adaptive Immunity :** This immunity is acquired in life time. The acquired immunity is of two types : Active or natural and passive or artificial.

(i) **Active Immunity :** When an organism's own cells produce antibodies it is called active immunity. It develops when a person suffers from a disease or gets vaccination for a disease.

(ii) **Passive Immunity :** In passive immunity, the antibodies are produced in some other organisms (*e.g.* vertebrates) in response to the given antigen. These antibodies are then injected into the human body at the time of need. This is known as **inoculation**. For example persons infected by rabies, tetanus, *Salmonella* (causes food poisoning) and snake venom are given the sufficient amount of antibodies so that they can survive.

Passive immunity provides immediate relief, however, active immunity requires some time for the formation of antibodies. There is another form of passive immunity. Nursing mothers transfer antibodies prepared in their body to the infants in their milk. Bottle-fed infants do not get this benefit. After a few weeks, infant's own immunity system starts working.

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Table : 8.1-6 Difference between Active Immunity and Passive Immunity

S.No.	Active Immunity	Passive Immunity
1.	It is developed when the person's own cells produce antibodies in response to infection or vaccine.	It develops when antibodies produced in other organisms are injected into a person to counter act antigen such as snake venom,
2.	It provides relief only after long period.	It provides immediate relief.
3.	It has no side effects.	It may cause reaction.
4.	It is long lasting.	It is not long lasting.

Disorders of Immune System

Allergies : Allergy is the hypersensitiveness of a person to some foreign substance coming in contact with or entering the body. The substances that cause **allergic** reaction are called **allergens**. The common allergens are dust, pollen mould, spores, fabrics, lipsticks, nail paints, feathers, fur, plants, bacteria, foods, heat, cold, sunlight.

Symptoms : The symptoms that result from an allergy may be of different kinds but mostly it affects the skin and mucous membrane. Hay fever affects the mucous membranes of the nose, eyes and upper respiratory tracts. In asthma, the lower portions of the respiratory system are severely affected. In eczema the skin becomes red, followed by the appearance of minute blisters. Eczema may affect any part of the body and is one of the most severest of all allergic symptoms.

Cause : During allergic reaction there is increased release of histamine from mast cells. It causes marked dilation of all the peripheral blood vessels and the capillaries become highly permeable so that large amounts of fluid leak out from the blood into the tissues.

(1) **Hay fever :** In this allergic form, there is swollen, reddened, running eyes and nose. The drugs called **antihistamines** are of major importance in the treatment of this allergic disorder.

(2) **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.

(3) **Anaphylactic shock :** It is an allergic reaction involving all the tissues of the body and occurs in a few minutes after the injection of an antigen such as **penicillin**. Such a reaction is very serious. Histamine released from ruptured mast cells causes marked dilation of all the arteries so that a large amount of fluid is passed from the blood to the tissues and there is a drastic fall in blood pressure. The affected person may become unconscious and the individual may die within a short time.

Autoimmunity : Sometimes it may also happen that the immune system of the body goes off the track and starts behaving against the 'own body' or 'self'. This leads to a variety of diseases known as autoimmune diseases. This type of diseases depends on which type of 'self-antigen' is involved. When the cells acting as antigens in the same body, they are called autoantigens. The nature of autoimmune diseases depends on the autoantigens involved. For example, if the autoantigens are RBC then the body destroys its own RBC, resulting in chronic anaemia; 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.

Immuno deficiencies

(1) **Severe Combined Immuno deficiency (SCID) :** Sometimes new born children are without T-cells and B-cells. These children are highly susceptible to various infections. The most serious disorder of this type is a congenital disease known as severe combined immuno deficiency (SCID) in which both B-cells and T-cells are not present in the body. Such children are highly susceptible even to minor infections. In developed countries like U.S.A. such children are kept alive by keeping them in germ-free environments called isolation suits.

Table : 8.1-7 Autoimmune Disorders

S.No.	Disorder	Symptoms	Antibodies Against
1.	Glomerulo nephritis	Lower back pain	Kidney cell antigens that resemble Strep bacteria antigens
2.	Grave disease	Restlessness, Weight loss,irritability, Increased heart rate and Blood pressure	Thyroid gland antigens near thyroid stimulating hormone receptor, causing overactivity
3.	Juvenile diabetes	Thirst, hunger, weakness, emaciation	Pancreatic beta cells
4.	Hemolytic anemia	Fatigue and weakness	Red blood cells
5.	Myastheni a gravis	Muscle weakness	Receptors for nerve messages on skeletal muscle
6.	Pernicious anemia	Fatigue and weakness	Binding site for vitamin B on cells lining stomach
7.	Rheumatic fever	Weakness, shortness of breath	Heart cell antigens that resemble Strep bacteria antigens
8.	Rheumatoi d arthritis	Joint pain and deformity	Cells lining joints
9.	Scleroder ma	Thick, hard, pigmented skin patches	Connective tissue cells
10.	Systemaic lupus erythmatos is	Red rash on face, prolonged fever, weakness, kidney damage	DNA, neurons, blood cells
11.	Ulcerative colitis	Lower abdominal pain	Colon cells

(2) **Acquired Immune Deficiency Syndrome (AIDS) :** It 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 by B-cells. This results in the loss of natural defence against viral infection.

Discovery : AIDS was first noticed in USA homosexuals in 1981 by Gottlies. Virus of AIDS was isolated and identified by **Prof. Luc Montagnier** in France in 1983 and almost the same time by **Prof. Robert Gallo** in USA. AIDS infections were detected in India for the first time in prostitutes of Chennai in 1986.

In India, four AIDS reference centres have been established.

(i) A.I.I.M.S., New Delhi.

(ii) National Institute of communicable Diseases, New Delhi,

(iii) National Institute of Virology, Pune.

(iv) Centre for Advanced Research on Virology, CMC, Vellore.

Symptoms of AIDS : An HIV infection can be divided into 3 stages.

(1) **Asymptomatic Carrier :** Only 1%-2% of those newly infected have mononucleosis-like symptoms that may include fever, chills, aches, swollen lymph glands, and an itchy rash. These symptoms disappear, and there are no other symptoms for 9 months or longer. Although the individual exhibits no symptoms during this stage. He or she is highly infectious. The standard HIV blood test for the presence of antibody becomes positive during this stage.

(2) **AIDS Related Complex (ARC) :** The most common symptom of ARC is swollen lymph glands in the neck, armpits, or groin that persist for 3 months or more. There is severe fatigue unrelated to exercise or drug use; unexplained persistent or recurrent fevers, often with night sweats; persistent cough not associated with smoking, a cold, or the flu; and persistent diarrhoea. Also possible are signs of nervous system impairment, including loss of memory, inability to think clearly, loss of judgement, and/or depression.

