# SHORT QUESTIONS

**2. What is immune response?**

**Ans: Immune Response:**

The body's response to foreign particles such as the production of antibodies directed against a specific antigen, is called an **immune response.** The term immune is derived from Latin word *iminunis* meaning "safe" or free of burred.

**3. List the ways of defence of the human body against invading microbes.**

**Ans: Immunology:**

**Immunology** is the study of foreign particles that can affect the living body and the defence mechanisms, which are taken by the body to eliminate these particles. The human body has three lines of defence against microbial attack.

i. First line of defence comprises external barriers that keep microbes out of the body.

ii. Second line of defence consists of nonspecific internal defence (innate immunity) that combats all invading microbes.

iii. Third line of defence includes the specific internal defence (adaptive/acquired immunity) also called immune system that directs its assault against specific microbes.

**4. Name the three lines of defence against microbial attack.**

**Ans:** The human body has three lines of defence against microbial attack.

**i.** **First line of defence** comprises **external barriers** that keep microbes out of the body.

**ii.** Second line of defence consists of **nonspecific internal defence** (innate immunity) that combats all invading microbes.

**iii.** Third line of defence includes the **specific internal defence** (adaptive/acquired immunity) also called **immune system** that directs its assault against specific microbes.

**5. How oil and sweat glands take part in defence against microorganisms?**

**Ans: Sebaceous Glands and Sweat Glands:**

In addition, the dermis part of skin also contains the sebaceous glands and sweat glands. **Sebaceous glands** produce **sebum**, an oily substance whereas **sweat glands** secrete **sweat**, a salty fluid that generally provides cooling effect to the body. Secretion from sweat glands and sebaceous glands usually cover the skin. These secretions contain natural antibiotics such as lactic acid that inhibit the growth of bacteria and fungi. These multiple defence make the unbroken skin an extremely effective barrier against microbial invasion.

**6. What is the role of acids and enzymes present in the digestive tract against bacteria?**

**Ans: Epithelium of digestive tract: an impenetrable barrier against microbial invasion:** The gastrointestinal tract as GIT, it is covered by mucous membrane which protects the GIT against microbial invasion by means of its various kind of secretions. Such as **hydrochloric acid** in the stomach is secreted by oxyntic or

parietal cells that kills the bacteria present in food. In addition various **digestive enzymes** present in gastric juice intestinal juice and pancreatic juice also digest the bacteria present in food.

**7. Name the parts of antibody molecule.**

**Ans:** A typical antibody is a Y-shaped molecule which consists of four polypeptide chains two identical long chains called **heavy** chains, and two identical short chains called light **chains.**

Each chain has a **constant segment**, a functional segment and a **variable segment.**

**8. What are the memory cells?**

**Ans:** Any small; long-lived lymphocyte that has previously encountered a given antigen and that on preexposure to the same antigen rapidly initiates the immune response **memory T cells** or proliferates and produces large amounts of specific antibody (**memory, B cells)** the agent of lasting immunity.

**9. How does an antibody differ from an antigen?**

**Ans: Antigens** are foreign particles usually proteins, which are capable of generating an immune response in the body, a property known as immunogenicity. This immune response consists of specific **antibodies** which are generated by plasma cells as a result of exposure to a specific epitope presented by the **antigen.**

| Antibody versus Antigen comparison chart | | |
|---|---|---|
| **What it is** | A chemical that attaches to the antigen in order to sterilize or kill the cell | A 'hook' in the cell's surface, partially responsible for what goes in and out of the body |
| **Significance** | Medium needed for the destruction of pathogens in the body | High, exists in almost every cell in the entire world. |
| **Importance** | High without it a lot of us would probably be dead by a virus attack | Very high, needed for controlling what goes in and out of the cell. Very important for it's inner function |
| **Complexity** | Very, High Complex chemical that bonds to a very specific Antigen | Medium, exists due to ran random mutations in the cell's gene |

**Differences between Antigen and Antibody:**

| | Antigen | Antibody |
|---|---|---|
| 1 | Generally, proteins but can be lipids, carbohydrates or nucleic acids | Antibodies are proteins. |

| | | |
|---|---|---|
| **2** | Taggers the formation of antibodies. | Variable sites have the antigen binding domain. |
| **3** | There are three basic kinds of antigens (Exogenous, Endogenous and Autoantigens) | There are five basic kinds of antibodies (Immunoglobulins M, G, E, D and A) |
| **4** | The region of the antigen that interacts with the antibodies is called epitope. | The variable region of the antibody that specially binds to an epitope is called paratope. |
| **5** | Cause disease or allergic reactions | Protects the body by immobilization or lysis of antigenic material |

**10. Why does each antibody bind only to a specific antigen?**

**Ans:** Antibodies (also called immunoglobulins or Ig's) are y-shaped proteins that circulate through the blood stream and bind to specific antigens, thereby attacking microbes. The antibodies are transported through the blood and the lymph to the pathogen invasion site.

