

TISSUE FLUID

The cells that make up the walls of the capillaries do not fit tightly together. This means that there are small gaps between them through which plasma leaks out. Red blood cells cannot get out of the blood capillaries because they are too large and cannot change their shape. The fluid formed when plasma continuously leaks out of the blood capillaries is called **tissue fluid**. Tissue fluid bathes all the body and the cells obtain other requirements from the tissue fluid.

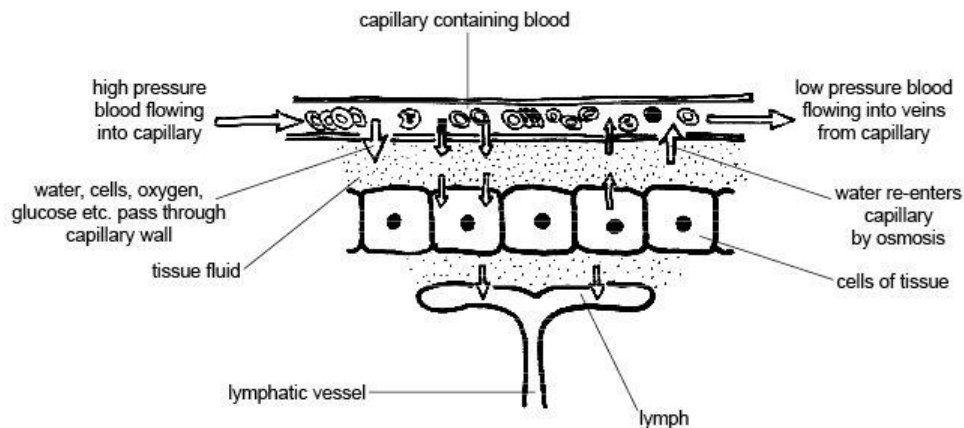
Functions of tissue fluid

- i. Waste products e.g. carbon dioxide and urea pass from the cells to the tissue fluids and finally to the capillaries.
- ii. Through tissue fluid, oxygen, glucose, amino acids and mineral salts pass from the blood into the cells.

LYMPH

- This is drained from tissue fluid.
- Not all the plasma that leaks out of the blood capillaries returns back to the vessels. In the tissues, besides the capillaries, there are small open ended vessels called **lymphatic capillaries** or **lacteals** into which tissue fluid slowly drains.
- The fluid in the lymphatic capillaries is therefore known as **lymph**.

Diagram showing the relationship between blood, tissue fluid and lymph

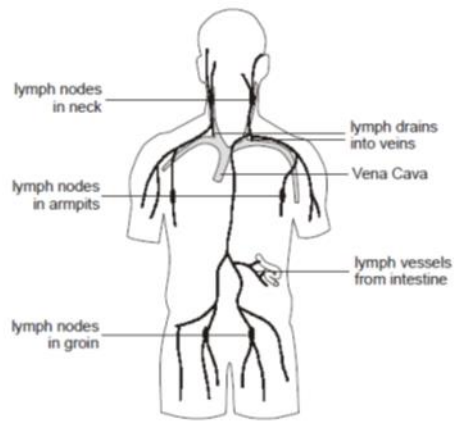


LYMPHATIC SYSTEM

- This is a body system consisting of lymph glands, lymph capillaries or lacteals and lymph ducts that carry lymph.
- The lacteals join up to form larger lymphatic vessels which in turn unite to form the lymph ducts. The lymph ducts are like veins in structure, and have valves which prevent the back flow of lymph.
- Lymph ducts pour the lymph into the **subclavian vein** which returns the deoxygenated blood from the arms to the heart; hence the lymph joins the blood circulatory system.
- Along the lymphatic system are lymph nodes which are situated at intervals. These nodes manufacture a type of white blood cells called **lymphocytes**.

Note: the lacteals which are found in the villi are also part of the lymphatic system. They drain the absorbed fatty acid and glycerol into the lymphatic system.

Diagram showing the lymphatic system



Functions of the lymphatic system

- i. It transports digested fats absorbed from the ileum.
- ii. Lymph nodes found along the lymphatic system manufacture white blood cells called lymphocytes.
- iii. It transports excretory materials e.g. carbon dioxide.
- iv. It fights against bacteria attacks because the lymph nodes trap the bacteria and stops them from joining the blood stream.

How lymph flows from tissues back to the heart

- i. Contraction and relaxation of muscles
- ii. Presence of valves which allow blood to flow in only one direction
- iii. Inspiration movements which lower pressure in the chest cavity thus pulling more lymph into the subclavian veins
- iv. Hydrostatic pressure which is brought about continuous flow of plasma into the lymph vessels

Problems of the lymphatic systems

1. Diseases e.g. kwashiorkor which is a protein deficiency disease and elephantiasis which is caused by the filarial worm (*Wuchereria bancrofti*) which is transmitted by the female culex mosquito.
2. Wounds which lead to swelling

Comparison between the blood vascular system and the lymphatic system

Similarities

- a. Both consist of a system of vessels
- b. Both contain a circulating fluid
- c. Both contain circulating cells

Differences

Blood vascular system	Lymphatic system
Has three types of vessels	Has one type of lymph vessel
Has valves in veins and at the bases of the	Has valves through out

major arteries	
Has a muscular heart	Does not have a muscular heart,
Does not have nodes	Has lymph nodes
Blood flows faster	Lymph flows relatively slowly
Blood consists of more than one cell type	Lymph consists of lymphocytes only

Comparison between blood and lymph

Similarities

- Both contain lymphocytes
- Both are fluids with dissolved substances
- Both are used for transport of the dissolved substances

Differences

Blood	Lymph
Has more than one type of cells	Has lymphocytes only
Has few fats	Has a lot of fats

IMMUNITY AND HIV

Immunity is the ability of the body to recognize foreign materials and remove them or prevent them from causing disruption to the body functions.