When the individual develops non-life threatening and recurrent infections such as thrush or herpes simplex, it is a signal that full-blown AIDS will occur shortly.

(3) **Full-Blown AIDS :** In this final stage, there is severe weight loss and weakness due to persistent diarrhoea and usually one of several opportunistic infections is present. These infections are called opportunistic because the body can usually prevent them – only an impaired immune system gives them the opportunity to get started. These infections include the following –

(i) **Pneumocystis carinii pneumonia :** There is not a single documented case of this type of pneumonia in persons with normal immunity.

(ii) **Toxoplasmic encephalitis :** In AIDS patients, this infection leads to loss of brain cells, seizures, and weakness.

(iii) **Mycobacterium avium :** This is an infection of the bone marrow that leads to a decrease in red blood cells, white blood cells, and platelets.

(iv) **Kaposi's Sarcoma :** A cancer of the blood vessels that causes reddish purple, coin-size spots and lesions on the skin.

Treatment of AIDS : The drug **zidovudine** (also called azidothymidine, or AZT) and dideoxyinosine (DDI) prevent HIV reproduction in cells. Proteases are enzymes HIV needs to bud from the host cell; researchers are hopeful that a protease inhibitor drug will soon be available.

A number of different types of vaccines are in, or are expected to be in, human trials. Several of these are sub unit vaccines that utilize genetically engineered proteins that resemble those found in HIV. For example, HIV-1, the cause of most AIDS cases has an outer envelop molecule called GP 120. When GP 120 combines with a CD4 molecule that projects from a helper T lymphocyte, the virus enters the cell. There are sub unit vaccines that make use of GP 120. An entirely different approach is being taken by **Jonas Salk**, who developed the polio vaccine. His vaccine utilizes whole HIV-1 killed by treatment with chemicals and radiation. So far, this vaccine has been found to be effective against experimental HIV-1 infection in chimpanzees, and clinical trials will occur soon.

AIDS Prevention : Shaking hands, hugging, social kissing, coughing or sneezing and swimming in the same pool do not transmit the AIDS virus. You cannot get AIDS from inanimate objects such as toilets, doorknobs, telephones, office machines, or household furniture.

HIV has been isolated from semen cervical secretions, lymphocytes, plasma, cerebrospinal fluid, tears, saliva, urine and breast milk. The secretions known to be especially infectious are semen, cervical secretions, blood and blood products. Infection spreads :

(1) By sexual intercourse, vaginal and anal

(2) By infected blood, blood products, donated semen and organs

(3) By contaminated needles used :

(i) During the treatment of patients

(ii) When drug abusers share needles

(4) From an infected mother to her child :

(i) Across the placenta before birth

(ii) While the baby is passing through the birth canal

(iii) Possibly by breast milk

The following behaviour will help prevent the spread of AIDS

(1) Do not use alcohol or drugs in a way that prevents you from being in control of your behaviour. Especially, do not inject drugs into veins, but if you are an intravenous drug user and cannot stop your behaviour, always use a sterile needle for injection or one cleansed by bleach.

(2) Refrain from multiple sex partners, especially with homosexual or bisexual men or intravenous drug users of either sex. Either abstain from sexual intercourse or develop a long-term monogamous (always the same partner) sexual relationship with a partner who is free of HIV and is not an intravenous drug user.

(3) If you uncertain about your partner, always use a latex condom. Follow the directions, and also use a spermicide containing nonoxynol-9, which kills viruses and virus-infected lymphocytes. The risk of contracting AIDS is greater in persons who already have a sexually transmitted disease.

Diagnosis : Once the host is infected by HIV. HIV is detected by the ELISA Test. (Enzyme–linked immunosorbent assay). A positive ELISA should be confirmed using another test called the western blot test.

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Hepatitis : It is a liver inflammation caused by virus, use of many drugs, chemicals and alcohol. Hepatitis may be of following types :

Hepatitis A : It is caused by *Hepatitis A* virus (HAV). It is transmitted through infected food, water, clothes and faecaes. It may occur in epidemic form especially in areas where hygiene is poor. This virus does not damage liver cells.

Hepatitis B : It is caused by *Hepatitis B* virus (HBV). It is transmitted by infected food and blood products; such as plasma or by medical instruments contaminated with infected blood. It results in the swelling of liver cells.

Hepatitis is also caused by poisonous chemicals, alcohol, as a side effect of certain drugs and from severe amoebiasis.

Vaccines

History of Vaccines and Vaccination : In vaccination weakened or dead pathogens, or portions of pathogens, are injected into a person who is required to be made immune. The pathogens given in a vaccine are unable to cause the disease, but are sufficient to stimulate the formation of antibodies by host's cells. The process of vaccination was initiated by Edward Jenner in 1790. He observed that milkmaids did not contract smallpox apparently because they were exposed to a similar but milder form of disease called cowpox. Edward Jenner infected first James Phipps,, a healthy boy of about 8 years with cowpox and two months later he infected the boy with smallpox. The boy did not suffer from small pox. Jenner proposed that an induced mild form of a disease would protect a person from a virulent form (which has ability to damage the host). He used the term vaccine (in Latin Vacca means 'cow') and the term vaccination for protective inoculation. Edward Jenner was the first to discover a safe and effective means of producing artificial immunity against small pox. Thus once vaccination is done the individual is protected from the disease. Vaccination develops acquired immunity. Pasteur confirmed Jenner's findings and produced vaccines for other diseases like anthrax, rabies and chicken cholera.

For protection need : Antibody provoking agents are called vaccines. These are used against viral and bacterial diseases. Calmette & Guerin developed BCG vaccine for T.B. and Salk made Polio vaccine. Sabin also prepared Polio vaccine. Enders developed vaccine against measles. WHO was formed in 1948 at Geneva to take health problems at global level. In May, 1974, Global Immunisation Programme was launched by WHO for six disease (Diphtheria, Pertussis, Tetanus, Measles, TB & Polio).

Vaccination : It is the possible way to induce active acquired immunity against the germs of various diseases such as polio, diphtheria, whooping cough, tetanus and small pox. The immune system is thus induced to produce antibodies against these antigens. The artificial introduction of disease factors in the body is known as vaccination. Usually 2-3 injections are given to achieve full immunity against a specific pathogen and the further dose is called as booster doses.

Other Vaccines : Vaccines are also available for diphtheria, tetanus, whooping cough, tuberculosis, measles, polio, mumps, plague.