**11. Why is passive immunity temporary?**

**Ans:** **Passive immunity** can also be acquired naturally by the fetus due to the transfer of antibodies by the maternal circulation in utero through the placenta around the third month of gestation. **Immunity** in newborn babies is only **temporary** and starts to decrease after the first few weeks, or months.

**12. Name the disorders of immune system.**

**Ans: Disorders of Immune System:** Some conditions that stimulate a defective immune response or destroy immune system are called disorders of immune system.

i. Allergies
ii. Autoimmune Disease
iii. Tissue rejection reaction

**13. What are the autoimmune diseases?**

**Ans: Autoimmune Disease:**

Sometimes, a person's immune system does not normally respond to the antigens (left-molecules) borne on the body's own cells and the antibodies are going to produce against bodies own components and begin to destroy them. This problem is called an **autoimmune disease.**

**For example:**

**a)** Some types of anemias are caused by antibodies that destroy a person's red blood cells.

**b)** Many cases of insulin-dependent (juvenile-onset) diabetes occur because the insulin-secreting cells of the pancreas are the victims of a misdirected immune response. Unfortunately, at present there is no way to cure autoimmune diseases. The autoimmune response can be suppressed with drugs.

**OR (Second Answer)**

**Autoimmune Disease:**

An autoimmune disease is a condition in which your immune system mistakenly attacks your body.

The immune system normally guards against germs like bacteria and viruses. When it senses these foreign invaders, it sends out an army of fighter cells

to attack them. Normally, the immune system can tell the difference between foreign cells and your own cells.

In an autoimmune disease, the immune system mistakes part of your body --- like your joints or skin --- as foreign. It releases proteins called autoantibodies that attack healthy cells. Some autoimmune diseases target only one organ. Type 1 diabetes damages the pancreas. Other diseases, like lupus, affect the whole body.

**13. Justify the inflammatory response in arthritis as an example of a misdirected immune response.**

**Ans:** In the disease, autoantibodies are formed against IgG (antibody or immunoglobin of class G). These autoantibodies are called rheumatoid factors. The agent that induces these autoantibodies is unknown. Within the inflamed joints, the synovial membrane is infiltrated with T cells, plasma cells and macrophages and the synovial fluid contains high levels of macrophage – produced inflammatory cytokines.

**14. Justify why the physician prescribe antipyretic therapy to the patients of runny nose or skin rashes.**

**Ans:** Runny nose or skin rashes are a type of hypersensitivity reaction in which histamine is released from the mast cells and basophils. Its release causes vasodilation, increased capillary permeability and smooth muscle contraction. Antihistamine drugs block histamine receptor sites so histamine action cannot take place. So, in this way they are effective on allergic rhinitis are runny nose and skin rashes.

**15. Justify why the physician prescribe antipyretic drugs, when fever is a nonspecific defence against microbial infections.**

**Ans:** Antipyretic drugs creates their effects by inhibiting prostaglandin production in the hypothalamus, which has the effect of blocking set point elevation and maintaining the set point at nearer normal levels.

**16. Define/Describe/Explain briefly:**

**immunity, immunology, microbe, phagocytes, monocytes, macrophages, perforins, granzymes, complementary proteins, interferon, cytokines, histamines, pyrogens, interleukin-1, cell mediated immunity, immunization, helper T cells, memory cells, plasma cells, T cells and B cells, antibody, antigen, Lymphocytes', antibody mediated immunity, immunization, clostrum, vaccine, vaccination, allergies, transplant rejection, autoimmune diseases,**

**Ans: Immunity:**

**Immunity** is the ability to resist damage from foreign substances such as microorganisms and harmful chemicals, e.g. toxins released by microorganisms.