There are two types of immunity;

- Natural immunity
- Artificial immunity

Natural immunity

This is the immunity gained by an individual through natural processes. Natural immunity is further divided into three into innate and acquired natural immunity.

a. Inborn/Innate natural immunity

This is the immunity which an individual is born with as a result of inheritance.

b. Acquired natural immunity

This is further divided into passive and active.

i. Natural acquired passive immunity

This involves acquiring antibodies from another individual. It usually lasts for a short period time since one's immune system is not involved in the process of production of antibodies e.g. mother to baby through breast feeding, mother to foetus across the placenta.

ii. Natural acquired active immunity

In this type of immunity, the body's immune system is actively involved in the production of antibodies against a particular pathogen.

For example, if one contracts measles, the immune system develops specific white blood cells which produce specific antibodies against the virus which fights off the infection. Upon recovery, the body retains that type of white blood cells with the ability to produce the specific antibodies in the blood stream such that subsequent infections by the same pathogen will be dealt with much faster since the cells (memory cells) simply multiply rapidly and become active to produce antibodies in large quantities to eliminate the pathogen before causing disease.

This type of immunity lasts longer in the body because antibodies are produced by the individual's own immune system.

Artificial immunity

This is the type of immunity which is induced by man's action/through artificial means. Artificial immunity is further divided into artificial passive immunity and artificial active immunity.

a. Artificial passive immunity

With this type of immunity, antibodies are artificially injected or transfused into one's blood system, either to protect one against a particular disease e.g. tetanus or to counteract the effect of a foreign body (pathogen) e.g. snake venom.

b. Artificial active immunity

Dead or weakened (attenuated) pathogens are introduced (inoculated) into one's blood system. This induces the body to produce antibodies against such pathogens such that subsequent pathogens will find the immune system already sensitized about that type of pathogen(antigen) enabling fast production of relevant antibodies.

Vaccines

A vaccine is a prepared dead, inactive or harmless bacteria or virus, which when introduced into the body causes the body to produce antibodies.

The virus and bacteria are treated in a way that prevents their reproduction. When they are introduced, the individual undergoes a mild form of the disease and the individual's cells manufacture antibodies i.e. the immunity is artificially obtained.

There are three types of vaccines.

1. Dead micro organisms e.g. the flu vaccine
2. Living-weakened micro organisms e.g. measles, T.B and polio vaccines.
3. Toxoids e.g. tetanus and diphtheria

HIV

The **Human Immunodeficiency Virus** (HIV) is the virus that weakens the immune system by destroying a specific type of white blood cells and leads to an accumulation of diseases in the body called **Acquired Immunodeficiency syndrome** (AIDS).

There's no vaccine for HIV/AIDS. ARVs simply control the effects of the virus within the patient but they do not eliminate the virus.

The signs and symptoms of AIDS include and are not limited to;

- i. Herpes
- ii. Appetite loss
- iii. Enlarged lymph glands
- iv. Severe weight loss
- v. Tiredness
- vi. Fever
- vii. Diarrhoea
- viii. Skin rash

It should be noted that these signs and symptoms can occur even in the absence of HIV. Therefore, the best way of detecting HIV is through tests that detect HIV antibodies in blood, saliva, urine or cells from inside of the cheek, with blood testing being the most common.

Ways of transmission

- i. Unprotected sexual intercourse with an infected person
- ii. Sharing sharp objects
- iii. Transfusion with infected blood
- iv. Breast feeding
- v. Infected mother to unborn baby

Means of control

- i. Education/sensitization
- ii. Abstain from sexual intercourse
- iii. Use a condom
- iv. Checking blood before transfusion
- v. Provide first aid ARVs to rape victims and health workers handling HIV/AIDS patients
- vi. Avoid sharing sharp body piercing objects with anyone
- vii. HIV positive mothers should not breastfeed their babies
- viii. Have one faithful sexual partner i.e. avoid the sex network
- ix. Use sterilized syringes and needles

N.B: Avoid discriminating those with HIV i.e. stigmatism, rather offer help to them in any way that you can.

REVISION QUESTIONS

1.a) What do you understand by the following?

- (i) Plasma
- (ii) Tissue fluid
- (iii) Lymph.

(b) With the help of a diagram show the relationship between blood, tissue fluid and lymph.

(c) Outline the functions of the lymphatic system.

(d) Give four differences between the lymphatic system and blood vascular system.

2.(a) Define the term immunity.

(b) With specific examples distinguish between the following immunological terms

- (i) Innate immunity and acquired immunity.
- (ii) Natural active acquired immunity and Natural passive acquired immunity.
- (iii) Artificial active acquired immunity and artificial passive acquired immunity.

(c) Outline the different causes of diseases.

d) How does the human body defend itself from disease causing germs?

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