Types of Vaccines

(1) **Killed vaccine :** These vaccines are prepared by killing the pathogenic organisms by heat uv-rays/alcohol formalin/phenol, e.g., Typhoid Vaccine, Cholera Vaccine.

(2) **Toxoid :** These are prepared by destroying the toxic property of the toxins produced by organisms but retaining its antigenic property, e.g., Tetanus toxoid, Antidiphtheria toxoid.

(3) **Attenuated living vaccines :** The pathogen is made weakened to make it nonvirulent, e.g., Oral Polio Vaccine (OPV), BCG (Bacille Calmette Guerin). MMR (Mumps, Measles, Rubella) Provide active life long immunity.

(4) **Antibodies as vaccines :** Serum is used after a person/animal has been exposed to infection. This serum contains antibodies against that pathogen. It provides passive artificial immunity for some period only, *e.g.*, ATS (*Anti tetanus serum*), *Antirabies serum*.

(5) Antigens like polysaccharides of *Pneumococci*, Interferon (glycoproteins) are also used as vaccines.

Table : 8.1-8 Some Important Vaccines

S.No.	Name of Vaccine	Category of Vaccine	Used for treatment of
1.	B.C.G.	Live vaccine (actual weakened germs)	Tuberculosis
2.	Cholera Vaccine	Killed vaccines (micro-organisms are killed)	Cholera
3.	Mumps Vaccine (MMR)	Live vaccine (actual weakened germs)	Mumps Measles & Rubella
4.	Oral Polio Vaccine (OPV)	Live vaccine	Polio, 1st dose given when child is 3 months old. Booster dose is given after 1 year
5.	Rubella Vaccine	Live vaccine	German measles and small pox
6.	Rubeolla Vaccine	Live vaccine	Measles
7.	Tetanustoxoid (TT)	Toxoid (bacterial toxin looses toxicity but retains antigenicity)	Tetanus
8.	Toxoid Serum	Toxoid (bacterial toxin looses toxicity but retains antigenicity)	Diphtheria
9.	Typhoid Vaccine (TAB)	Killed vaccine (micro organisms are killed)	Typhoid (Typhoid & Paratyphoid)
10.	Triple Antigen (DPT) (Diphtheria, Pertussis Tetanus)	Toxoid	Diphtheria, tetanus and whooping cough, Ist dose given when child is 3 months old. Booster dose at 2 years.

Tips & Tricks

- Ancylostoma duodenale larvae penetrate through exposed parts of hands and feet. It is common amongst agricultural workers.
- Cruetzfeldt Jakob Disease (CJD) is human disease equivalent to BSE. (Bovine spongiform encephalopathy). Upto 1984, about 26 cases of (CJD) were reported in India.
- He La cells : Cancer cells capable to propagate outside a living system. These are named after their donor, Heriatta Lacks, who died of cervical in 1951.
- Ames Test : It is a routine screening test developed by Bruce Ames to know the mutagenicity and carcinogenic nature of a substance.
- Plague vaccine provides immunity for six month. It was developed by Dr. Hoffkine, a Russian scientist.
- Small pox has been completely eradicated through compulsory immunization and the last case of small pox in human being was reported in 1978.
- Ali Maow Maalin was the last recorded victim of small pox.
- In mumps, if sex organ are involved then it may cause sterility in males.
- MMR vaccine : Triple antigen for Measles, Mumps and German measles (Rubeolla).
- August 29 is called Mosquito day.
- The wood of Tectona grandis is termite resistance.
- In September, 1997, India launched a Rs. 791 crore "Enhanced Malaria Control Project" aided by World bank loan. The 5 year project will stress for a decentralized strategy and people participation.
- Robert Koch (1876) was first to establish connection between disease and pathogen (anthrax disease of sheep due to *Bacillus anthracis*).
- Pasteur (1879). Development of vaccines through attennation of pathogens.
- AIDS Day. December 1.
- Epitope. Region of antigen at which antibody combines.
- Paratope. Region of antibody that combines with antigen.
- Lentivirus. Slow acting virus, *e.g.*, HIV.
- MALT. Mucosa Associated Lymphoid Tissue.

Ordinary Thinking

Objective Questions

General

1. Which one of the following provide non specific pathogen defense for the body **[NCERT; Odisha JEE 2008]**
(a) T-cells (b) B-cells
(c) Phagocytes (d) Stem cells

2. To which category multiple sclerosis belong **[VITEEE 2008]**
(a) Immunodeficiency diseases (b) Autoimmune diseases
(c) Hyper sensitivity (d) All the above

3. Which one of the following statement is correct **[CBSE PMT 2009]**
(a) Patients who have undergone surgery are given cannabinoids to relieve pain
(b) Benign tumours show the property of metastasis
(c) Heroin accelerates body functions
(d) Malignant tumours may exhibit metastasis

4. Note the following:
(A) Skin (B) Phagocytes
(C) B-cells (D) Inflammation
(E) Antibodies (F) T-cells
(G) Fever (H) Antimicrobial proteins
(I) NK-cells (J) Secretions
Identify the factors involved in 2nd line of defence **[EAMCET 2009]**
(a) (B), (D), (G) and (I) (b) (B), (C), (E) and (I)
(c) (D), (F), (H) and (J) (d) (C), (E), (G) and (H)

5. Choose the wrong statement regarding AIDS **[Kerala PMT 2009]**
(a) AIDS is an immunodeficiency disease
(b) It us caused by a retrovirus, HIV
(c) HIV selectively infects and kill B-lymphocytes
(d) Retroviruses have RNA genomes that replicate *via* DNA intermediate
(e) Viral RNA genome is converted into DNA copy by reverse transcriptase

6. Only one of the following four ways through which AIDS can spread **[WB JEE 2008]**
(a) Infected needles and syringes
(b) Through mosquito bites
(c) Looking after AIDS patient
(d) Shaking hands, coughing, sneezing, hugging

7. Active immunity development is related to **[WB JEE 2008]**
(a) Natural killer cells (b) Memory cells
(c) Helper T cells (d) Suppresser T cells

8. When an organ is transplanted and is rejected by the body, the lymphocytes are produced by **[AMU (Med.) 2009]**
(a) Cytotoxic T cells (b) NK cells
(c) Suppressor T cells (d) B cells

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9. Which one of the following statements is correct with respect to immunity **[NCERT; CBSE PMT (Mains) 2012]**