**Immunology:**

**Immunology** is the study of foreign particles that can affect the living body and the defence mechanisms, which are taken by the body to eliminate these particles.

**Microbe:**

A microorganism or microbe is a microscopic organism, which may exist in its single-celled form or in a colony of cells.

**Phagocytes:**

There are white blood cells in the body called **phagocytes.** A phagocyte is a cell that destroys other abnormal body cells (cancerous cells) or invaded microorganism by engulfing or ingesting them. This process is called **phagocytosis:**

Two types of blood cells are phagocytes macrophages and neutrophils.

**Monocytes:**

Monocytes are formed in bone marrow. From bone marrow, through blood macrophages are transported to the areas of body where they are needed

**OR**

**Monocytes** are a type of leukocyte or white blood cell. They are the largest type of leukocyte and can differentiate into macrophages and myeloid lineage dendritic cells. As a part of the vertebrate innate immune system **monocytes** also influence the process of adaptive immunity.

**Macrophages:**

Macrophages are derived from monocytes or the monocytes that leave the blood are called macrophages. Macrophages are generally found in the organs such as the lungs, liver, spleen, kidney and lymph nodes, rather than remaining in the blood.

**Perforins:**

Natural killer (NK) cells kill their target by releasing proteins called **perforins,** which punch holes through the membranes of the infected cells.

**Granzymes:**

The pores formed by these proteins allow for the passive diffusion of certain apoptotic proteases, known as the **granzymes,** into the target cell. The cell dies by apoptosis' **NK** cells also attack cancer cells at an early stage of tumor.

**Complementary Proteins:**

The body cannot make some amino acids in required amounts. These are called essential and they must come from the diet. Combining two or

more foods with incomplete **proteins**, to form **complementary proteins**, can provide adequate amounts of all the essential amino acids.

**Interferon:**

Interferons (IFNs) belong to the large class of proteins known as **cytokines**, molecules used for communication between cells during infection. They are made and released by host cells in response to the presence of several pathogens specially viruses. Interferons are named for their ability to **"interfere"** with viral replication as interferons activate molecules which prevent the virus from producing and replicating its RNA or DNA. In this way, interferons limit cell-to-cell spread of viruses in the body. INFs also activate immune cells such as natural killer cells and macrophages that in turn destroy virally infected cells.

**Cytokines:**

Cytokines are a broad and loose category of small proteins that are important in cell signaling. Their release has an effect on the behavior of cells around them.

**Histamines:**

Histamines is an organic nitrogenous compound involved in local immune responses, as well as regulating physiological function in the gut and acting as a neurotransmitter for the brain spinal cord, and uterus.

**Pyrogens:**

Fever or **pyrexia** is the raised body temperature than normal. The invaded microorganisms often release certain chemicals, which are generally termed as **pyrogens**.

**Interieukin-1:**

When macrophages perform phagocytosis of invaded microorganisms, after digesting them they not only display microbial antigens on their surfaces but also being to secrete about 100 different compounds including various enzymes interferons and a protein called **interleukin-1.**

**Cell Mediated Immunity:**

Cell-mediated immunity is an immune response that does not involve antibodies, but rather involves the activation of phagocytes, antigen-specific cytotoxic, T -lymphocytes and the release of various cytokines in response to an antigen.

**OR**

The activation of T –cells by a specific antigen is called **cell-mediated immunity.**

**Immunization:**

There are two ways to acquire adaptive immunity: (a) Active Immunity (b) Passive Immunity. Both types may be acquired naturally or artificially. Providing immunity artificially is called **immunization.**

**Help T Cells:**

These cells secrete **interleukin 2**, which stimulates cell division of T cells and B cells. In other words, these cells recruit even more cells to help fight the pathogen.

**Memory Cells:**

These cells remain dormant after the initial exposure to an antigen. If the same antigen presents itself again, even if it is years later, the memory cells are stimulated to convert themselves into helper T cells and help fight the pathogen.

**Plasma Cells:**

A **plasma cell** can produce more than 10 million molecules of antibody per hour. If the same antigen enters the body later the memory B cells divide to make more plasma cells and memory cells that can protect against future attacks by the same antigen. The stimulation of B cells to divide into plasma clone cells is called **Humoral and cell mediated** immune **response.**

**T cells and B cells:**

T cells (thymus cells) and B cells (**bone marrow-** or bursa-derived cells) are the major cellular components of the adaptive **immune** response T cells are involved in cell-mediated immunity, whereas B cells are primarily responsible for Humoral immunity (relating to antibodies).