(a) Preformed antibodies need to be injected to treat the bite by a viper snake

(b) The antibodies against small pox pathogen are produced by T-lymphocytes

(c) Antibodies are protein molecules, each of which has four light chains

(d) Rejection of a kidney graft is the function of B-lymphocytes

10. The most commonly used marker enzyme in clinical diagnosis of prostate cancer is **[AMU (Med.) 2009]**

(a) Amylase (b) Alkaline phosphatase

(c) γ-GTPase (d) Acid phosphatase

11. Cells obtained from cancerous tumors are known as **[MP PMT 2009]**

(a) Hybridomas (b) Myelomas

(c) Lymphocytes (d) Monoclonal cells

12. Which *Ig* is produced in primary immune response **[WB JEE 2009]**

Or

Which antibody is first to be released into blood following an infection **[WB JEE 2016]**

(a) *IgA* (b) *IgE*

(c) *IgG* (d) *IgM*

13. Immunodeficiency makes a person highly susceptible to infection. It is caused by **[AFMC 2006]**

(a) Lack of *B* cells (b) Lack of *T* cells

(c) Lack of both *B* and *T* cells (d) None of the above

14. Expand ELISA **[DPMT 2007]**

(a) Enzyme linked immunosorbent assay

(b) Enzyme linked ion sorbent assay

(c) Enzyme linked inductive assay

(d) None of the above

15. In higher vertebrates, the immune system can distinguish self-cells and non-self. If this property is lost due to genetic abnormality and it attacks self-cells, then it leads to **[NEET (Phase-I) 2016]**

(a) Allergic response (b) Graft rejection

(c) Auto-immune disease (d) Active immunity

16. Characters of acquired immunity are **[DPMT 2007]**

(a) Specificity of antigen

(b) Difference between self and non-self

(c) Retains memory

(d) All of these

17. DPT vaccine is given for **[Pb. PMT 2004]**

(a) Tetanus, polio, plague

(b) Diphtheria, whooping cough and leprosy

(c) Diphtheria, pneumonia, tetanus

(d) Diphtheria, whooping cough, tetanus

18. Plasma cells are derived from **[MHCET 2015]**

(a) Cytotoxic T – cells (b) Helper T – cells

(c) Memory B – cells (d) Memory T – cells

19. Rishikesh is famous for the production of **[AIIMS 2004]**

(a) Antibiotics (b) Heavy electricals

(c) Fertilizers (d) Transistorized radios

20. B.C.G. vaccine is used against **[NCERT; AFMC 2002, 05, 09]**

(a) T.B. (b) Leprosy

(c) Food poisoning (d) None of these

21. The immune system which works against self is **[MP PMT 2003]**

(a) Self immune system (b) Autoimmunity

(c) Specific immunity (d) None of the above

22. How many polypeptide chains are present in gamma immunoglobulin **[Odisha JEE 2010]**

Or

How many variable segments are present in the basic structure of antibody molecule **[WB JEE 2010]**

(a) 5 (b) 4

(c) 6 (d) 2

23. AIDS is caused by **[MP PMT 1996]**

(a) Blood cancer (b) HTLV–III

(c) Bacterium (d) TMV

24. Bursa of Fabricius is an important organ of birds. This organ is associated with **[VITEEE 2006; WB JEE 2012]**

(a) Generation of basophils (b) Production of uric acid

(c) Metabolism of fatty acid (d) Generation of B-cell

25. Passive immunity can be obtained by injecting **[WB JEE 2008]**

Or

After vaccination the body builds up

(a) Antigens

(b) Antibodies

(c) Antibiotics

(d) Vaccination having weakened germs

26. As per the guidelines of the Indian Red Cross Society, which of the following persons is recommended for blood donation **[KCET 2011]**

(a) People not in good health, under the influence of alcohol or drugs

(b) Ladies during menstruation, pregnancy and breast feeding

(c) Healthy women but unwed and below the age of 35

(d) Persons who are immunized with live vaccines

27. First triple antigen vaccination is given to the child at the age of

(a) One month (b) Three month

(c) Four month (d) One year

28. Edward Jenner discovered **[KCET 2001; MH CET 2015; WB JEE 2016]**

(a) Vaccination against polio

(b) Immunization against polio

(c) Vaccination against small pox

(d) Immunization against small pox

29. Immediate hypersensitivity which result in the release of histamine and other inflammatory substances is mediated by **[AMU (Med.) 2010]**

(a) *IgA* (b) *IgD*

(c) *IgE* (d) *IgG*

30. Immunoglobulins are proteins that show.....Structure **[AMU (Med.) 2010]**
(a) Primary (b) Secondary
(c) Tertiary (d) Quaternary

31. Which one of the following acts as a physiological barrier to the entry of microorganisms in human body **[NCERT; CBSE PMT (Pre.) 2011]**
(a) Skin
(b) Epithelium of Urogenial tract
(c) Tears
(d) Monocytes

32. In ELISA TEST substance used is **[Bihar CECE 2006]**
(a) Peroxidase (b) Polymerase
(c) Ligase (d) Endonuclease

33. Vaccine against rabies was first developed by **[J & K CET 2010]**
(a) Edward Jenner (b) George Snell
(c) Louis Pasteur (d) Peter Goror

34. After infection of germs immunity acquired is **[NCERT]**

Or

The immunity obtained after the body has recovered from a disease is **[MP PMT 1996]**
(a) Active immunity (b) Passive immunity
(c) Natural immunity (d) Both (a) and (b)

35. Antibody formation and immunity production is done by a protein called globulin present in the **[AIIMS 1993]**
(a) Stroma of RBC (b) Haemoglobin of RBC
(c) Plasma (d) Blood platelets

36. Study of interaction of antigens and antibodies in the blood is **[CMC Vellore 1993; JIPMER 1993, 98]**
(a) Cryobiology (b) Serology
(c) Haematology (d) Angiology

37. AIDS is caused by HIV that principally infects **[MP PMT 1994; CBSE PMT 2005]**
(a) All lymphocytes (b) Activator B cells
(c) T-4 lymphocytes (d) Cytotoxic T cells

38. Which part of the body is known as '*Police guard*'
(a) Tonsils (b) Liver
(c) Skin (d) Leucocytes

39. Which one of the following is not an autoimmune disease **[J & K CET 2010]**
(a) Grave's disease (b) Pernicious anemia
(c) Rheumatoid arthritis (d) Insomnia

40. Read the following four statements (*A-D*)
(a) Colostrum is recommended for the new born because it is rich in antigens
(b) Chikengunya is caused by a Gram negative bacterium
(c) Tissue culture has proved useful in obtaining virus-free plants
(d) Beer is manufactured by distillation of fermented grape juice

How many of the above statements are wrong **[NCERT; CBSE PMT (Mains) 2012]**
(a) Two (b) Three
(c) Four (d) One