**Antibody:**

Antibody (also called immunoglobulin or Ig's) are y-shaped proteins that circulate through the blood stream and bind to specific antigens, thereby attacking microbes. The antibodies are transported through the blood and the lymph to the pathogen invasion site.

**Antigen:**

In immunology, an antigen is a molecule capable of inducing an immune response in the host organism. Sometimes antigens are part of the host itself in an autoimmune disease. Antigens are "targeted" by antibodies.

**Lymphocytes:**

Lymphocytes are one of several different types of white blood cells. Each type of white blood cell has a specific function and they all work together to fight

illness and disease.

**OR**

Lymphocytes are a type of white blood cell generated by the immune system to defend the body against cancerous cells, and foreign matter.

**Antibody mediated immunity:**

**Antibody-Mediated (**Humoral) **Immunity (AMI).** On exposure to antigenic determinants in lymphatic organs, B-lymphocytes are activated and differentiated to form plasma cells. Plasma cells are specialized, differentiated cells that synthesize and secrete **antibodies** specific for an antigen.

**Immunization:**

Providing immunity artificially is called i**mmunization.**

**Colostrums:**

Passive immunity may also be provided by **colostrums,** the first secretion of the mammary glands. The baby absorbs the antibodies through its gut.

**OR**

Colostrums is a form of milk produced by the mammary glands of mammals during pregnancy. Most species will generate colostrums just prior to giving birth. Colostrums contains antibodies to protect the newborn against disease.

**Vaccine:**

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

**Vaccination:**

Artificial Active Immunity (vaccination) is achieved by injecting (or administering orally) small amounts of antigen, called the vaccine, into the body of an individual. The process is called **vaccination.**

**Allergies:**

Allergies are actually a form of immune response. A foreign substance, such as a pollen grain, enters the bloodstream and is recognized as an antigen by a particular type of B cell. This B cell proliferates, producing plasma cells that pour out the antibodies attach to the plasma membranes of histamine-containing cells located in the respiratory and digestive tracts.

**Transplant Rejection:**

It is occasionally desirable to transplant some tissue or an organ such as the skin, kidney, heart, or liver from one person to another to replace a non-functional damaged or lost body part. In such cases, there is a danger that the recipient cells may recognize the donor's organ or tissue as being foreign. This triggers the recipient's immune mechanisms, which may act to destroy the donor tissue. Such a response is called transplant rejection.

**Autoimmune Diseases:**

Sometimes, a person's immune system does not normally respond to the antigens (self-molecules) borne on the body's own cells and the antibodies are going to produce against bodies own components and begin to destroy them. This problem is called an **autoimmune disease.**

**17. Write the differences between:**

**(a) sebaceous gland and sweat gland**

**(b) macrophages and neutrophils**

**(c) interleukin-1 and interleukin-2**

**(d) Antibody-mediated immune response and a cell-mediated immune response**

**(e) cytotoxic T cells and suppresser T cell**

**(f) plasma cells and memory cells**

(g) antibody and antigen

(h) inborn immunity and acquired immunity

(i) natural passive immunity and artificial passive immunity

**Ans: (a) sebaceous gland and sweat gland:**

**Sebaceous Gland and Sweat Gland:**

In addition, the dermis part of skin also contains the sebaceous glands and sweat glands. **Sebaceous gland** produces **sebum**, an only substance whereas **sweat gland** secretes **sweat**, a salty fluid that generally provides cooling effect to the body. Secretion from sweat glands and sebaceous glands usually cover the skin. These secretions contain natural antibiotics such as lactic acid that inhibit the growth of bacteria and fungi. These multiple defence make the unbroken skin an extremely effective barrier against microbial invasion.

**OR (Second Answer)**

| Sweat | Sebum |
|---|---|
| It is secreted by sweat glands (skin surface) | It is secreted by sebaceous (oil) glands |
| It is fluids in nature | It is only in nature |
| It is composed of mainly sodium chloride and water. Some other substances are also present in small amount | It is composed of oil or **wax** like secretion. Other hydrocarbons and fatty acids are also present |
| **Function:** Temperature control and Excretion | **Function:** Lubrication |

**(b) macrophages and neutrophils:**

**Macrophages:**

Macrophages are derived from monocytes or the monocytes that leave the blood are called macrophages.