41. Antibodies are produced by **[AIEEE Pharmacy 2004; DPMT 2007; MP PMT 2007; Odisha JEE 2009]**
(a) Erythrocytes (b) Thrombocytes
(c) Monocytes (d) Lymphocytes

42. What is the process, in which antibody comes in contact with antigen and convert them in harmless insoluble matter, called **[GUJCET 2007; Odisha JEE 2009]**
(a) Activation (b) Agglutination
(c) Neutralization (d) Opsonization

43. People administered with preformed antibodies get **[Kerala PMT 2012]**

Or

Short- lived immunity acquired from mother to foetus across placenta or through mother's milk to the infant is categorized as **[NCERT; AFMC 2012]**
(a) Active immunity (b) Innate immunity
(c) Auto immunity (d) Natural immunity
(e) Passive immunity

44. Which cell of immune system cause pore formation at the surface of the plasma membrane **[NCERT; Odisha JEE 2004]**
(a) Helper T-cell (b) Killer T-cell
(c) Suppressor T-cell (d) B-cell

45. Humoral immunity is due to **[Pb. PMT 2000; Odisha PMT 2002, 04; WB JEE 2011, 12]**
(a) B-lymphocytes (b) T-lymphocytes
(c) L-Lymphocytes (d) P- Lymphocytes

46. At which stage of HIV infection does one usually show symptoms of AIDS **[NCERT; CBSE PMT (Pre.) 2010, 11; AIPMT 2015; AIPMT (Cancelled) 2015)]**
(a) Within 15 days of sexual contact with an infected person
(b) When the infecting retrovirus enters host cells
(c) When viral DNA is produced by reverse transcriptase
(d) When HIV replicates rapidly in helper T-lymphocytes and damages large number of these

47. Which one of the following pairs of disease can spread through blood transfusion **[NCERT; AIEEE Pharmacy 2004]**
(a) Cholera and hepatitis
(b) Hepatitis and AIDS
(c) Diabetes mellitus and malaria
(d) Hay fever and AIDS

48. Which of the glands is often referred in relation with AIDS **[BHU 1995]**

Or

T-cells are lymphocytes which produce the cellular immunity. These are developed from **[MP PMT 2003]**
(a) Thyroid (b) Thymus
(c) Adrenal (d) Pancreas

49. How does AIDS virus enter into man **[MP PMT 1995]**
(a) Through food (b) Through kissing
(c) Through water (d) Through blood

50. Sensitivity to any allergen is related to **[CBSE PMT 1996]**
(a) Deviation from the process of immunity
(b) Age of the person
(c) Eating habit
(d) Rise in environmental temperature

51. Passive immunity was discovered by **[CBSE PMT 1996]**
(a) Robert Koch (b) L. Pasteur
(c) Edward Jenner (d) Eemil Von Behring

52. A certain patient is suspected to be suffering from Acquired Immuno Deficiency Syndrome. Which diagnostic technique will you recommend for its detection **[NCERT; DPMT 2003; BVP 2004; Pb PMT 2004; MH CET 2004; AMU (Med.) 2006; CBSE PMT (Pre.) 2011]**
(a) ELISA (b) Australian antigen
(c) HIV test (d) None of these

53. The cell-mediated immunity inside the human body is carried out by **[NEET 2013]**
(a) Erythrocytes (b) T-lymphocytes
(c) B-lymphocytes (d) Thrombocytes

54. HIV causes reduction in **[NCERT; MP PMT 1997, 2010; BHU 2000, 08; AFMC 2004; CBSE PMT 2006; WB JEE 2009]**

Or

HIV virus affects ..... in AIDS patient **[Odisha JEE 2004, 09; MP PMT 2012]**
(a) T-helper cells only (b) All T-cells
(c) B-cells only (d) Both B and T-cells

55. A molecule that elicits an immune response is called **[MP PMT 1997]**
(a) Antibody (b) Antigen
(c) Mutagen (d) Carcinogen

56. Vaccines are prepared from immune **[MP PMT 1998]**
(a) Vitamins (b) Blood
(c) Serum (d) Plasma

57. AIDS can be transmitted by **[MP PMT 1998]**
(a) Blood circulation (b) Hand shake
(c) Courtship (d) All of the above

58. The antibodies are **[MP PMT 1998]**
(a) Gamma–globulins (b) Albumins
(c) Vitamins (d) Sugar

59. The factor responsible for cirrhosis of liver is **[NCERT; MP PMT 1998]**
(a) Sugar (b) Vitamins
(c) Fats and oils (d) Alcoholism

60. Full form of AIDS is **[MP PMT 1999; CPMT 2009]**
(a) Anti immune deficiency syndrome
(b) Auto immune deficiency syndrome
(c) Acquired immuno deficiency syndrome
(d) Acquired immune disease symptom

61. The antibodies are **[CBSE PMT 1996, 99; BHU 2000; MP PMT 2012]**
(a) Lipids (b) Germs
(c) Proteins (d) Carbohydrates

62. The term 'active immunity' means **[NCERT; CBSE PMT 1999; BHU 1999]**
(a) Resistance developed after disease
(b) Resistance developed before disease
(c) Resistance rate of heart beat
(d) Increasing quantity of blood

63. The immunoglobulin abundant in colostrum is **[NCERT; Kerala PMT 2010; AIPMT 2015]**

Or

The yellowish fluid colostrum has abundant antibodies to protect the infant **[MP PMT 2011]**
(a) *Ig G* (b) *Ig M*
(c) *Ig D* (d) *Ig E*
(e) *Ig A*

64. In the immune system, interferons are a part of **[Kerala PMT 2010]**
(a) Physiological barriers (b) Cellular barriers
(c) Physical barriers (d) Cytokine barriers
(e) Macrophages

65. Match the type of immunity listed in column I with the examples listed in column II. Choose the answer that gives the correct combination of alphabets of the two columns

Column I Types of immunity		Column II Example	
A.	Natural active	p.	Immunity developed by heredity
B.	Artificial passive	q.	From mother to foetus through placenta
C.	Artificial active	r.	Injection of antiserum to travellers
D.	Natural passive	s.	Fighting infections naturally
		t.	Induced by vaccination

[KCET 2010]
(a) A→s, B→t, C→q, D→r (b) A→t, B→s, C→r, D→p
(c) A→p, B→q, C→r, D→t (d) A→s, B→r, C→t, D→q

66. Consider the following four statements (*A* – *D*) regarding kidney transplant and select the two correct ones out of these
(A) Even if a kidney transplant is proper the recipient may need to take immuno-suppresants for a long time
(B) The cell-mediated immune response is responsible for the graft rejection
(C) The *B* – lymphocytes are responsible for rejection of the graft
(D) The acceptance or rejection of a kidney transplant depends on specific interferons
The two correct statements are **[CBSE PMT (Pre.) 2010; AIPMT 2015]**
(a) (A) and (B) (b) (B) and (C)
(c) (C) and (D) (d) (A) and (D)

67. Which of the following is an autoimmune disease **[NCERT; Odisha JEE 2004; MP PMT 2010]**
(a) Rheumatoid arthritis (b) Grave's disease
(c) Hashimoto's disease (d) All of the above

68. Antibodies are of which class of proteins **[MP PMT 2010]**
(a) Structural (b) Enzymatic
(c) Transport (d) Immunoglobulin

69. Which one of the following can **not** be used for preparation of vaccines against plague **[CBSE PMT (Mains) 2010]**
(a) Formalin-inactivated suspensions of virulent bacteria
(b) Avirulent live bacteria
(c) Synthetic capsular polysaccharide material
(d) Heat-killed suspensions of virulent bacteria

70. Select the correct statement with respect to diseases and immunisation **[NCERT; CBSE PMT (Mains) 2011]**
(a) Certain protozoans have been used to mass produce hepatitis B vaccine
(b) Injection of snake antivenom against snake bite is an example of active immunisation
(c) If due to some reason *B* and *T*-lymphocytes are damaged, the body will not produce antibodies against a pathogen
(d) Injection of dead / inactivated pathogens causes passive immunity

71. An immunoglobulin G molecule is composed of **[WB JEE 2016]**
(a) Two identical heavy chains and two identical light chains
(b) Two identical heavy chains and two different light different heavy chains and two different light chains chains
(c) Two different heavy chains and two identical light chains
(d) Two

72. MALT constitutes about _____ percent of the lymphoid tissue in human body **[NEET 2017]**
(a) 50% (b) 20%
(c) 70% (d) 10%

NCERT Exemplar Questions

1. The organisms which cause diseases in plants and animals are called **[NCERT]**
(a) Pathogens (b) Vectors
(c) Insects (d) Worms

2. When an apparently healthy person is diagnosed as unhealthy by a psychiatrist, the reason could be that **[NCERT]**
(a) The patient was not efficient at his work
(b) The patient was not economically prosperous
(c) The patient shows behavioural and social maladjustment
(d) He does not take interest in sports

3. AIDS is caused by HIV. Among the following, which one is not a mode of transmission of HIV **[NCERT]**
(a) Transfusion of contaminated blood
(b) Sharing the infected needles
(c) Shaking hands with infected persons
(d) Sexual contact with infected persons

4. The substance produced by a cell in viral infection that can protect other cells from further infection is **[NCERT]**
(a) Serotonin (b) Colostrums
(c) Interferon (d) Histamine

5. Transplantation of tissues/organs to save certain patients often fails due to rejection of such tissues/organs by the patient. Which type of immune response is responsible for such rejections **[NCERT; NEET 2017]**
(a) Auto-immune response
(b) Humoral immune response
(c) Physiological immune response
(d) Cell-mediated immune response

6. Antivenom against snake poison contains **[NCERT]**
(a) Antigens
(b) Antigen-antibody complexes
(c) Antibodies
(d) Enzymes

7. Which of the following is not a lymphoid tissue **[NCERT]**
(a) Spleen (b) Tonsils
(b) Pancreas (d) Thymus

8. Which of the following glands is large sized at birth but reduces in size with ageing **[NCERT]**
(a) Pineal (b) Pituitary
(c) Thymus (d) Thyroid

Critical Thinking Objective Questions

1. Certain compounds are released by the WBC which raise the body temperature. These compounds are known as **[RPMT 2001]**
(a) Pyrogens (b) Histamines
(c) Toxigens (d) Pathogens

2. Hypochromic microcytic anaemia and leucopenia are caused by the deficiency of ..... respectively **[EAMCET 2009]**
(a) Pyridoxine and riboflavin (b) Pyridoxine and folacin
(c) Biotin and folacin (d) Biotin and cyanocobalamin

3. A person likey to develop tetanus is immunized by administering **[CBSE PMT 2009]**

Or

When a quick immune response is required due to infection of a deadly microbes, the patient is injected with **[NCERT]**
(a) Dead germs (b) Preformed antibodies
(c) Wide spectrum antibiotics (d) weakened germs

4. If you suspect major deficiency of antibodies in a person, to which of the following would you look for confirmatory evidence **[CBSE PMT 2007; AIPMT 2015]**
(a) Serum albumins (b) Serum globulins
(c) Fibrinogen in the plasma (d) Haemocytes

5. Active immunity is obtained by
(a) Antibodies (b) Weakened germs infection
(c) Natural resistance (d) None of these

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6. Each immunoglobin has two heavy chains & two light chains, the antigen binding site is present in **[NCERT; DPMT 2007; AIIMS 2008]**

(a) Variable region of heavy chain

(b) Variable region of both heavy and light chain

(c) Variable region of light chain

(d) Constant region of both light and heavy chain

7. SCID is caused by defective gene coding for the enzyme called **[Kerala PMT 2006]**

(a) Adenosine transaminase (b) Guanosine transaminase

(c) Adenosine deaminase (d) Guanosine deaminase

(e) Adenosine transferase

8. Which of the following vaccines are injected to babies at the age of 1½, 2½ and 3½ months **[Kerala PMT 2006]**

(a) DPT–Hip.B and Polio (b) Polio and BCG

(c) BCG and DPT–Hib (d) BCG and Hepatitis B

(e) Polio and DPT–Hip.B

9. In which one of the following options the two examples are correctly matched with their particular type of immunity **[NCERT; CBSE PMT (Pre.) 2012]**

	Examples	Type of immunity
(a)	Polymorphonuclear leukocytes and monocytes	Cellular barriers
(b)	Anti- tetanus and anti–snake bite injections	Active immunity
(c)	Saliva in mouth and Tears in eyes	Physical barriers
(d)	Mucus coating of epithelium lining the urinogenital tract and the *HCl* in stomach	Physiological barriers

10. Match each disease with its correct type of vaccine

(A)	Tuberculosis	(I)	Harmless virus
(B)	Whooping cough	(II)	Inactivated toxin
(C)	Diphtheria	(III)	Killed bacteria
(D)	Polio	(IV)	Harmless bacteria

[AIPMT (Cancelled) 2015]