**Monocytes:**

Monocytes are formed in bone marrow. From bone marrow through blood macrophages are transported to the areas of the body where they are needed. Macrophages are generally found in the organs such as the lungs, liver, spleen, kidney and lymph nodes, rather than remaining in the blood.

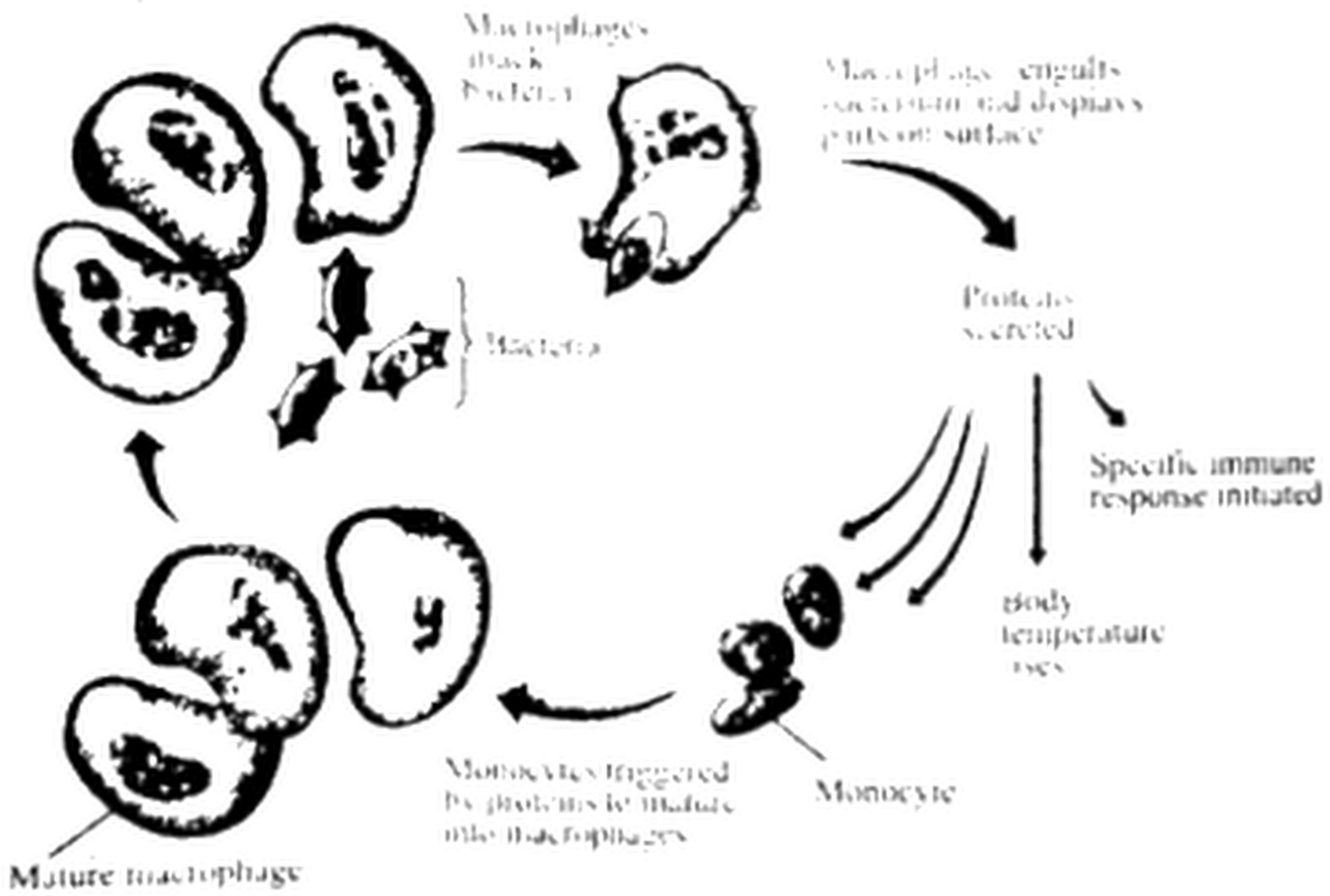
**Functions of Macrophages:**

**i.** In these organs they patrol within the free spaces among the cells and provide protection by trapping and destroying microorganism entering the tissue.