	(A)	(B)	(C)	(D)
(a)	(III)	(II)	(IV)	(I)
(b)	(IV)	(III)	(II)	(I)
(c)	(I)	(II)	(IV)	(III)
(d)	(II)	(I)	(III)	(IV)

11. AIDS related complex (ARC) is a disease which leads to fever, swollen lymph nodes, night sweats, loss in weight etc. represents **[MP PMT 1994]**

(a) Severe form of AIDS (b) Initial form of AIDS

(c) No link with AIDS (d) None of the above

12. Which of the following disease is due to an allergic reaction **[NCERT; CBSE PMT 1995; AIIMS 1998; AFMC 2002]**

(a) Goitre (b) Enteric fever

(c) Skin cancer (d) Hay fever

13. The protein $\alpha-1$ antitrypsin is used to treat the disease **[Kerala PMT 2011]**

(a) Cancer

(b) Rheumatoid arthritis

(c) Alzheimer's disease

(d) Emphysema

(e) ADA deficiency disease in children

14. Severe Acute Respiratory Syndrome (SARS) **[CBSE PMT 2004; AIIMS 2004, 08]**

(a) Is caused by a variant of *Pneumococcus*

(b) Is caused by a variant of the common cold virus (corona virus)

(c) Is an acute form of asthma

(d) Affects non-vegetarians much faster than the vegetarians

15. Which immunoglobulin is the largest in size **[Odisha JEE 2004]**

(a) *IgA* (b) *IgD*

(c) *IgE* (d) *IgM*

16. If interferon is being produced in the body of a sick person, the person is most likely to be suffering from **[CPMT 2004]**

(a) Typhoid (b) Malaria

(c) Measles (d) Tetanus

17. A person is injected with globulin against hepatitis. This is **[BVP 2004]**

(a) Artificially acquired passive immunity

(b) Artificially acquired active immunity

(c) Naturally acquired active immunity

(d) Naturally acquired passive immunity

18. How does vaccination work **[J & K CET 2012]**

(a) The immune system produces antibodies which stay in the blood

(b) Memory lymphocytes are produced. They remain in the body to fight off any future infection with the live pathogen

(c) The dead pathogen stays in the body and constantly stimulates the immune system

(d) All of the above

19. ELISA is used to detect viruses, where **[CPMT 2004]**

(a) Alkaline phosphatase is the key reagent

(b) Catalase is the key reagent

(c) DNA-probes are required

(d) Southern blotting is done

20. Allergy involves **[BCECE (Bihar) 2005; Kerala PMT 2006, 07; AMU (Med.) 2012; J & K CET 2012]**

Or

The antibodies produced during allergy are **[NCERT]**

(a) IgE (b) IgG

(c) IgA (d) IgM

21. Which of the following is correct regarding AIDS causative agent HIV **[NEET (Phase-II) 2016]**

(a) HIV does not escape but attacks the acquired immune response

(b) HIV is enveloped virus containing one molecule of single-stranded RNA and one molecule of reverse transcriptase

(c) HIV is enveloped virus that contains two identical molecules of single-stranded RNA and two molecules of reverse transcriptase

(d) HIV is unenveloped retrovirus

AR Assertion & Reason

Read the assertion and reason carefully to mark the correct option out of the options given below :

(a) If both the assertion and the reason are true and the reason is a correct explanation of the assertion

(b) If both the assertion and reason are true but the reason is not a correct explanation of the assertion

(c) If the assertion is true but the reason is false

(d) If both the assertion and reason are false

(e) If the assertion is false but reason is true

1. Assertion : Myaesthenia gravis is an autoimmune disease.
Reason : Immune system rejects the transplant muscles.

2. Assertion : SCID is a primary immunodeficiency.
Reason : It is a serious congenital immunodeficiency.

3. Assertion : STDs are also called silent diseases.
Reason : These remain asymptomatic during early stages.

4. Assertion : Genital herpes cannot be cured.
Reason : Genital herpes can be inhibited by Acyclovir.

5. Assertion : AIDS spreads more rapidly than the hepatitis.
Reason : HIV has shorter incubation period than that of HBV.

6. Assertion : Anti – AIDS vaccines are being developed in USA.
Reason : These vaccines may be used to control HIV infection in India.

7. Assertion : Chlamydiosis is most common bacterial sexually transmitted disease.
Reason : It can be easily differentiated from gonococcal urethritis.

Answers

General

1	c	2	b	3	d	4	a	5	c
6	a	7	b	8	a	9	a	10	d
11	b	12	d	13	c	14	a	15	c
16	d	17	d	18	c	19	a	20	a
21	b	22	b	23	b	24	d	25	b
26	d	27	b	28	c	29	c	30	d
31	c	32	a	33	c	34	a	35	c
36	b	37	c	38	a	39	d	40	a
41	d	42	b	43	e	44	b	45	a
46	d	47	b	48	b	49	d	50	a
51	d	52	a	53	b	54	a	55	b
56	c	57	c	58	a	59	d	60	c
61	c	62	a	63	e	64	d	65	d
66	a	67	d	68	d	69	c	70	c
71	a	72	a						

NCERT Exemplar Questions

1	a	2	c	3	c	4	c	5	d
6	c	7	c	8	c				

Critical Thinking Questions

1	a	2	b	3	b	4	b	5	b
6	b	7	c	8	a	9	a	10	b
11	b	12	d	13	d	14	b	15	d
16	c	17	a	18	b	19	a	20	a
21	a								

Assertion and Reason

1	c	2	a	3	a	4	b	5	d
6	c	7	c						

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Answers and Solutions

General

9. (a) Preformed antibodies need to be injected to treat the bite by a viper snake. It is also a type of immunisation which is called as passive immunization.

13. (c) The *B* cells and *T* cells are produced in bone marrow. The *T* cells (*T*-helper cells) stimulated *B* cells to produce antibodies. Antibodies are the main component of immune system.

16. (d) Acquired immunity is obtained during the life of an individual to a particular micro-organism due to previous infection, vaccination or inoculation of antiserum. It has four unique characteristics :

(i) Specificity : It is specific for each & every type of pathogen.

(ii) Diversity : It operates against the whole diversity of pathogenic organisms, their toxins & pollutants.

(iii) Difference between self & non-self : It can differentiate molecules & cells of foreign origin from those of self.

(iv) Memory : The immunity against a pathogen developed during an initial infection is retained by the individual so that second encounter with the pathogen invites a heightened immune response.

24. (d) Bursa of fabricus is a blind sac on the cloaca in the birds. It has lymphoid tissue involved in antibodies production and in fighting against invading bacteria. It is therefore called cloacal thymus.

28. (c) Edward Jenner of Britain in 1796 showed that vaccination with cowpox protects individuals from small pox.