**ii.** As macrophages interact with microbes, they not only engulf and destroy them they also display some parts of microbes on their surface so that other body cells may also be informed.

**iii.** The macrophages also secrete many different proteins when they perform phagocytosis of the microbes. Some of these proteins trigger the maturation of monocytes into macrophages thereby increasing their numbers.

**iv.** Another protein **interleukin-1** signals the brain to raise the body temperature producing fever. Some other proteins also stimulate the specific immune response.




**Response of macrophages to foreign particles**

**Neutrophils:**

These belong to the granulocyte type of WBCs. They are highly short-lived and highly mobile as they squeeze between ells of capillary walls and can enter parts of tissue where other cells/molecules would not be able to enter otherwise.

**Functions of Neutrophils:**

**i.** They move like *Amoeba* forming pseudopodia

**ii.** They proceed rapidly to infected area to perform their duty and they often die after a single phagocytic event.

**iii.** Neutrophils also release lysosomal enzymes and certain chemicals that kill microorganisms and cause inflammation.

## OR (Second Answer)

### Difference between Neutrophils and Macrophages:

| Neutrophils | Macrophages |
|---|---|
| **Definition:** | |
| Neutrophils is a granular leukocyte comprising of a nucleus with three to five lobes | Macrophage is a large white blood cell that engulfs foreign particles in the body |
| **Shape of the Nucleus:** | |
| Neutrophils have a multi-lobed nucleus | Macrophage have a large rounded shape nucleus |
| **Granulocytes/Agranulocytes:** | |
| Neutrophils are granulocytes | Macrophages are Agranulocytes |
| **Makeup:** | |
| Neutrophils make up 50-70% of circulating white blood cells | Monocytes make up 2-8% of circulating white blood cells |
| **Difference in Phenotype:** | |
| Neutrophils consist of Ly6G$^+$ and MPO$^+$ receptors on the cell membrane | Macrophages consist of EMR1$^+$, CD107$^+$ (Mac-3$^+$), and CD68$^+$ receptors on the cell membrane |
| **Site of Maturation:** | |

| | |
|---|---|
| Neutrophils mature in the bone marrow | Macrophages mature in tissues |
| **Mature Cells in Circulation:** | |
| Mature neutrophils are found in circulation | Very few macrophages can be found in circulation |
| **Mature Cells Recruited into Tissues from Circulation:** | |
| During innate and acquired immunity, mature neutrophils migrate from circulation into tissues | Only immature monocytes migrate from the circulation into tissues |
| **Normal Residence of Mature Cells in connective Tissues:** | |
| Mature neutrophils do not reside in connective tissues | Mature macrophages normally reside in connective tissues |
| **Phenotypically Distinct Sub-Populations in Different Tissues:** | |
| No phenotypic variations are incapable of proliferating | M2 macrophages are capable of proliferating in certain circumstances |
| **Lifespan:** | |
| The lifespan of neutrophils is typically several days | The life span of macrophages is weeks to months |
| **Role:** | |

| | |
|---|---|
| Neutrophils are the first to attack bacteria at the site of infection. The action of neutrophils forms pus | Monocytes from the circulation enter the peripheral tissues, becoming tissue macrophages, which engulf large particles and pathogens |

**(c) interleukin-1 and interleukin-2:**

| Interleukin-1 | Interleukin-2 |
|---|---|
| Interleukin-1 alpha (IL-1α) is a protein that in humans is encoded by the IL1A gene. The protein encoded by the interleukin-1 family. Interleukin-1 alpha possesses a wide spectrum of metabolic physiological, hematopoietic activities and plays one of the central roles in the regulation of the immune responses | Interleukin-2 (IL-2) is an interleukin a type of cytokine immune system signaling molecule which is a leukocytotroplic hormone that is instrumental protein beds structural response to metabola infection and in discriminating between foreign (non-self) and self line mediates its effects by binding to IL-2 receptors which are expressed by lymphocytes the ceils that are responsible for immunity |