31. (c) Physiological barriers to the entry of micro-organisms in human body are tears in eyes, saliva in mouth and *HCl* in stomach.

40. (a) Colostrum is recommended for the new born because it is rich in antibodies (B) Chikengunya is caused by a virus.

42. (b) Three main events occur in the process of formation of antigen-antibody complex. These are – agglutination, opsonization and neutralization.

(i) *Agglutination* : When an antibody comes in contact with the antigen, foreign bodies like virus, bacteria etc. it become associated with them and are converted into a mass of harmless, insoluble matter.

(ii) *Opsonization* : Specific immunoglobulin molecules, surround the antigen over its surface. The phagocytes identify such complexes, engulf them and destroy them.

(iii) *Neutralization* : Antibodies make the toxins produced by viruses and bacteria ineffective and destroy them.

46. (d) Symptoms of AIDS appear when there is depletion of helper T-cells.

48. (b) Thymus is an important gland in the early part of human life and forms T–lymphocytes. It is referred in relation to AIDS because AIDS virus destroyes T–lymphocytes.

69. (c) Synthetic capsular polysaccharide vaccines are available for treatment of pneumonia caused by *Streptococcus pneumoniae*, *Hemophilus influenza* and for meningtidis caused by Neisseria meningitids. They are not available for plague

Critical Thinking Questions

6. (b) Each antibody consists of 4 polypeptides – two heavy chains & two light chains joined to form a 'Y' shaped molecule. The amino acid sequence in the tips of the 'Y' varies greatly among different antibodies. This variable region, composed of 110–130 aminoacids, give the antibody its specificity for binding antigen. The variable region includes the ends of the light & heavy chains.

9. (a) Neutrophils and monocytes are example of cellular barrier providing innate immunity.

21. (a) HIV attacks helper T cells and not try to hide from them.

Assertion and Reason

1. (c) Autoimmunity is a type of disorder when the immune system of an individual starts rejecting its own body cells or self. This leads to a variety of disease called autoimmune diseases. If the self antigens are muscle cells, then immune system destroys own muscles cells and causes myaesthenia gravis characterized by severe weakness.

2. (a) Severe combined Immuno Deficiency (SCID) is the most serious congential immuno-deficiency of children so called primary immunodeficiency.

3. (a)
4. (b)
5. (d)
6. (c)
7. (c)

Health and Diseases

SET Self Evaluation Test

1. Allergens are [DPMT 2006]
   (a) Infectious and increased secretion of IgE
   (b) Non-infectious and increased secretions of IgE
   (c) Infectious and increased secretion of IgG
   (d) Non-infectious and increased secretion of IgM

2. The treatment of snake-bite by antivenine is an example of [AIIMS 2004]
   (a) Artificially acquired active immunity
   (b) Artificially acquired passive immunity
   (c) Naturally acquired passive immunity
   (d) Specific natural immunity

3. Column I lists the components of body defense and column II lists the corresponding descriptions. Match the two columns. Choose the correct option from those given

Column I	Column II
A. Active natural immunity	p. Injection of gamma globulins
B. First line of defense	q. Complement proteins and interferons
C. Passive natural immunity	r Direct contact with the pathogens that have entered inside
D. Second line of defense	s. Surface barriers
	t. Antibodies transferred through the placenta

[KCET 2006]
   (a) A= s, B= r, C= t, D= q (b) A= r, B= s, C= q, D= t
   (c) A= r, B= s, C= t, D= q (d) A= t, B= r, C= q, D= p

4. Which of the following organs is not involved in the elicitation of immune response [NCERT; CPMT 2004]
   (a) Brain (b) Lymph nodes
   (c) Spleen (d) Thymus

5. Passive immunity is defined as immunity [AIIMS 1998]
   (a) Inherited from the parents
   (b) Achieved through vaccination
   (c) Acquired through first exposure to the disease
   (d) Achieved through the sera of other animals enriched in antibodies

6. Inflammatory response in allergy is caused by the release of one of the following by mast cells [MP PMT 1997; AIIMS 1999]
   (a) Histamines (b) Antibodies
   (c) Antigen (d) None of them

7. Vaccination against small pox means the introduction into our body, of [MP PMT 1996]
   (a) Leucocytes obtained from animal
   (b) Antibodies produced in other animals
   (c) Antibodies
   (d) Actual weakened germs or attenuated small pox virus

8. Suspension of killed or attenuated pathogenic micro-organisms on inoculation if stimulate the formation of antibodies, it is known as [MP PMT 1994]
   (a) Vaccine (b) Antibiotic
   (c) Sera (d) Antitoxins

9. What is introduced in polio vaccination [MP PMT 1995]
   (a) Antibodies (b) Antigen
   (c) Antibiotics (d) Bacteriostatic agent

10. An insect bite may result in inflammation of that spot. This is triggered by the alarm chemicals such as [AIIMS 2008]
    (a) Histamine and dopamine (b) Histamine and kinins
    (c) Interferons and opsonin (d) Interferons and histones

11. This class of antibodies is made up of five immunoglobulin unit [AMU (Med.) 2009; WB JEE 2011]
    (a) IgG (b) IgM
    (c) IgA (d) IgD

12. Antibodies resemble which of the following shape [J & K CET 2012]
    (a) X (b) Y
    (c) Z (d) O

13. People, who are at the high risk of getting *HIV* infection [MP PMT 2011]
    (a) Individuals who have multiple sexual partners
    (b) Drug addicts who take drugs intravenously
    (c) Individuals who require repeated blood transfusions
    (d) All of the above

14. Interferons are [MP PMT 2011]
    (a) Protein products of macrophases, which destroy microbes
    (b) Protein secreted by Virus infected cells which protect non infected cells from further viral infection
    (c) Allergens
    (d) Antibody molecules

AS Answers and Solutions

1	b	2	b	3	c	4	a	5	d
6	a	7	d	8	a	9	b	10	b
11	b	12	b	13	d	14	b		

1. (b) Allergenes are non-infectious foreign substances that cause allergic reaction. Allergy is the hyper-sensitiveness of a person to some foreign substance coming in contact with or entering the body. The common allergenes are dust, pollen, mould spores, fabrics, lipsticks, nailpaints, fur, heat bacteria etc.
   Allergy involves mainly the secretion of IgE antibodies and histamine. The allergy causes marked dilation of all the peripheral blood vessels.

5. (d) Passive immunity is conferred by transfer of immune products, like antibodies etc. from another individual into a non-immune individual.

8. (a) Vaccine generates the primary immune response and the memory T or B cells.

* * *