**(d) antibody-mediated immune response and a cell-mediated immune response:**

| Antibody-mediated immune response | Cell-mediated immune response |
|---|---|
| **1.** It consists of B-lymphocytes which produce the antibodies that circulate in the body fluids. | **1.** It consists of T –lymphocytes which produce normally 4 types of T-cells |

| | |
|---|---|
| **2.** It defends the body against viruses and bacteria | **2.** It defends the body against all pathogens including fungi and protozoa |
| **3.** It does not respond to transplants. | **3.** It reacts against transplants. |
| **4.** It does not provide immunity against cancer. | **4.** It provides immunity against cancer |

**OR (Second Answer)**

| | **Antibody mediated Immunity** | **Cell mediated Immunity** |
|---|---|---|
| **Main cells** | B lymphocytes | T lymphocytes |
| **Maturation** | Generated and matured in bone marrow | Originate in bone marrow and complete development in thymus |
| **Project against** | Extracellular microbes and their toxin induced diseases infections (virulence related to polysaccharide capsule) | Intracellular microbes viruses parasites (leishmania) bacteria (mycobacteria listeria) kill tumor cells |
| **%age of lymphocytes** | 10-20% circulating peripheral lymphocyte population | 60-70% |
| **Location in lymph nodes** | Superficial cortex | Parasitical areas |

| **Location in spleen** | White pulp | Periarteriolar sheaths |
|---|---|---|
| **Receptors** | B-cell antigen receptor complex consisting of marrow IgM and IgD immunoglobulin | In 95% T cells a alpha/beta TCR In minority a gamma, T cell |
| **Accessory surface molecules** | Lga Lgβ Fc receptors CD40, CD21 | CD3 molecular complex Dimmer of CD28 integrins |
| **End result of activation** | Differentiation of B cells into antibody secreting cells called plasma cells | Secrete locally acting proteins called cytokines |
| **Hypersensitivity reactions** | 1, II, III are antibody mediated | IV is cell mediated |
| **Role of MHC molecules** | Antigen receptor recognizes whole unprocessed proteins and has no requirement for presentation by MHC protein | Antigen receptor recognizes only processed pentides in association with MHC protein |
| **Regulator of antibody synthesis** | No | Yes |
| **Onset** | Rapid | Delayed type hypersensitivity |
| **Antibodies** | Formed | Not formed |

| | | |
|---|---|---|
| **Evaluation** | From plasma level of antibodies | Skin test for development of delayed type of hypersensitivity |
| **Cells involved** | Ab synthesis requires 3 cells t lymphocytes b lymphocytes macrophage | Macrophage helper T cells natural killer T cells cytotoxic T cells |

**(e) cytotoxic T cells and suppressor T cell:**

| Cytotoxic T cells | Suppressor T cells |
|---|---|
| These cells secrete **cytotoxic** which triggers destruction of the pathogen's DNA or **perforins** which is a protein that creates holes in the pathogen's plasma membrane. The holes cause the pathogen lyse (rupture) | When infection is successfully removed, these cells begin to secrete certain proteins that inhibit further proliferation of T cell. Therefore, they shut down the immune response. |

**(f) Plasma cells and memory cells:**

After binding with specific type of antigen the B cells produce two type of cells **Plasma** clone cells and **memory B cells.**

**Plasma Clone cells:**

The plasma clone are specialized to secrete bulk quantity of antibodies After B cells become plasma cells they live only for a few days but secrete a great deal of antibody during the time. A **plasma cell** can produce more than 10 million molecules of anti-body per hour. **Memory B Cell:**

It the same time antigen enters the body later the memory B cells

divided to make more plasma cells and memory cells that can protect future attacks by the same antigen. The stimulation of B cells to divided into plasma clone cells and memory B cells and the secretion of antibodies by plasma clone cells is called **Humoral and cell mediated** immune **response.**

**OR (Second Answer)**

| Plasma cells | Memory cells |
|---|---|
| **1.** are immediately active and act against pathogens (viruses, or bacteria) the first time they invade the body | **1.** Act rapidly against antigens (pathogen) the 2nd, 3rd, 4th time they re-enter the body |
| 2. produce antibodies that identify and stop any craziness going on | 2. When a antigen (pathogen) occurs again memory cells have already been imprinted by the invading antigens (pathogens) meaning, a quick response can occur due to memory cells recognition of an antigen (pathogen) |
| 3. they don't last that long | They last longer |

**(g) antibody and antigen:**

- Both antigen and antibody are paramount for immunology. Both partake in autoimmune disease and the end result is the same
- Both antigen and antibodies are microscopic particles and contain proteins Antigens has combination from polysaccharides as well whereas antibodies are purely made up of protein.

- Antigens can be cells but antibodies are never cells.
- Antigens act as the key, whereas the antibodies act as the lock.
- There are mainly two types of antigens, which are self and non self
- Antibodies are made of five main subcategories according to the protein's constructs. Depending on the permissive nature, It project aspects of the antibody like placental transference, secretion etc.

Thus, consider the antigen or the causative particle as a key to lock the on antibody or the disease fighter. The key can take several forms but the epitope the to be the same as the paratrope

**OR (Second Answer)**

| Antigen | Antibody |
|---|---|
| An antigen is a foreign body in the blood. Examples of antigens include foreign proteins, pathogenic bacteria, and viruses | An antibody is a globular protein that recognizes an antigen and attaches to its surface, forming an antibody antigen complex |
| The antibody-antigen complex is recognized by a macrophage which ingests the whole complex by the process of phagocytosis | |

**(h) Inborn immunity and acquired immunity:**

The two basic type of immunity are(a)inborn or innate immunity acquired immunity. The ability of the immune system to kill microorganisms is not specific. First and second line of defence that you have already studied in this chapter are the part of inborn immunity. Highly specific protect is provides by the **acquired (adaptive) part** of the immunity system, but it takes several days for this system to become fully functional. The two components of the acquired immune system are **cell-immunity** and **antibody mediated (Humoral) immunity.**

## OR (Second Answer)

**Difference Between Innate Immunity and Acquired Immunity;**

| Innate Immunity | Acquired Immunity |
|---|---|
| Innate immunity is the form of immunity that is inborn in an organizer and is activated immediately in response to an invading microorganism | Acquired immunity, also referred to as adaptive immunity or specific immunity is the type of immunity that adapted by the body to defend the body against invading pathogen |
| **Nature:** | |
| Innate immunity is generic or non-specific in nature | Acquired immunity is specific in nature |
| **Acquisition:** | |
| Innate immunity is present from the point of birth. | Acquired immunity develops over growth |
| **Inheritance:** | |
| Innate immunity is inheritable | Acquired immunity is not inheritable, with the exception of one form of passive immunity acquired by a body from its mother during gestation |
| **Defense Mechanisms:** | |

| | |
|---|---|
| Aspects of innate immunity such as mechanical barriers exert their defensive mechanics irrespective of the presence or absence of an invading pathogen | In case of acquired immunity, contact with a pathogen is essential to build up defensive mechanisms |
| **Response:** | |
| Innate immunity is triggered immediately in response to infection | Acquired immunity takes a while to develop and exert its effects |
| **Cells:** | |
| The major immune cells involved in innate defensive mechanisms are NK cells, neutrophils macrophages, eosinophils, basophils etc. | The major immune cells involved in the acquired system are majorly the lymphocyte, the B cells and T cells |

**OR (Second Answer)**

| | Innate Immunity | Acquired (Adaptive) Immunity |
|---|---|---|
| 1 | Present from birth itself | Develops during life time |
| 2 | The immunity remains throughout life | Can be short lived or lifelong |
| 3 | Contact or exposure with pathogen or its antigen is not essential | Contact with pathogen or its antigen is essential |
| 4 | Innate immunity is inheritable | Acquired immunity cannot be passed to the next generation except for a brief period to neonates |

| | | |
|---|---|---|
| 5 | It protects the individuals from contraction of diseases of other organisms | It protects the individuals from pathogens present on other members of the same species |

**(i) natural passive immunity and artificial passive immunity:**

**Natural passive immunity:**

It may be gained naturally. For example, antibodies from a mother cap cross the placenta and enter her foetus. In this way the provide protection for the baby unit its own immune system is fully functional. Passive immunity may also be provided by **colostrums**, the first secretion of the mammary glands. The baby absorbs the antibodies through its gut.

**Artificial passive immunity:**

Antibodies, which have been formed in one individual, are extracted and then injected into the blood another individual which may or may not be of the same species. They can be used for immediate protection if a person has been, or is likely to be exposed to a particular disease. For example, specific antibodies used for combating tetanus and aiphtheria used to be cultured in horses and injected into humans. Only antibodies of human origin are now used for humans. Antibodies against rabies and some snake venoms are also available. Antibodies against the human rhesus blood group antigen are use.